NEC

PHOTOCOUPLER

PS9711

HIGH NOISE REDUCTION/HIGH-SPEED 10 Mbps, TOTEM-POLE OUTPUT TYPE 5-PIN SOP TOM PHOTOCOUPLER

–NEPOC™ Series–

DESCRIPTION

The PS9711 is an optically coupled high-speed, totem-pole output isolator containing a GaAlAs LED on light emitting diode (input) and a photodiode and a signal processing circuit on light receiving side (output side) on one chip.

FEATURES

- High common mode transient immunity (CM_H, CM_L = ±10 kV/μs TYP.)
- Small package (5-pin SOP)
★ - High-speed response (t_{PHL} = 30 ns, t_{PLH} = 35 ns TYP.)
- Pulse width distortion ($|t_{PHL} - t_{PLH}|$ = 7 ns TYP.)
- Totem-pole output (No pull-up resistor required)
- Ordering number of taping product: PS9711-E3, E4: 900 pcs/reel,
  PS9711-F3, F4 (Recommended): 3 500 pcs/reel

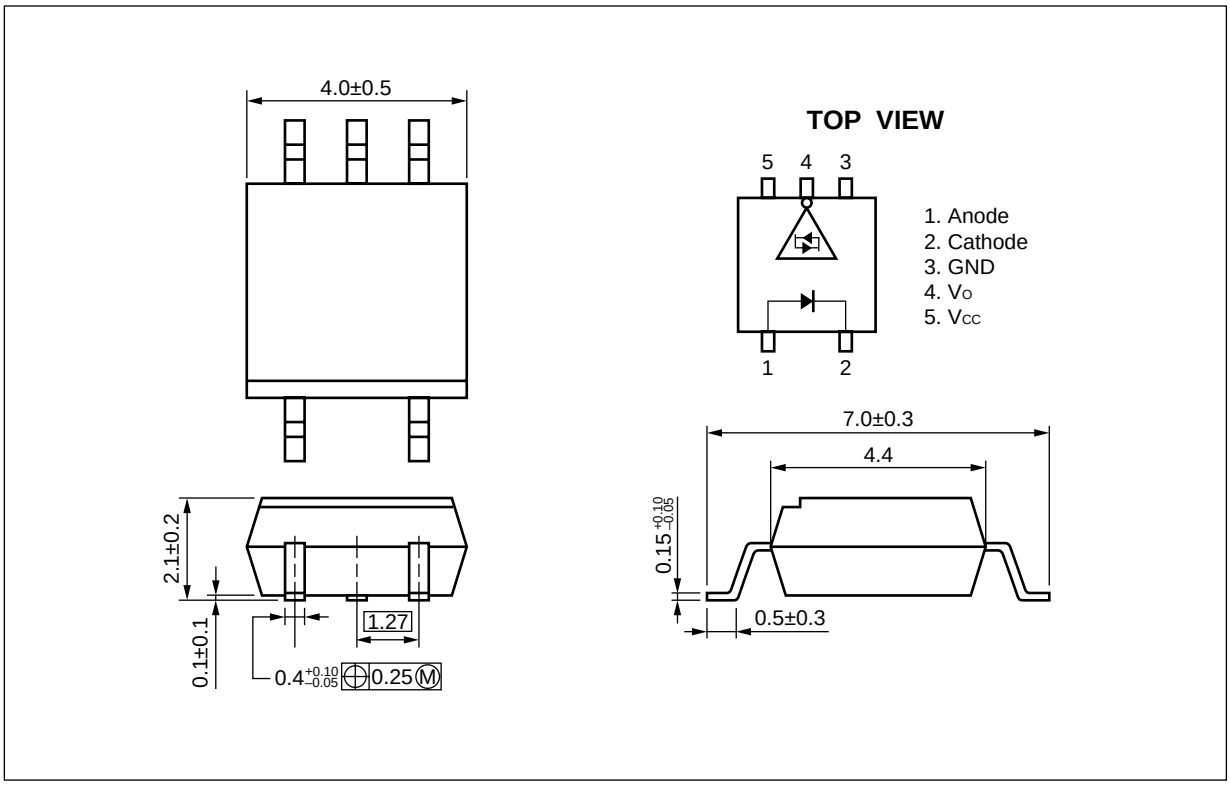
APPLICATIONS

- Computer and peripheral manufactures
- Measurement equipment
- PDP

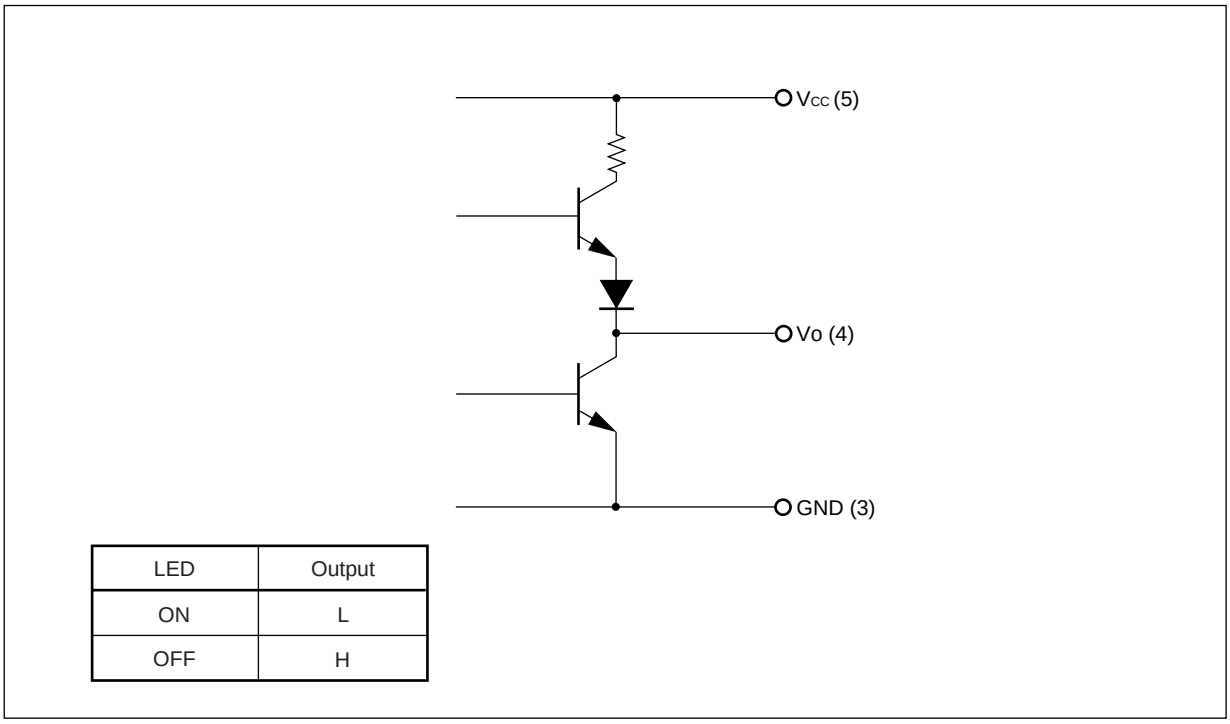
Document No. P13103EJ3V0DS00 (3rd edition)
Date Published February 2000 NS CP(K)
Printed in Japan

The mark ★ shows major revised points.

PACKAGE DIMENSIONS (in millimeters)



★ **INTERNAL OUT PUT CIRCUIT**



LED	Output
ON	L
OFF	H

ORDERING INFORMATION

Part Number	Package	Packing Style	Application Part Number*1
PS9711	5-pin SOP	Magazine case 100 pcs	PS9711
PS9711-E3		Embossed Tape 900 pcs/reel	
PS9711-E4			
PS9711-F3		Embossed Tape 3 500 pcs/reel	
PS9711-F4			

