NEC

PHOTOCOUPLER
PS9114

HIGH CMR, 10 Mbps OPEN COLLECTOR OUTPUT TYPE 5-PIN SOP PHOTOCOUPLER

–NEPOC Series–

DESCRIPTION

The PS9114 is an optically coupled high-speed, isolator containing a GaAlAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

The PS9114 is specified high CMR, high CTR and pulse width distortion with operating temperature.

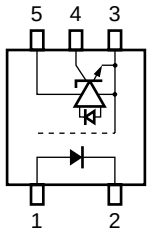
FEATURES

- High common mode transient immunity (CM_H, CM_L = ±20 kV/μs TYP.)
- ★ Small package (5-pin SOP)
- 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 taping product: PS9114-F3, F4: 2 500 pcs/reel
- ★ Pb-Free product
- ★ Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved No. 40008902 (Option)

APPLICATIONS

- Measurement equipment
- PDP
- FA Network

PIN CONNECTION
(Top View)



1. Anode
2. Cathode
3. GND
4. V_O
5. V_{CC}

TRUTH TABLE

LED	Output
ON	L
OFF	H

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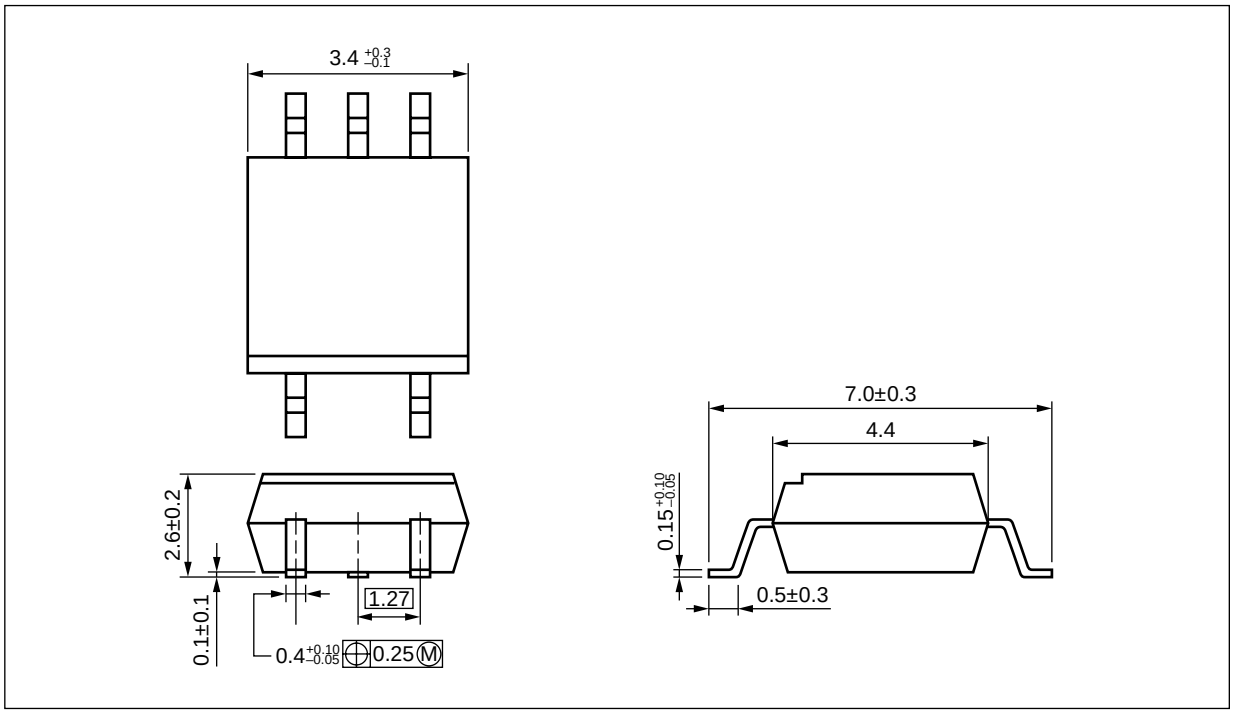
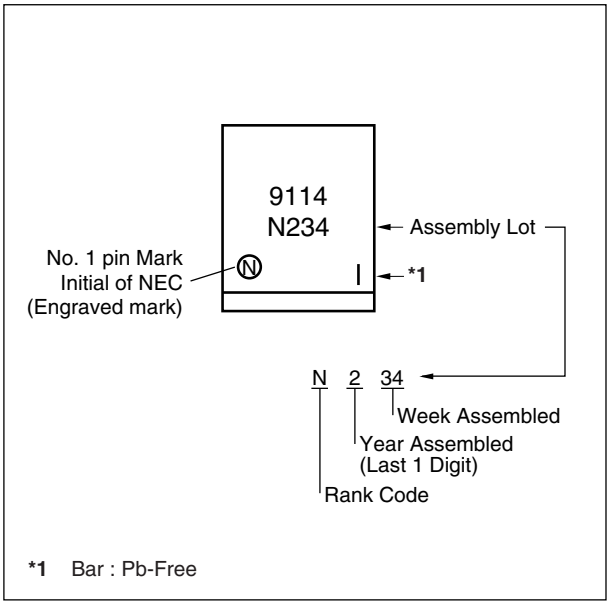
Date Published February 2005 CP(K)
Printed in Japan

