CEL

PHOTOCOUPLER

PS9687L1,PS9687L2

HIGH CMR, 10 Mbps OPEN COLLECTOR OUTPUT TYPE 8-PIN DIP PHOTOCOUPLER FOR CREEPAGE DISTANCE OF 8 mm

–NEPOC Series–

DESCRIPTION

The PS9687L1 and PS9687L2 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.

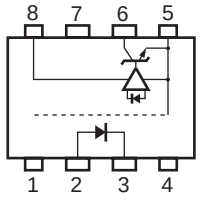
The PS9687L1 and PS9687L2 are designed specifically for long creepage-distance as well as high common mode transient immunity (CMR) and high speed digital output type. Consequently, they are suitable for high speed logic interface that needs long creepage-distance (8 mm) on mounting.

The PS9687L1 is in a plastic DIP (Dual In-line Package) and the PS9687L2 is lead bending type (Gull-wing) for surface mounting.

FEATURES

- Long creepage distance (8 mm MIN.)
- High common mode transient immunity (CM_H, CM_L = ±20 kV/μs TYP.)
- High isolation voltage (BV = 5 000 Vr.m.s.)
- High-speed response (10 Mbps)
- Pulse width distortion ($|t_{PHL} - t_{PLH}|$ = 15 ns TYP.)
- Open collector output
- Ordering number of tape product: PS9687L2-E3, E4: 1 000 pcs/reel
- Safety standards
  - UL approved: File No. E72422
  - BSI approved: No. 8990/8991
  - DIN EN60747-5-2 (VDE0884 Part2) approved: No.40008906 (Option)

PIN CONNECTIONS
(Top View)