***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	30	mA
	Reverse Voltage	V_R	3.0	V
Detector	Supply Voltage	V_{CC}	7	V
	Output Voltage	V_O	7	V
	High Level Output Current*1	I_{OH}	–5	mA
	Low Level Output Current*1	I_{OL}	13	mA
	Power Dissipation*1	P_C	130	mW
Isolation Voltage*2		BV	2 500	Vr.m.s.
Operating Ambient Temperature		T_A	–40 to +85	°C
Storage Temperature		T_{stg}	–55 to +125	°C

***1** T_A = –40 to +85 °C

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

RECOMMENDED OPERATING CONDITIONS

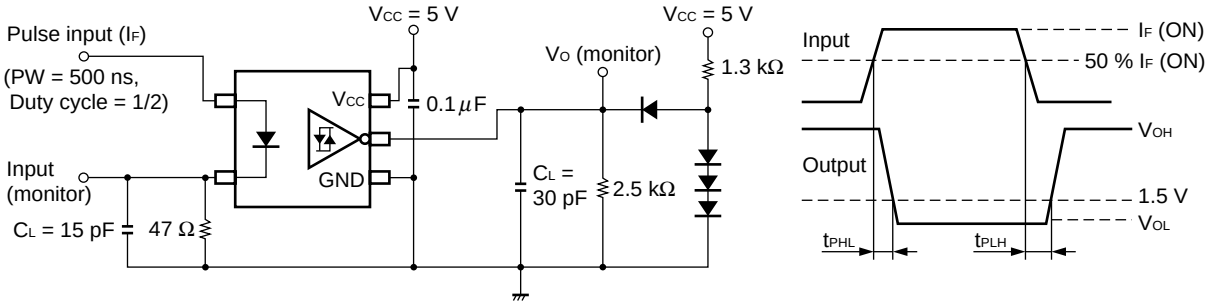
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
★ High Level Input Current	I_{FH}	7.5		12.5	mA
Low Level Input Current	I_{FL}	0		250	μA
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
TTL (loads)	N			3	

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	1.9	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, I_F = 250 μA			1	200	μA
	High Level Output Voltage	V_{OH}	V_{CC} = 4.5 V, I_F = 250 μA, I_{OH} = –2 mA		2.4	3.0		V
	Low Level Output Voltage	V_{OL}	V_{CC} = 4.5 V, I_F = 7 mA, I_O = 8 mA			0.38	0.6	V
	High Level Supply Current	I_{CCH}	V_{CC} = 5.5 V, I_F = 0 mA			11	17	mA
	Low Level Supply Current	I_{CCL}	V_{CC} = 5.5 V, I_F = 10 mA			12	18	mA
	High Level Output Short Circuit Current	I_{OSH}	V_{CC} = 5.5 V, V_O = GND, I_F = 0 mA, 10 ms or less			–26		mA
	Low Level Output Short Circuit Current	I_{OSL}	V_{CC} = V_O = 5.5 V, I_F = 8 mA, 10 ms or less			34		mA
Coupled	Threshold Input Current (H → L)	I_{FHL}	V_{CC} = 5 V	T_A = 25 °C		2.0	5	mA
							6	
	Threshold Input Current (L → H)	I_{FLH}	V_{CC} = 5 V	T_A = 25 °C	0.5			mA
					0.35			
	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			0.4		pF
★	Propagation Delay Time (H → L)[*2]	t_{PHL}		T_A = 25 °C	15	30	65	ns
			V_{CC} = 5 V, I_F = 7.5 mA		10		85	
★	Propagation Delay Time (L → H)[*2]	t_{PLH}		T_A = 25 °C	15	35	65	ns
			V_{CC} = 5 V, I_F = 7.5 mA		10		85	
	Pulse Width Distortion (PWD)[*2]	$\lvert t_{PHL}-t_{PLH} \rvert$	V_{CC} = 5 V, I_F = 7.5 mA			7	35	ns
	Common Mode Transient Immunity at High Level Output[*3]	CM_H	V_{CC} = 5 V, T_A = 25 °C, I_F = 0 mA, $V_{O\ (MIN.)}$ = 2 V, V_{CM} = 100 V		1	10		kV/μs
	Common Mode Transient Immunity at Low Level Output[*3]	CM_L	V_{CC} = 5 V, T_A = 25 °C, I_F = 7.5 mA, $V_{O\ (MAX.)}$ = 0.8 V, V_{CM} = 100 V		1	10		kV/μs