The mark ★ shows major revised points.

PACKAGE DIMENSIONS (UNIT: mm)



★ **MARKING**



★ ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9114	PS9114-A	Pb-Free*2	Magazine case 100 pcs	Standard products	PS9114
PS9114-F3	PS9114-F3-A		Embossed Tape 2 500 pcs/reel	(UL approved)	
PS9114-F4	PS9114-F4-A				
PS9114-V	PS9114-V-A		Magazine case 100 pcs	DIN EN60747-5-2	
PS9114-V-F3	PS9114-V-F3-A		Embossed Tape 2 500 pcs/reel	(VDE0884 Part2)	
PS9114-V-F4	PS9114-V-F4-A			Approved (Option)	

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

***2** With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

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

Parameter		Symbol	Ratings	Unit
Diode	Forward Current*1	I_F	30	mA
	Reverse Voltage	V_R	5	V
Detector	Supply Voltage	V_{CC}	7	V
	Output Voltage	V_O	7	V
	Output Current	I_O	25	mA
	Power Dissipation*2	P_C	40	mW
Isolation Voltage*3		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 = 25°C or more.

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

***3** AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output. Pins 1-2 shorted together, 3-4 shorted together.

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
TTL (R_L = 1 kΩ, loads)	N			5	
Pull-up resistor	R_L	330		4 k	Ω

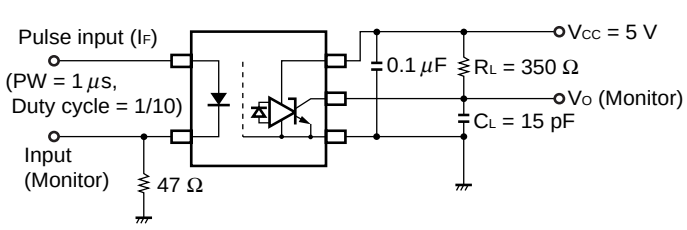
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, T_A = –40 to +85°C)

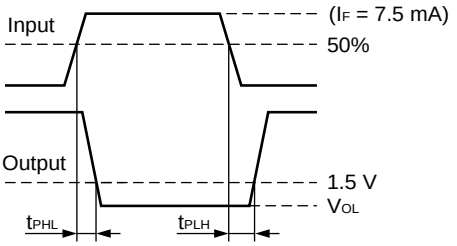
Parameter		Symbol	Conditions	MIN.	TYP.[*1]	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C	1.4	1.65	1.9	V
	Reverse Current	I_R	V_R = 3 V, T_A = 25°C			10	μA
	Terminal Capacitance	C_t	V = 0 V, f = 1 MHz, T_A = 25°C		30		pF
Detector	High Level Output Current	I_{OH}	V_{CC} = V_O = 5.5 V, V_F = 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	I_{CCH}	V_{CC} = 5.5 V, I_F = 0 mA, V_O = open		3	8	mA
	Low Level Supply Current	I_{CCL}	V_{CC} = 5.5 V, I_F = 10 mA, V_O = open		7.0	11	mA
Coupled	Threshold Input Current (H → L)	I_{FHL}	V_{CC} = 5 V, V_O = 0.8 V, R_L = 350 Ω		2	5	mA
	Isolation Resistance	R_{I-O}	V_{I-O} = 1 kV_{DC}, RH = 40 to 60%, T_A = 25°C	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V = 0 V, f = 1 MHz, T_A = 25°C		0.6		pF
	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	ns
			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	ns
	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	R_L = 350 Ω, T_A = 25°C, I_F = 0 mA, $V_{O\,(MIN.)}$ = 2 V, V_{CM} = 1 kV	10	20		kV/μs
	Common Mode Transient Immunity at Low Level Output[*4]	CM_L	R_L = 350 Ω, T_A = 25°C, I_F = 7.5 mA, $V_{O\,(MAX.)}$ = 0.8 V, V_{CM} = 1 kV	10	20		kV/μs