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

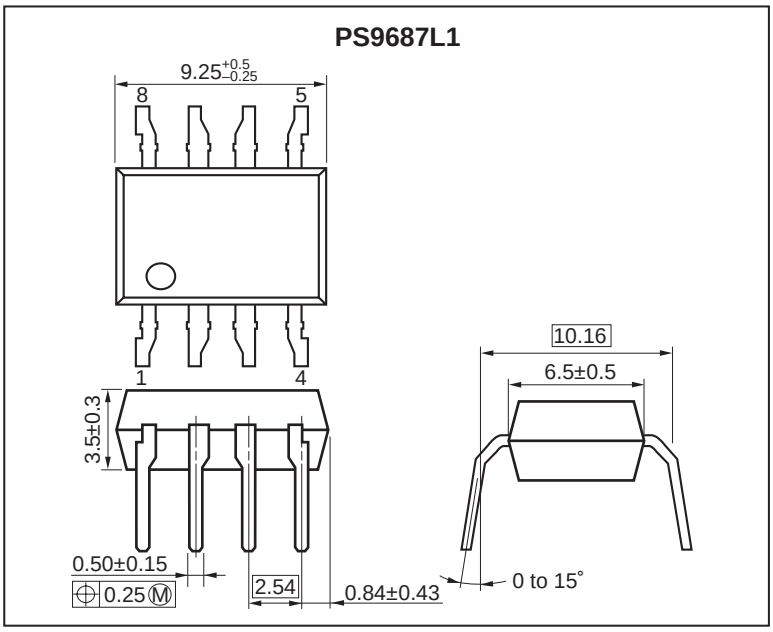
APPLICATIONS

- FA Network
- Measurement equipment
- PDP

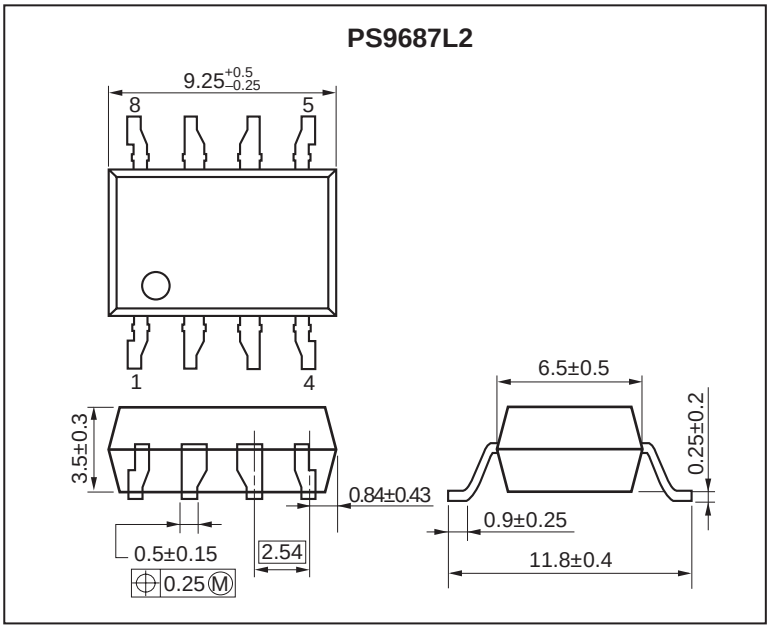
Document No. PN10573EJ01V0DS (1st edition)
Date Published July 2005 CP(K)

PACKAGE DIMENSIONS (UNIT: mm)

