NEC

PHOTOCOUPLER

PS9613,PS9613L

1 Mbps, OPEN COLLECTOR OUTPUT, FOR GATE DRIVE INTERFACE INTELLIGENT POWER MODULE 8-PIN DIP PHOTOCOUPLER

–NEPOC™ Series–

DESCRIPTION

The PS9613 and PS9613L are optically coupled isolators containing a GaAlAs LED on the input side and a photo diode and a signal processing circuit on the output side on one chip.

The PS9613 is in a plastic DIP (Dual In-line Package) and the PS9613L is lead bending type (Gull-wing) for surface mounting.

FEATURES

- High instantaneous common mode rejection voltage (CM_H, CM_L = ±15 kV/μs MIN.)
- High-speed response (t_{PHL} = 500 ns MAX., t_{PLH} = 750 ns MAX.)
- Maximum propagation delays ($t_{PLH} - t_{PHL}$ = 270 ns TYP.)
- Pulse width distortion ($| t_{PHL} - t_{PLH} |$ = 270 ns TYP.)
- Ordering number of taping product: PS9613L-E3, E4: 1 000 pcs/reel
- UL approved: File No. E72422 (S)
- VDE0884 approved (Option)

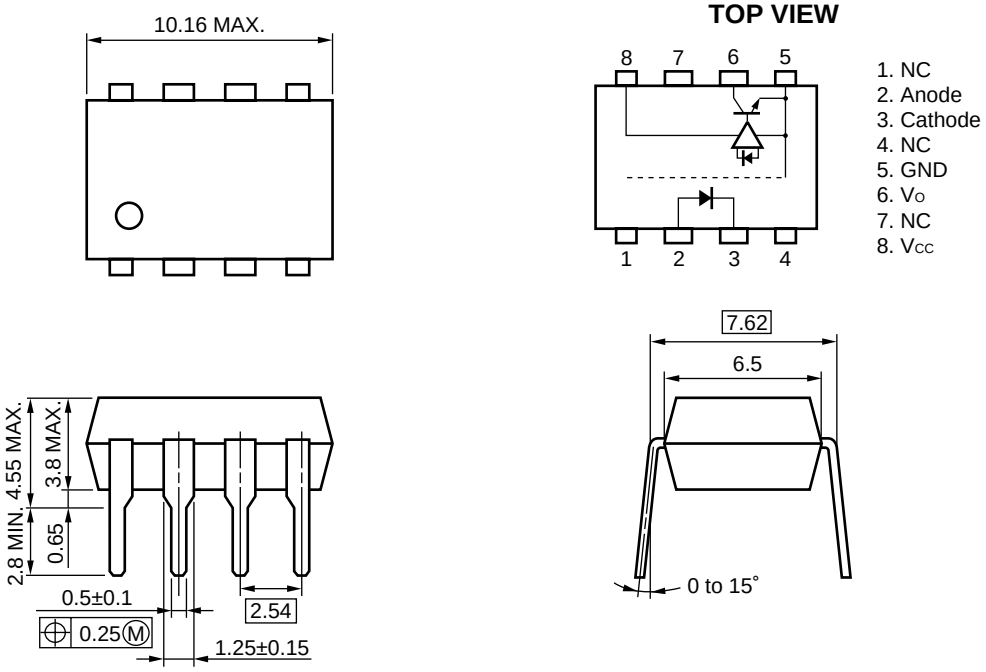
APPLICATIONS

- IPM Driver
- General purpose inverter

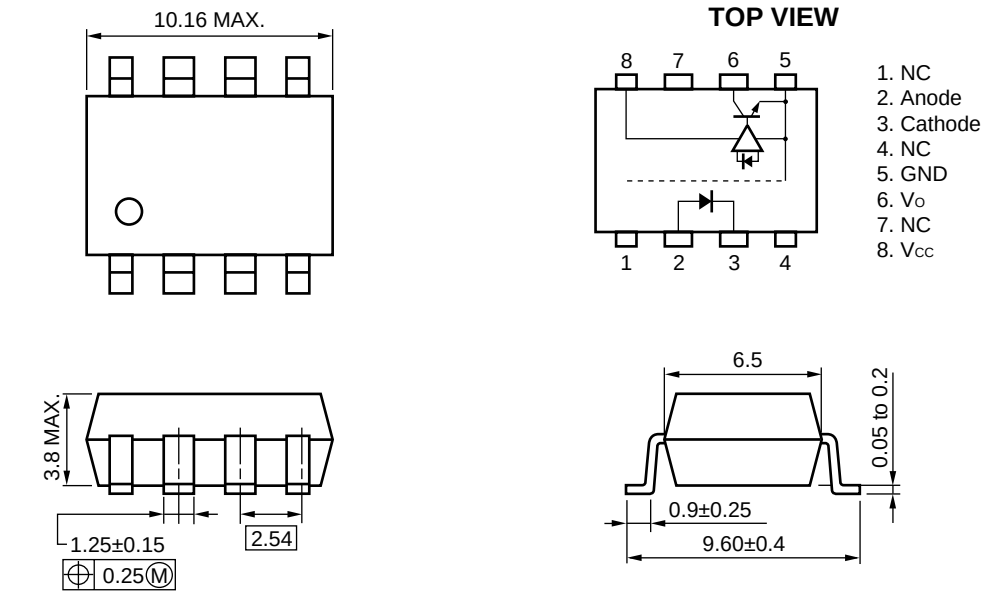