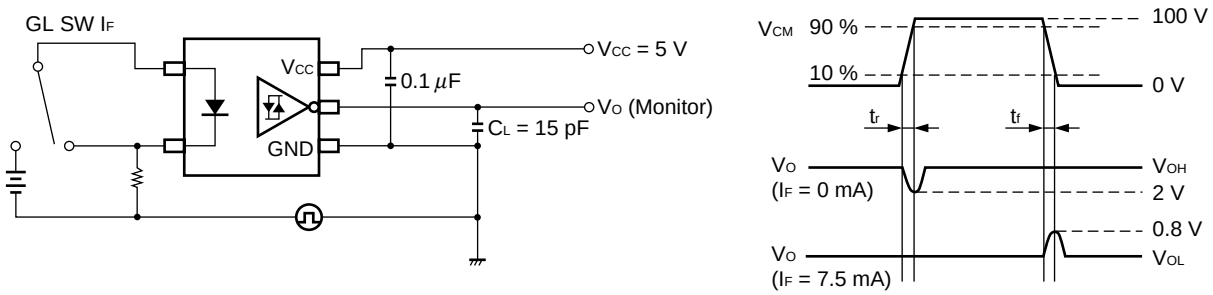
***1** Typical values at T_A = 25 °C

***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



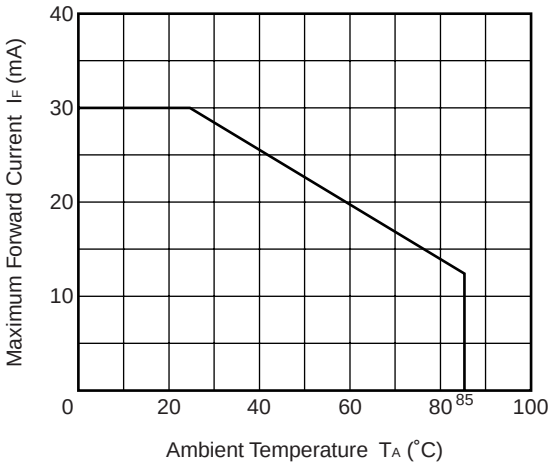
C_L is approximately which includes probe and stray wiring capacitance.

USAGE CAUTIONS

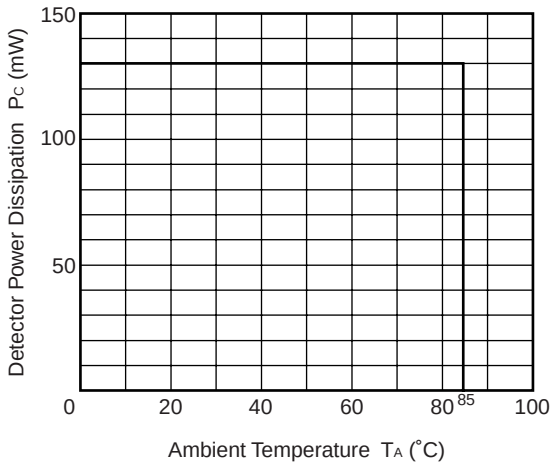
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 μF is used between V_{CC} and GND near device.

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

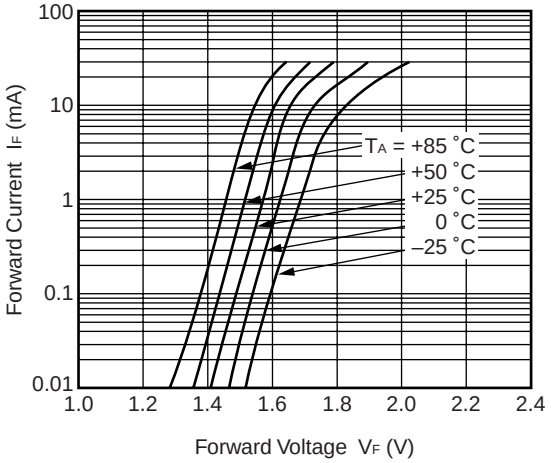
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