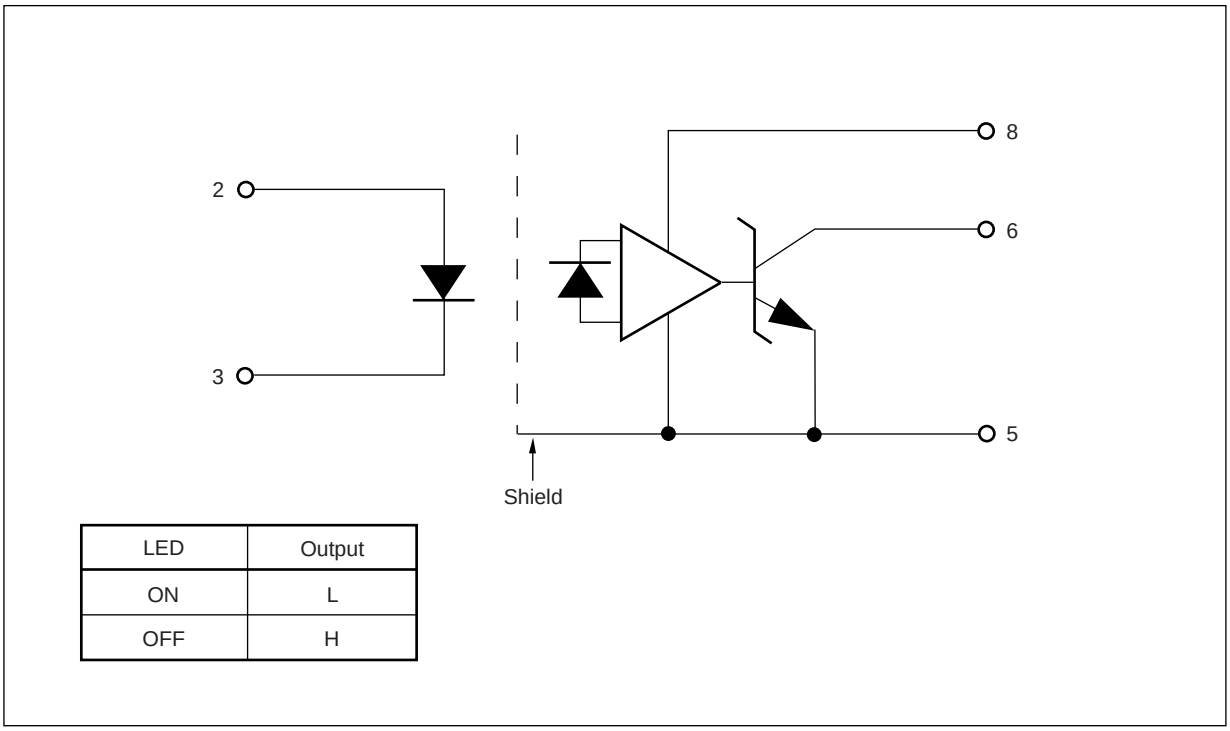
DIP Type



Lead Bending Type

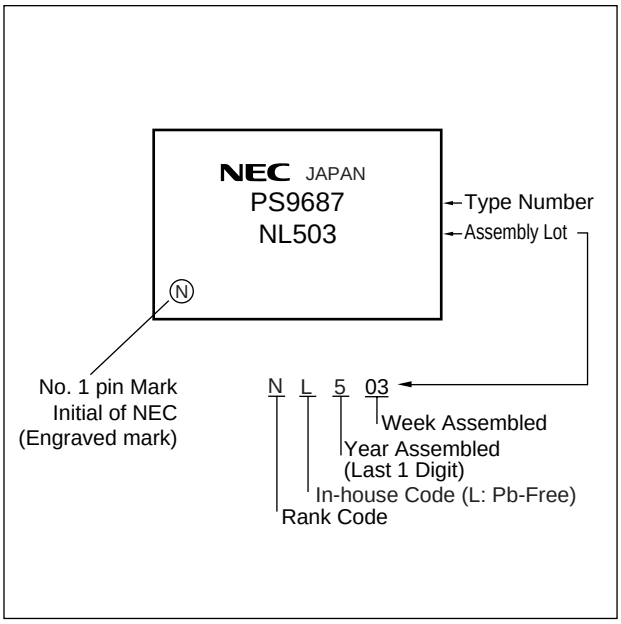


FUNCTIONAL DIAGRAM



LED	Output
ON	L
OFF	H

MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9687L1	PS9687L1-A	Pb-Free	Magazine case 50 pcs	Standard products (UL, BSI approved)	PS9687L1
PS9687L2	PS9687L2-A				PS9687L2
PS9687L2-E3	PS9687L2-E3-A		Embossed Tape 1 000 pcs/reel		
PS9687L2-E4	PS9687L2-E4-A				
PS9687L1-V	PS9687L1-V-A		Magazine case 50 pcs	DIN EN60747-5-2 (VDE0884 Part2) approved (Option)	PS9687L1
PS9687L2-V	PS9687L2-V-A				PS9687L2
PS9687L2-V-E3	PS9687L2-V-E3-A		Embossed Tape 1 000 pcs/reel		
PS9687L2-V-E4	PS9687L2-V-E4-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
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	5 000	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 (Collector pin). 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 1-4 shorted together, 5-8 shorted together.

RECOMMENDED OPERATING CONDITIONS (T_A = 25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
High Level Input Current	I_{FH}	6.3	10	12.0	mA
Low Level Input Voltage	V_{FL}	0		0.8	V
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
TTL (R_L = 1 kΩ, loads)	N			5	
Pull-up Resistance	R_L	330		4 k	Ω

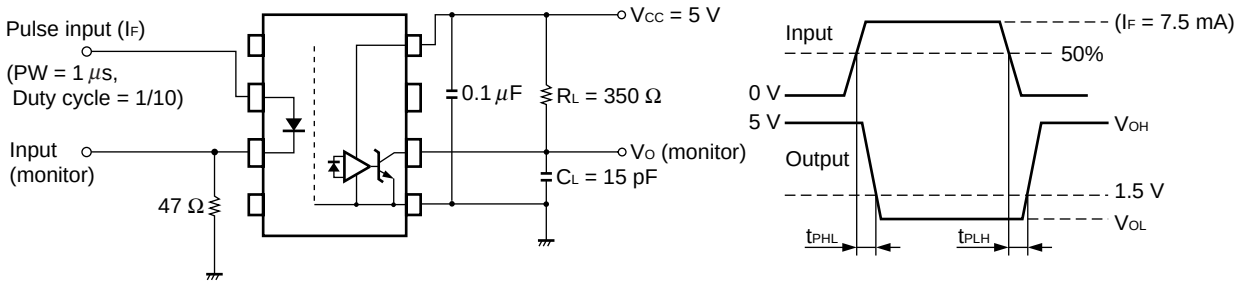
ELECTRICAL CHARACTERISTICS (T_A = –40 to +85°C, unless otherwise specified)