Document No. P13981EJ2V0DS00 (2nd edition)
Date Published May 2000 NS CP(K)
Printed in Japan

PACKAGE DIMENSIONS (in millimeters)

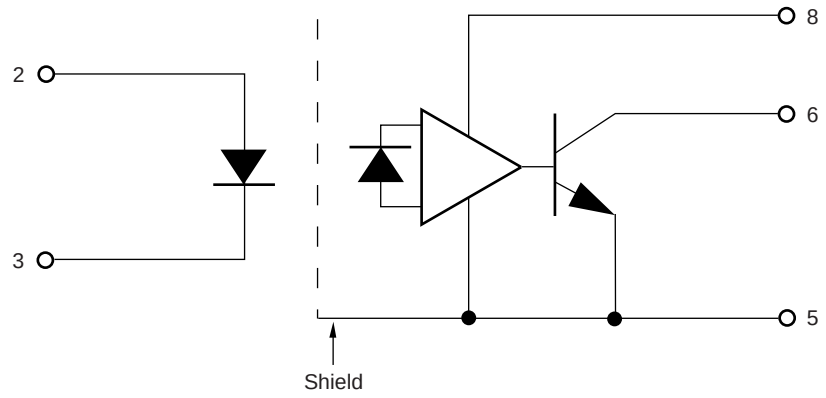
PS9613



PS9613L



FUNCTIONAL DIAGRAM



LED	Output
ON	L
OFF	H

ORDERING INFORMATION

Part Number	Package	Packing Style	Safety Standards Approval	Application Part Number*1
PS9613	8-pin DIP	Magazine case 50 pcs	UL approved	PS9613
PS9613L				PS9613L
PS9613L-E3		Embossed Tape 1 000 pcs/reel		
PS9613L-E4				
PS9613-V		Magazine case 50 pcs	VDE0884 approved	PS9613
PS9613L-V				PS9613L
PS9613L-V-E3		Embossed Tape 1 000 pcs/reel		
PS9613L-V-E4				

***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
Diode	Forward Current	I_F	25	mA
	Reverse Voltage	V_R	3.0	V
Detector	Supply Voltage	V_{CC}	–0.5 to +35	V
	Output Voltage	V_O	–0.5 to +35	V
	Output Current	I_O	15	mA
	Power Dissipation	P_C	100	mW
Isolation Voltage*1		BV	5 000	Vr.m.s.
Operating Ambient Temperature		T_A	–40 to +100	°C
Storage Temperature		T_{stg}	–55 to +125	°C