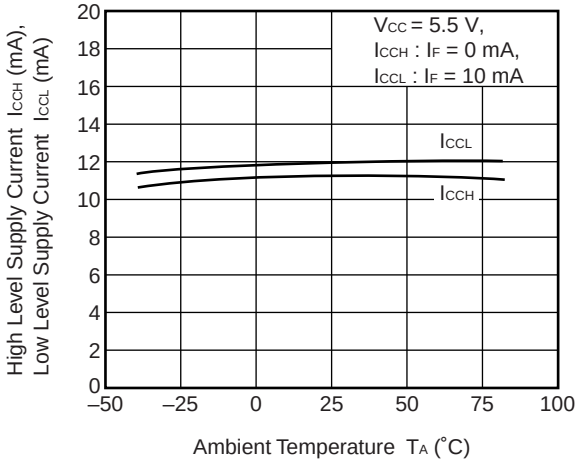
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



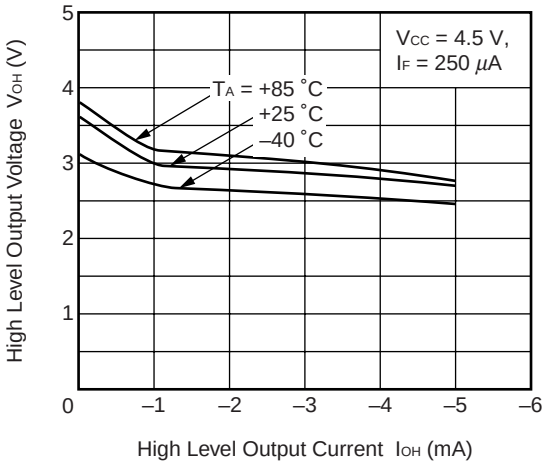
FORWARD CURRENT vs. FORWARD VOLTAGE



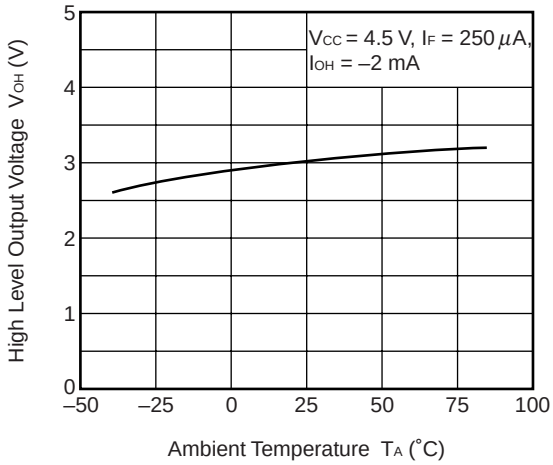
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



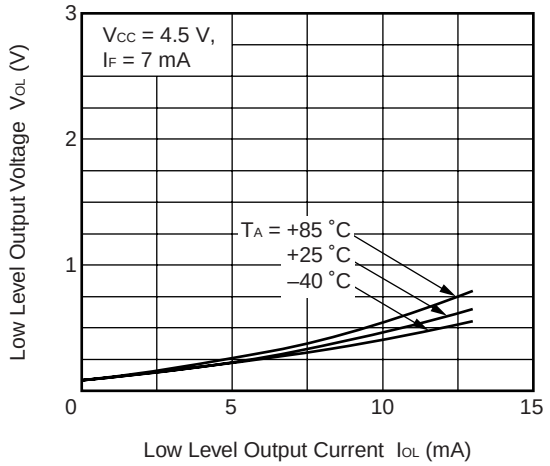
HIGH LEVEL OUTPUT VOLTAGE vs. HIGH LEVEL OUTPUT CURRENT