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_F = 0 V, f = 1 MHz, T_A = 25°C		30	150	pF
Detector	High Level Output Current	I_{OH}	V_{CC} = V_O = 5.5 V, V_F = 0.8 V		1	100	μA
	Low Level Output Voltage[*2]	V_{OL}	V_{CC} = 5.5 V, I_F = 5 mA, I_{OL} = 13 mA		0.35	0.6	V
	High Level Supply Current	I_{CCH}	V_{CC} = 5.5 V, I_F = 0 mA, V_O = Open		6	10	mA
	Low Level Supply Current	I_{CCL}	V_{CC} = 5.5 V, I_F = 10 mA, V_O = Open		11	13	mA
Coupled	Threshold Input Current (H → L)	I_{FHL}	V_{CC} = 5 V, V_O = 0.8 V, R_L = 350 Ω		2.5	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		0.9	5	pF
	Propagation Delay Time (H → L)[*3]	t_{PHL}	V_{CC} = 5 V, T_A = 25°C		40	75	ns
			R_L = 350 Ω, I_F = 7.5 mA, C_L = 15 pF			100	
	Propagation Delay Time (L → H)[*3]	t_{PLH}	T_A = 25 °C		55	75	ns
						100	
	Rise Time	t_r			20		ns
	Fall Time	t_f			10		ns
	Pulse Width Distortion (PWD)[*3]	$\lvert t_{PHL}-t_{PLH} \rvert$			15	50	ns
	Propagation Delay Skew	t_{PSK}				60	ns
	Common Mode Transient Immunity at High Level Output[*4]	CM_H	V_{CC} = 5 V, T_A = 25°C, I_F = 0 mA, $V_{O(MIN.)}$ = 2 V, V_{CM} = 1 kV, R_L = 350 Ω	10	20		kV/μs
	Common Mode Transient Immunity at Low Level Output[*4]	CM_L	V_{CC} = 5 V, T_A = 25°C, I_F = 7.5 mA, $V_{O(MAX.)}$ = 0.8 V, V_{CM} = 1 kV, R_L = 350 Ω	10	20		kV/μs

***1** Typical values at T_A = 25°C

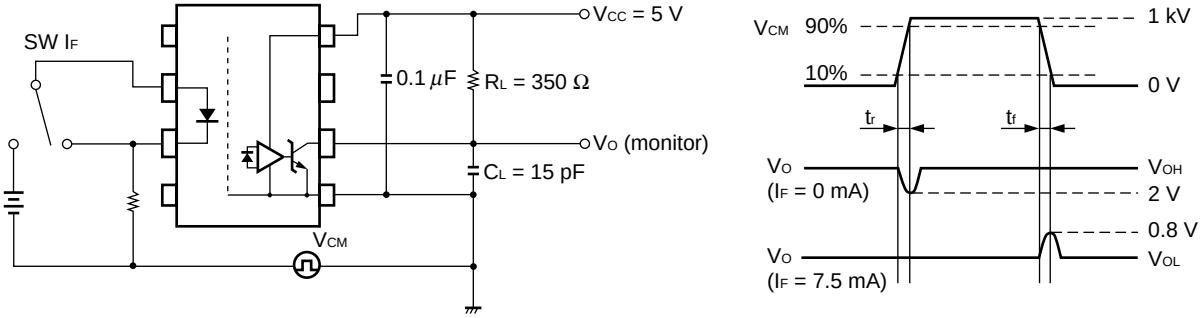
***2** Because V_{OL} of 2 V or more may be output when LED current is input and when output power supply is on and off, confirm the characteristics (operation with the power supply on and off) during design, before using this device.

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



Remark C_L includes probe and stray wiring capacitance.

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



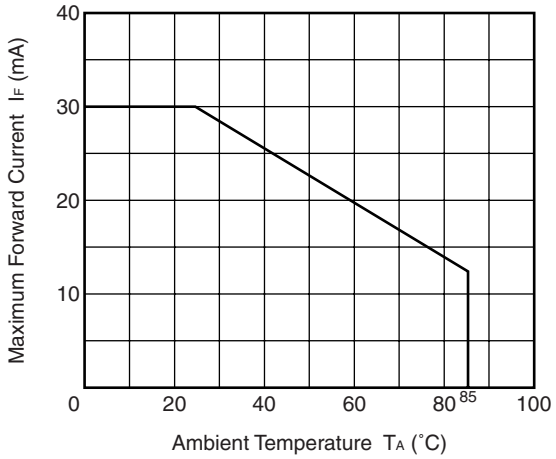
Remark C_L includes probe and stray wiring capacitance.