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

RECOMMENDED OPERATING CONDITIONS

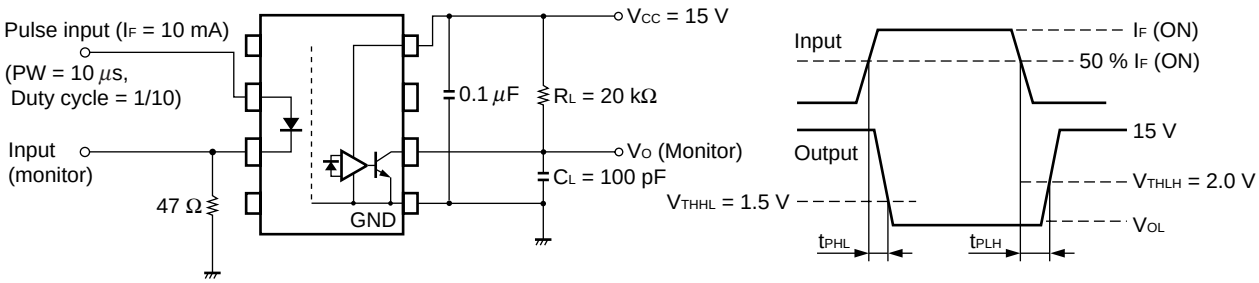
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward Current	I_F	10		20	mA
Output Voltage	V_O	0		30	V
Supply Voltage	V_{CC}	4.5		30	V
LED Off Voltage	V_F	0		0.8	V

ELECTRICAL CHARACTERISTICS (T_A = –40 to +100 °C, V_{CC} = 15 V, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP. [*1]	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA	1.3	1.65	2.1	V
	Reverse Current	I_R	V_R = 3 V			200	μA
	Terminal Capacitance	C_t	V = 0 V, f = 1 MHz, T_A = 25 °C		30		pF
Detector	Low Level Output Voltage	V_{OL}	I_F = 10 mA, V_{CC} = 5 V, I_O = 2.4 mA		0.13	0.6	V
	High Level Output Current	I_{OH}	V_{CC} = 30 V, V_F = 0.8 V		1.0	50	μA
	High Level Supply Current	I_{CCH}	V_{CC} = 30 V, V_F = 0.8 V, V_O = open		0.6	1.3	mA
	Low Level Supply Current	I_{CCL}	V_{CC} = 30 V, I_F = 10 mA, V_O = open		0.6	1.3	mA
Coupled	Threshold Input Current (H → L)	I_{FHL}	V_O = 0.8 V, I_O = 0.75 mA		1.5	5.0	mA
	Current Transfer Ratio (I_C/I_F)	CTR	I_F = 10 mA, V_O = 0.6 V	44	110		%
	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) [*2]	t_{PHL}	I_F = 10mA, R_L = 20 kΩ, C_L = 100 pF, V_{THHL} = 1.5 V, V_{THLH} = 2.0 V		250	500	ns
	Propagation Delay Time (L → H) [*2]	t_{PLH}			520	750	
	Maximum Propagation Delays	t_{PLH}–t_{PHL}		–200	270	650	
	Pulse Width Distortion (PWD) [*2]	$\lvert t_{PHL}–t_{PLH} \rvert$			270	650	
	Instantaneous Common Mode Rejection Voltage (Output: High) [*3]	CM_H	T_A = 25 °C, I_F = 0 mA, V_O > 3.0 V, V_{CM} = 1.5 kV, R_L = 20 kΩ, C_L = 100 pF	15			kV/μs
	Instantaneous Common Mode Rejection Voltage (Output: Low) [*3]	CM_L	T_A = 25 °C, I_F = 10 mA, V_O < 1.0 V, V_{CM} = 1.5 kV, R_L = 20 kΩ, C_L = 100 pF	15			kV/μs