***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.

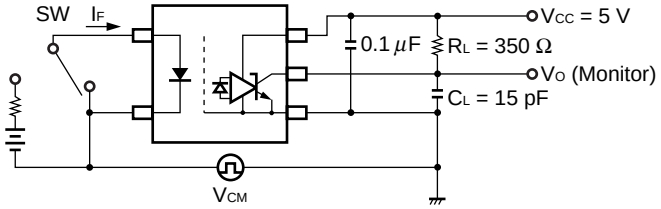
***3** Test circuit for propagation delay time

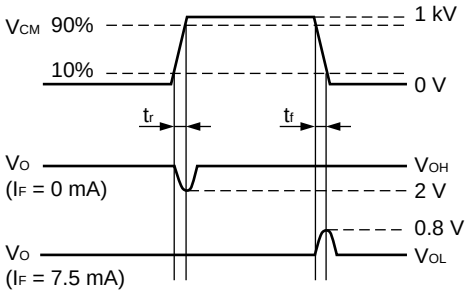




Remark C_L includes probe and stray wiring capacitance.

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





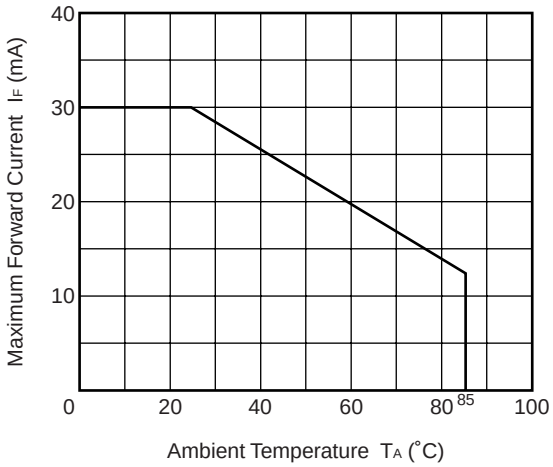
Remark C_L includes probe and stray wiring capacitance.

USAGE CAUTIONS

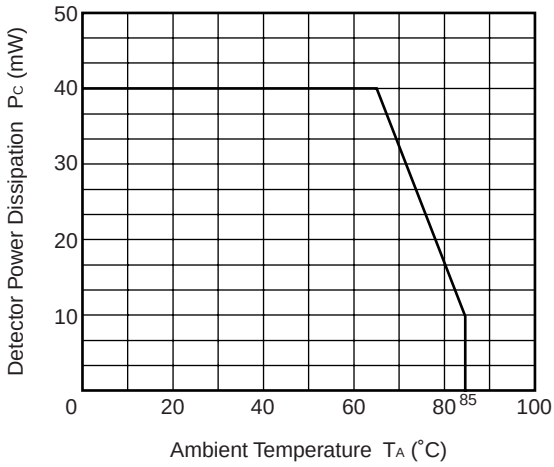
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of 0.1 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor 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)

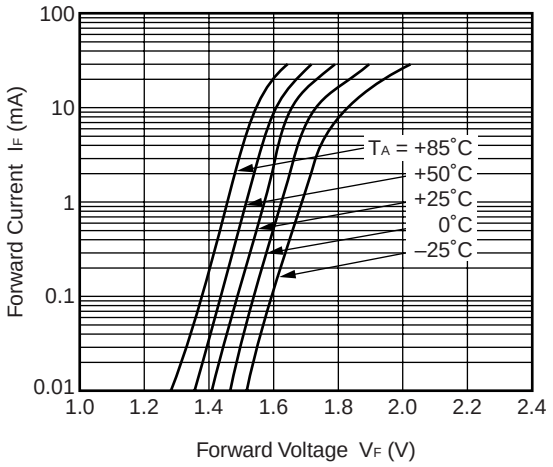
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