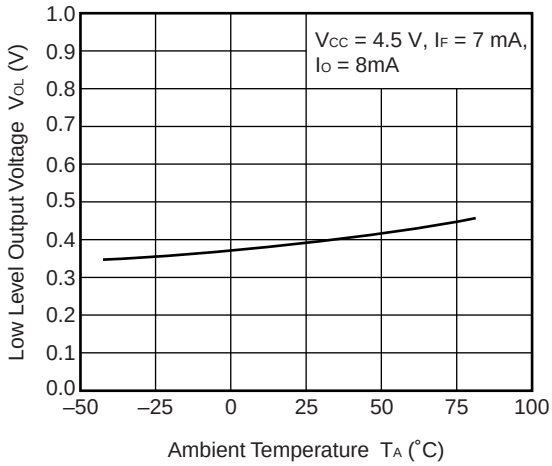
HIGH LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



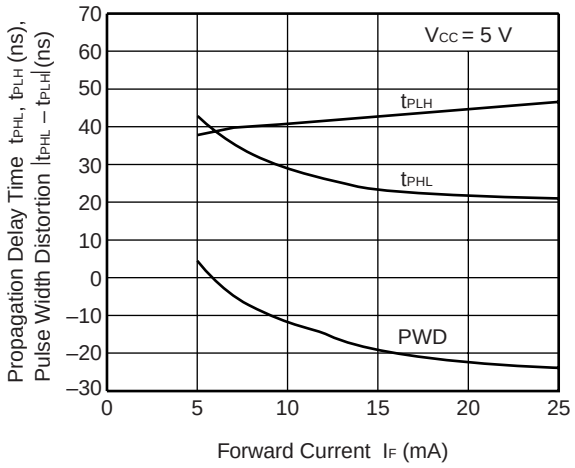
LOW LEVEL OUTPUT VOLTAGE vs.
LOW LEVEL OUTPUT CURRENT



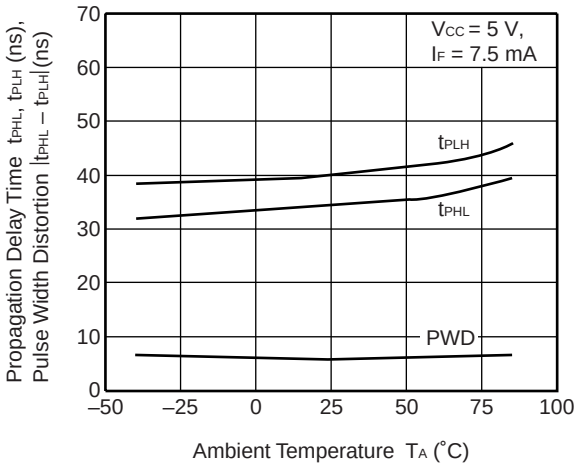
LOW LEVEL OUTPUT VOLTAGE vs.
AMBIENT TEMPERATURE



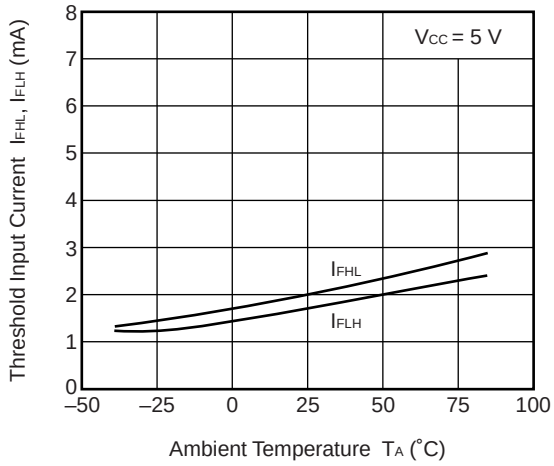
PROPAGATION DELAY TIME,
PULSE WIDTH DISTORTION
vs. FORWARD CURRENT