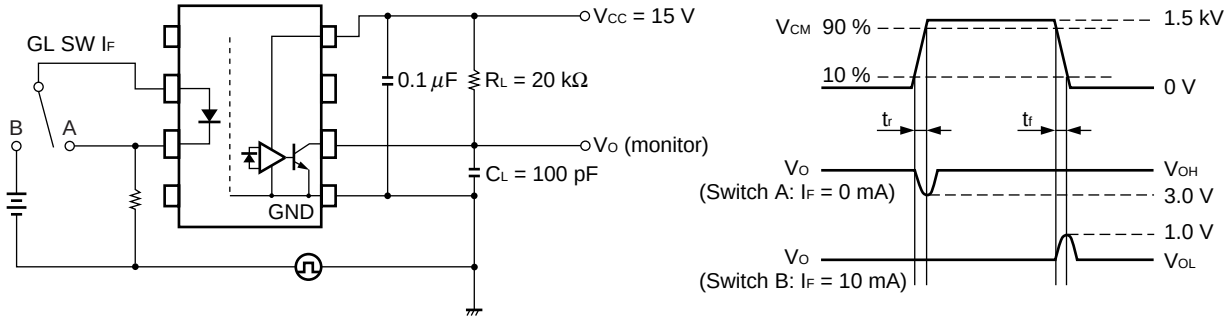
***1** Typical values at T_A = 25 °C.

***2** Test circuit for propagation delay time



C_L is approximately which includes probe and stray wiring capacitance.

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



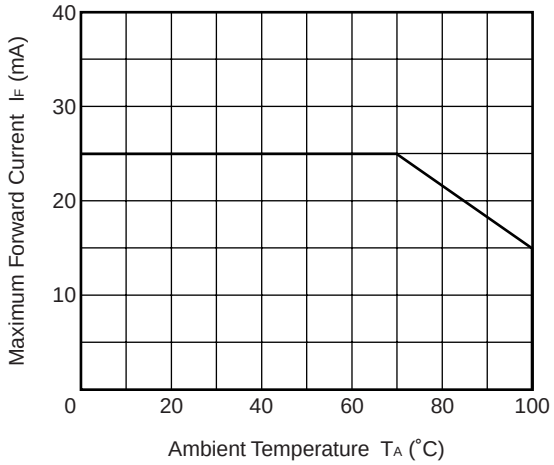
C_L is approximately which includes probe and stray wiring capacitance.

USAGE CAUTION

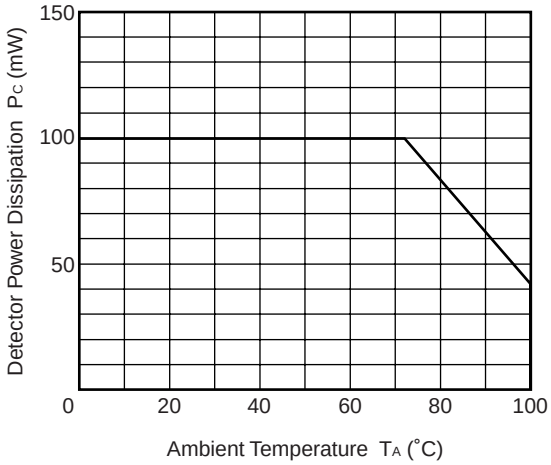
By-pass capacitor of more than 0.1 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.

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

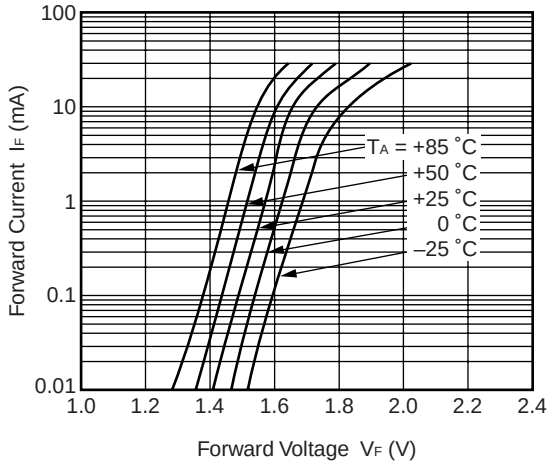
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