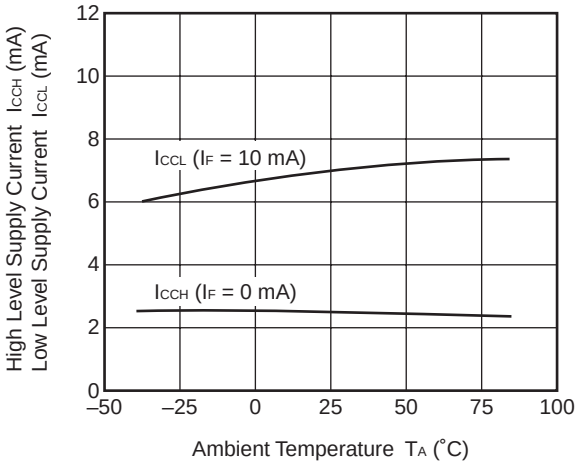
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



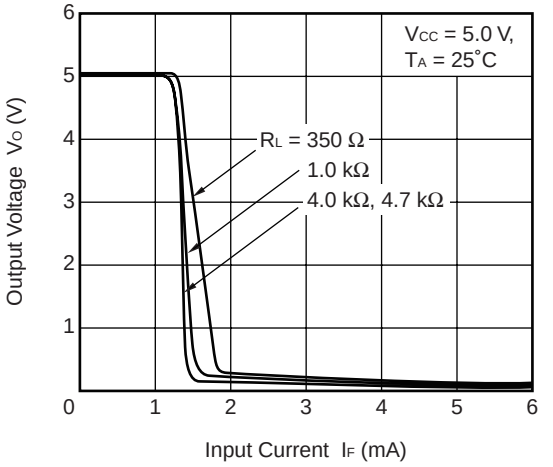
FORWARD CURRENT vs. FORWARD VOLTAGE



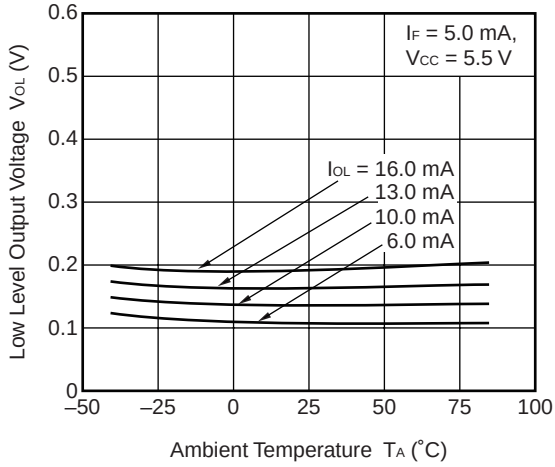
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs. INPUT CURRENT

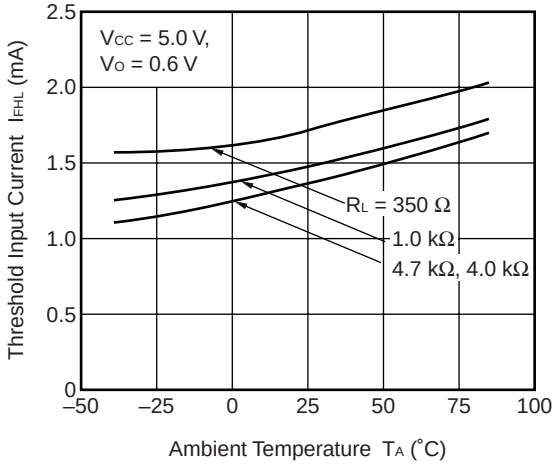


LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

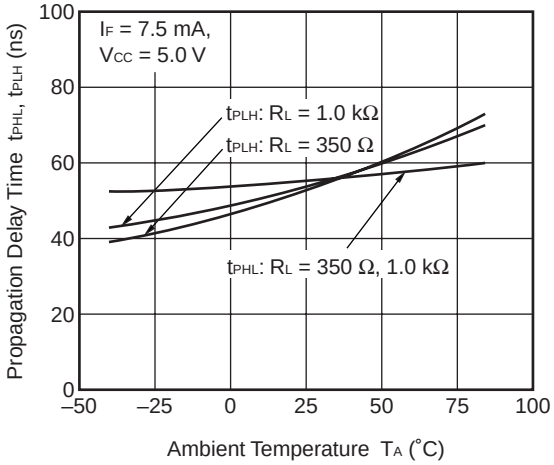


Remark The graphs indicate nominal characteristics.