USAGE CAUTIONS

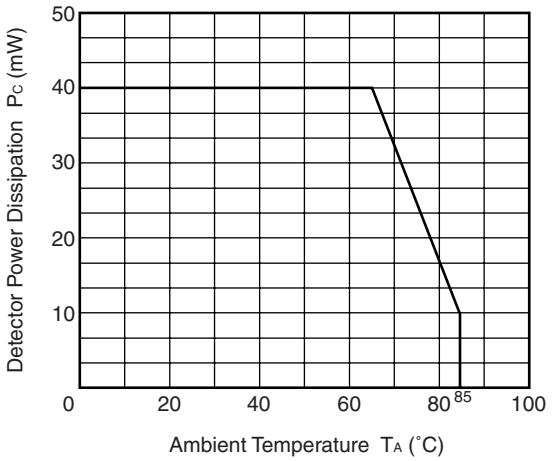
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler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

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

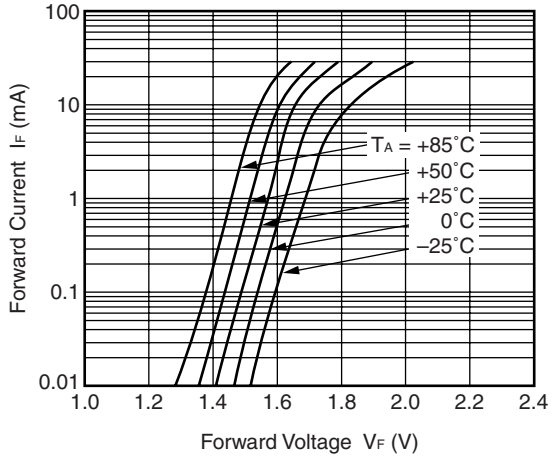
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



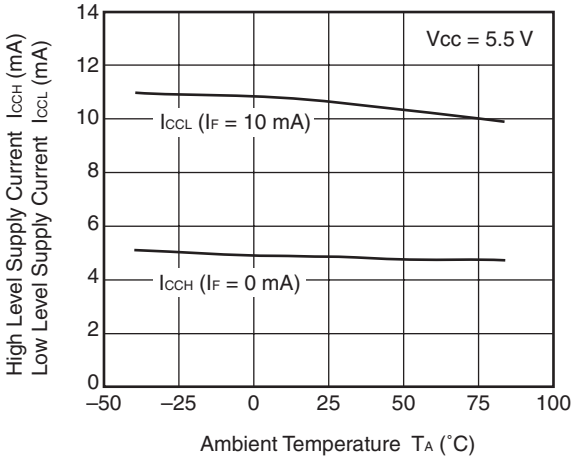
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



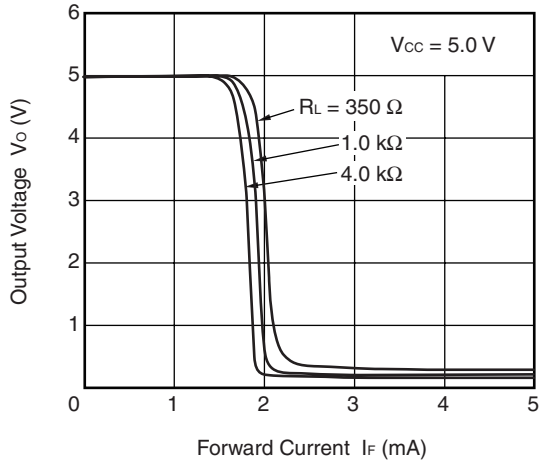
FORWARD CURRENT vs. FORWARD VOLTAGE



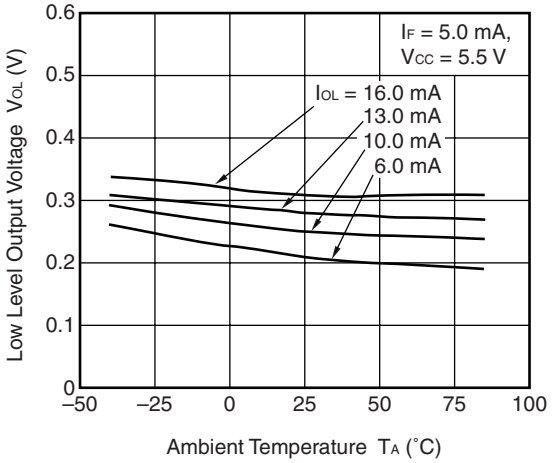
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs. FORWARD CURRENT