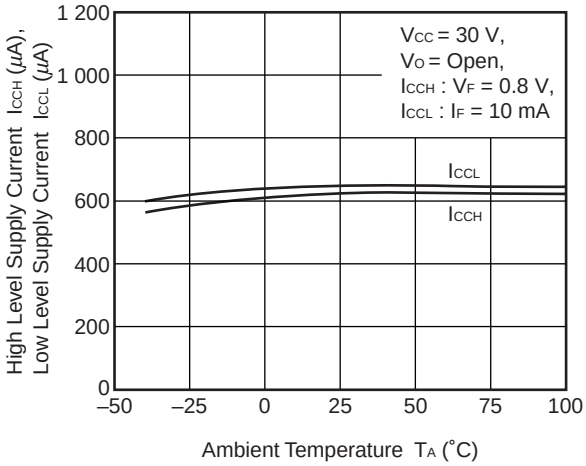
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



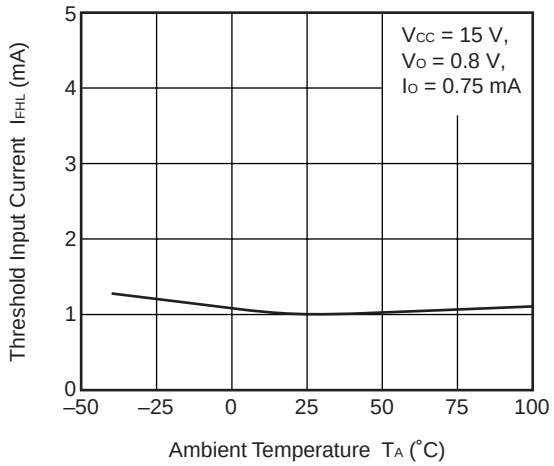
FORWARD CURRENT vs. FORWARD VOLTAGE



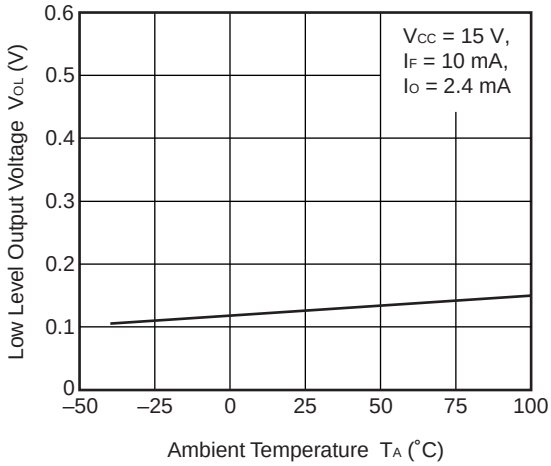
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



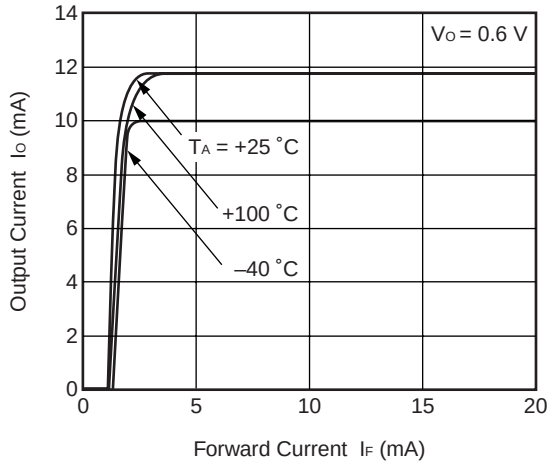
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



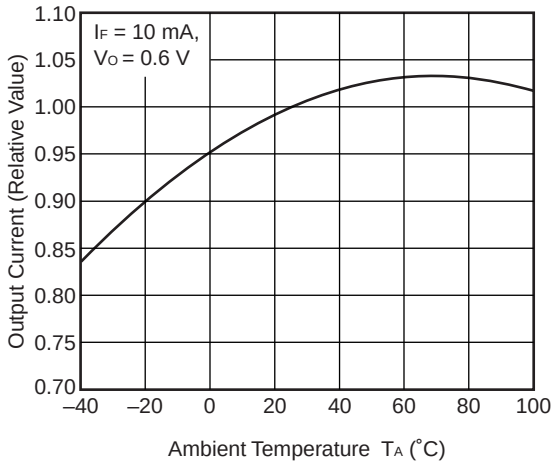
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