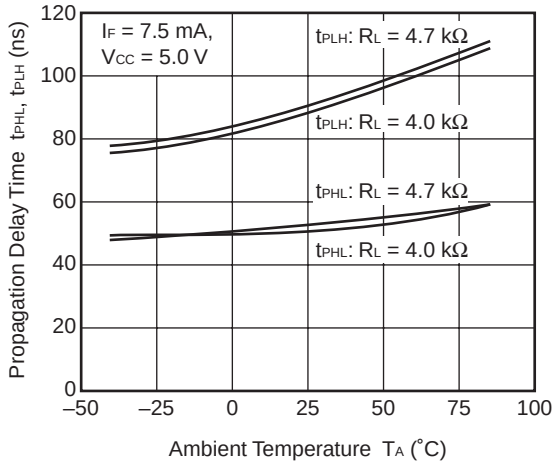
THRESHOLD INPUT CURRENT vs.
AMBIENT TEMPERATURE



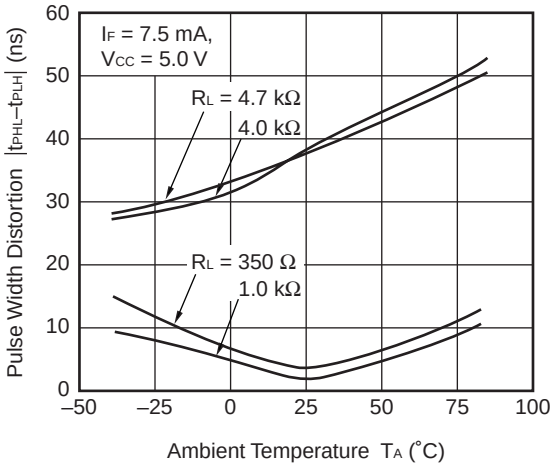
PROPAGATION DELAY TIME vs.
AMBIENT TEMPERATURE



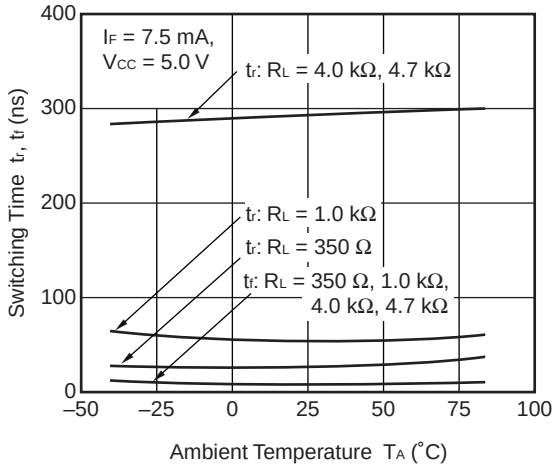
PROPAGATION DELAY TIME vs.
AMBIENT TEMPERATURE



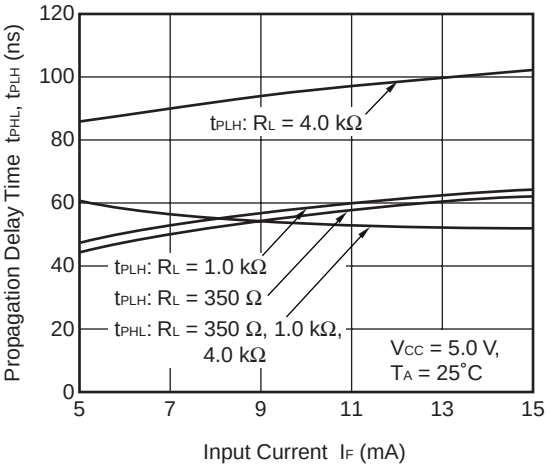
PULSE WIDTH DISTORTION vs.
AMBIENT TEMPERATURE



SWITCHING TIME vs.
AMBIENT TEMPERATURE



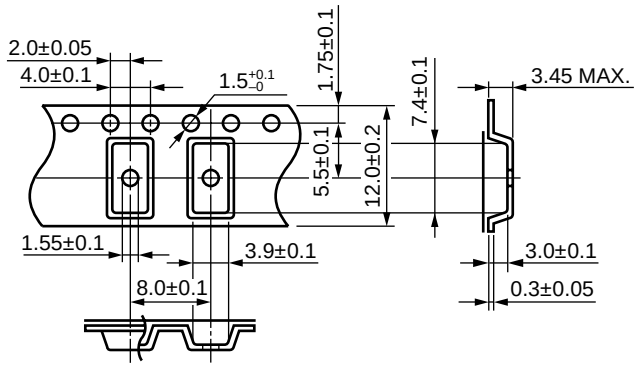
PROPAGATION DELAY TIME vs.
INPUT CURRENT