PROPAGATION DELAY TIME,
PULSE WIDTH DISTORTION
vs. AMBIENT TEMPERATURE



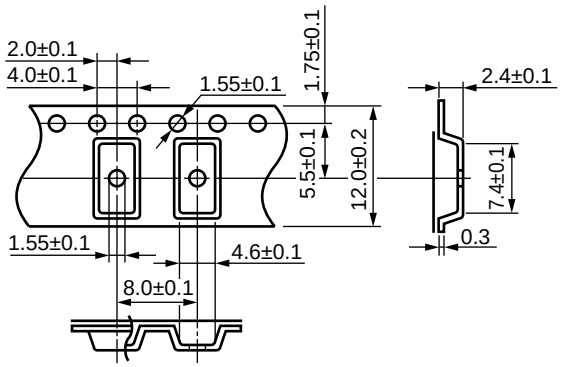
THRESHOLD INPUT CURRENT vs.
AMBIENT TEMPERATURE



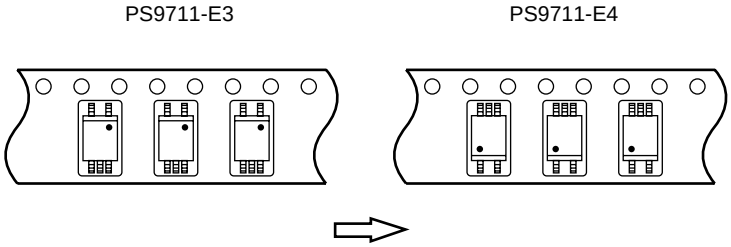
Remark The graphs indicate nominal characteristics.

★ **TAPING SPECIFICATIONS (in millimeters)**

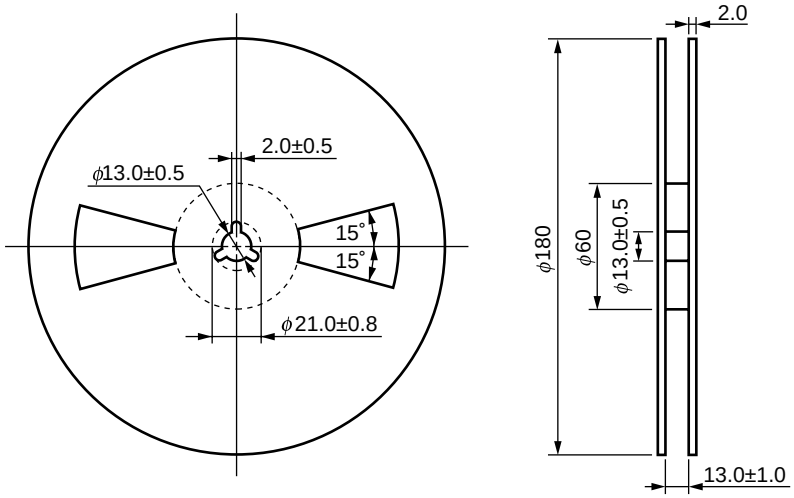
Outline and Dimensions (Tape)



Tape Direction

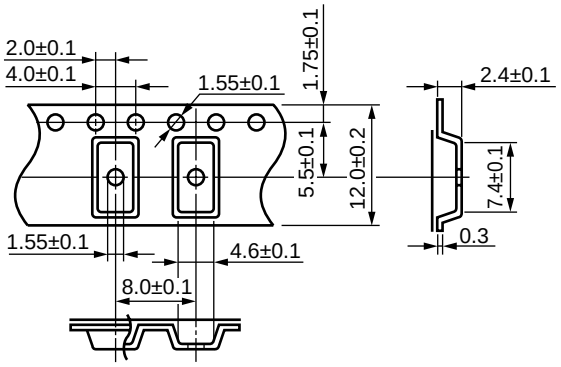


Outline and Dimensions (Tape)