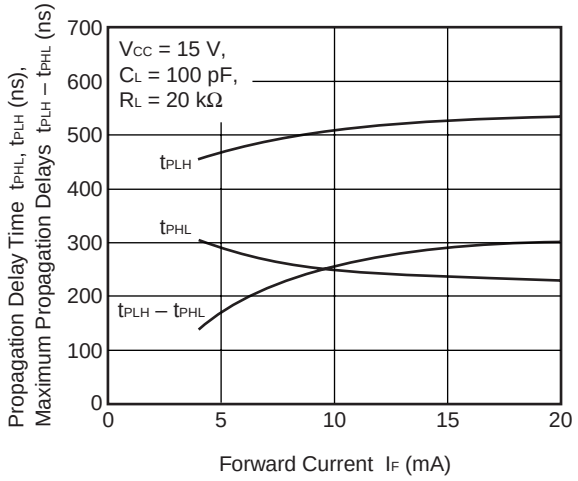
OUTPUT CURRENT vs. FORWARD CURRENT



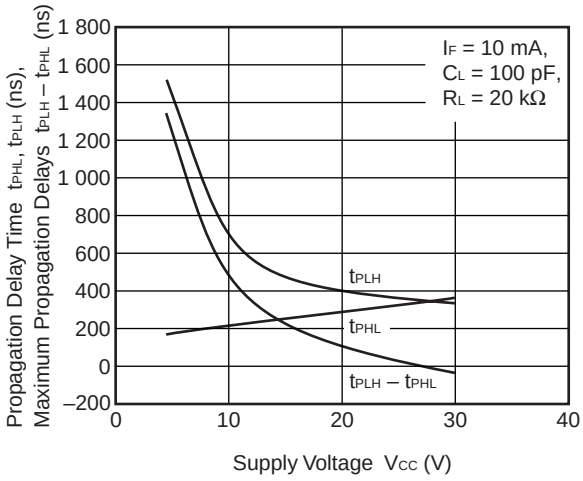
OUTPUT CURRENT vs. AMBIENT TEMPERATURE



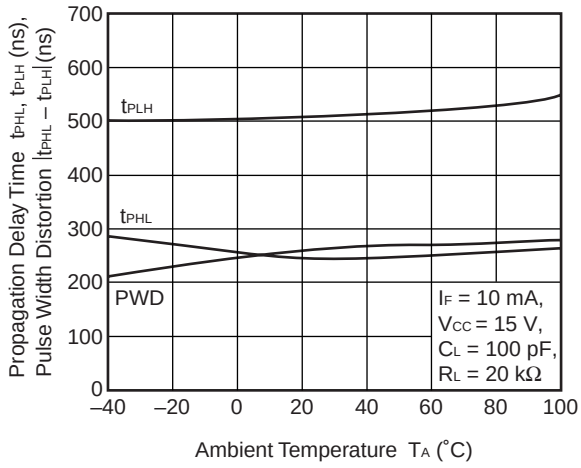
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. FORWARD CURRENT



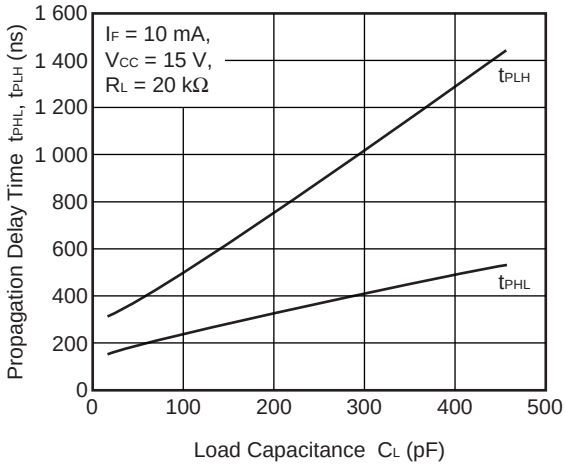
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE



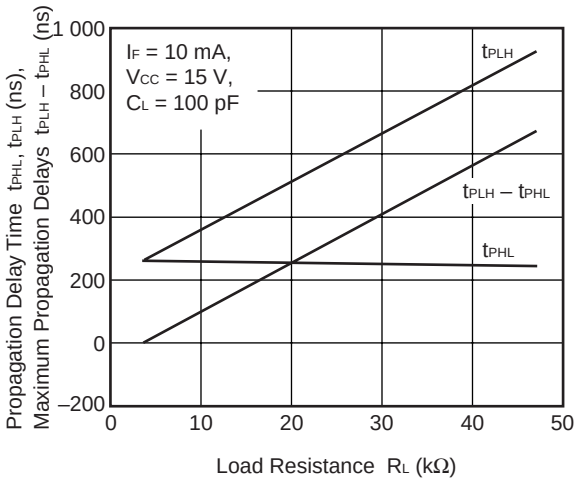
PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



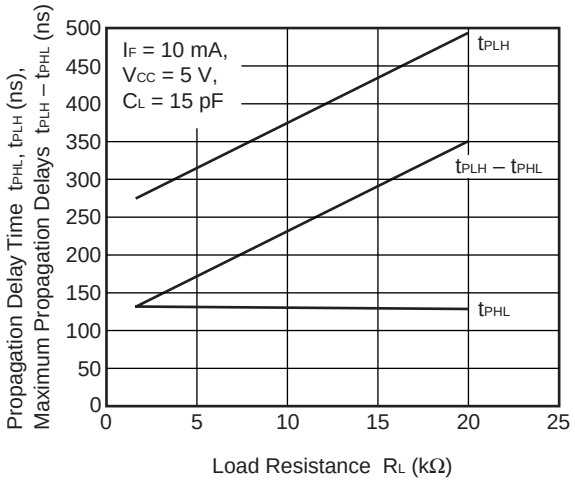
PROPAGATION DELAY TIME vs. LOAD CAPACITANCE



PROPAGATION DELAY TIME,
MAXIMUM PROPAGATION DELAYS
vs. LOAD RESISTANCE



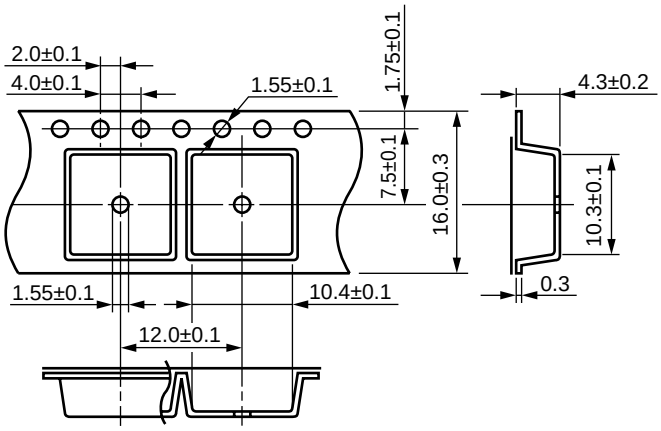
PROPAGATION DELAY TIME,
MAXIMUM PROPAGATION DELAYS
vs. LOAD RESISTANCE



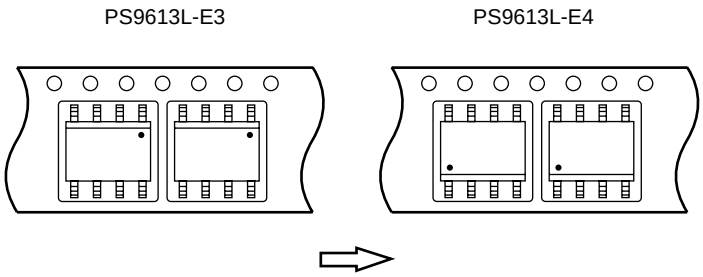
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (in millimeters)