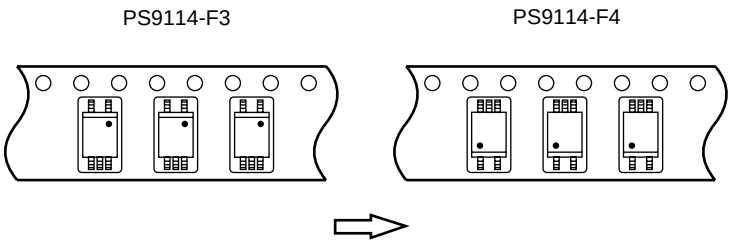
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

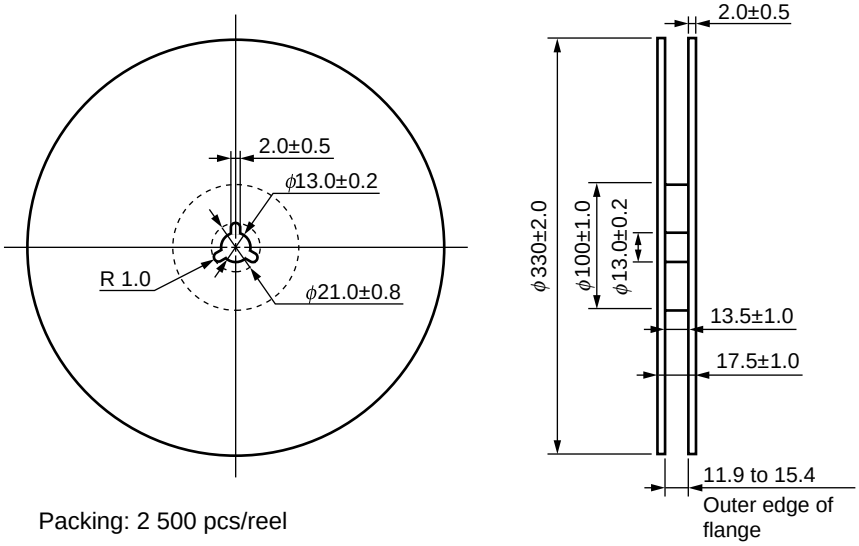
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



Packing: 2 500 pcs/reel

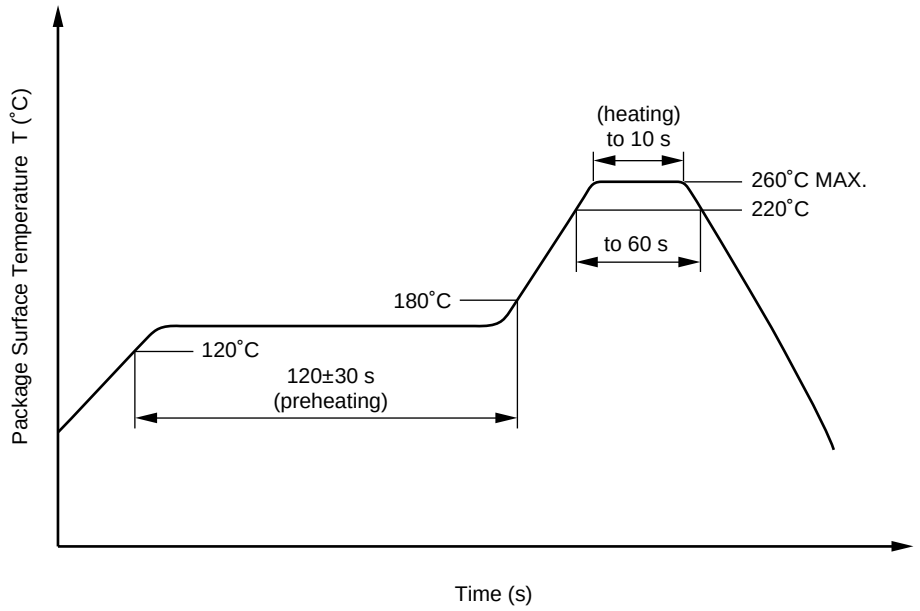
NOTES ON HANDLING

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.

★ USAGE CAUTIONS

1. Protect against static electricity when handling.

2. Avoid storage at a high temperature and high humidity.

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  (Note)

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

M8E 00.4-0110

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.

►For further information, please contact

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