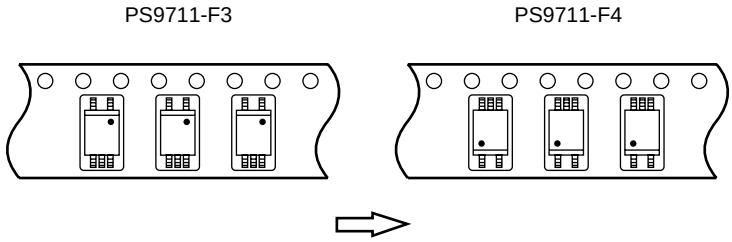


Packing: 900 pcs/reel

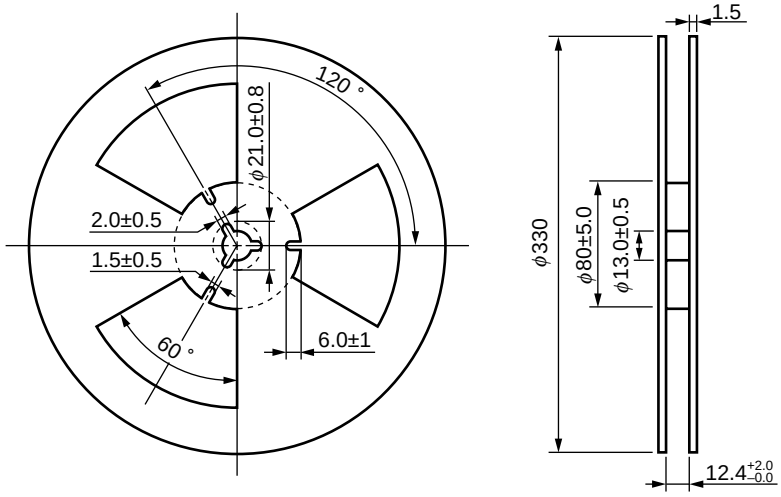
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



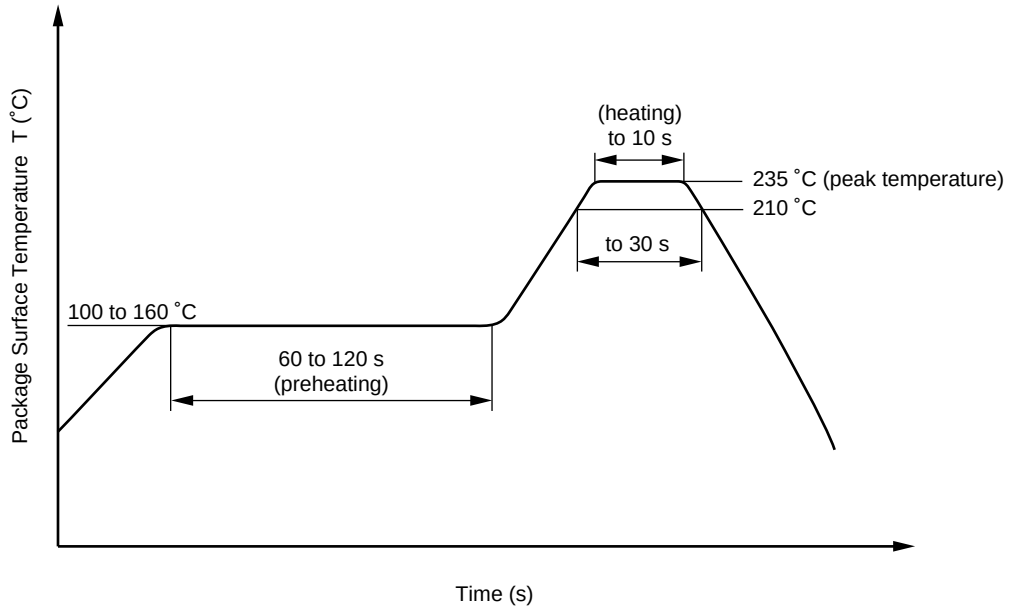
Packing: 3 500 pcs/reel

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]

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 subject to change without notice. Before using this document, please confirm that this is the latest version.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.
- NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation 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 the customer's equipment shall be done under the full responsibility of the customer. NEC Corporation assumes no responsibility for any losses incurred by the customer or third parties arising from the use of these circuits, software, and information.
- While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.
- NEC devices are classified into the following three quality grades:
  "Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device 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 or medical equipment for life support, etc.

  The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.