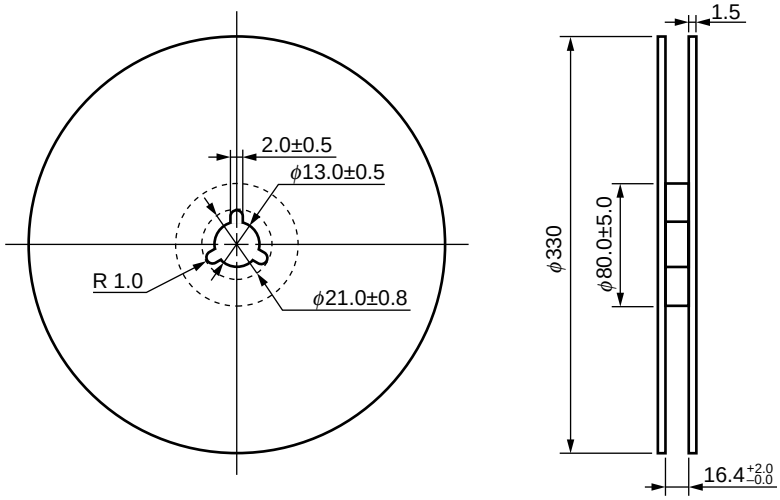
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Tape)



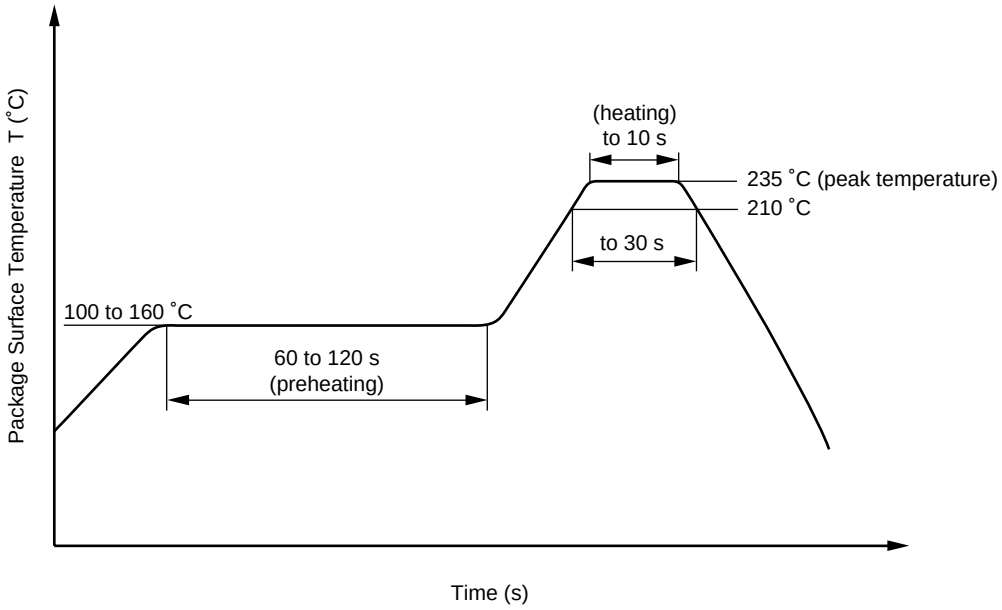
Packing: 1 000 pcs/reel

RECOMMENDED SOLDERING CONDITIONS

(1) Infrared reflow soldering

- Peak reflow temperature — 235 °C or below (package surface temperature)
- Time of temperature higher than 210 °C — 30 seconds or less
- 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) Dip soldering

- Temperature — 260 °C or below (molten solder temperature)
- Time — 10 seconds or less
- 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) Cautions

- Fluxes

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

[MEMO]

[MEMO]

[MEMO]

CAUTION

Within this device there exists GaAs (Gallium Arsenide) material which is a harmful substance if ingested. Please do not under any circumstances break the hermetic seal.

NEPOC is a trademark of NEC Corporation.

- **The information in this document is current as of May, 2000. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
- NEC semiconductor products are classified into the following three quality grades:
  "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.

  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

  "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

  The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.

  (Note)

  (1) "NEC" as used in this statement means NEC Corporation and also includes its majority-owned subsidiaries.

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

M8E 00.4