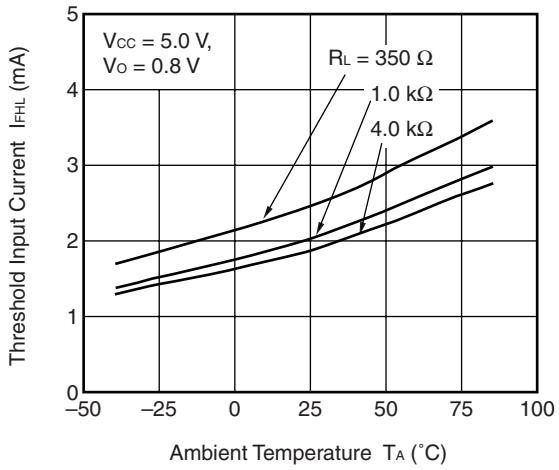


LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

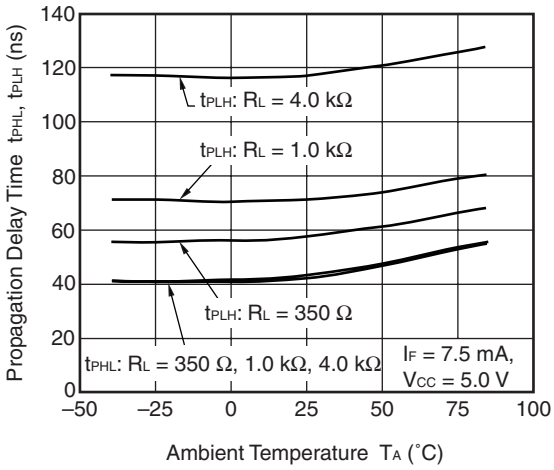


Remark The graphs indicate nominal characteristics.

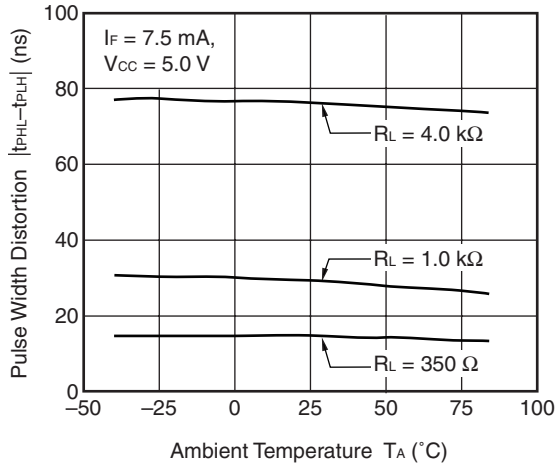
THRESHOLD INPUT CURRENT vs.
AMBIENT TEMPERATURE



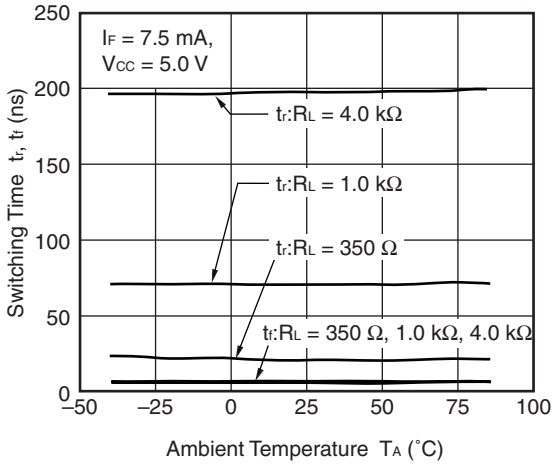
PROPAGATION DELAY TIME vs.
AMBIENT TEMPERATURE



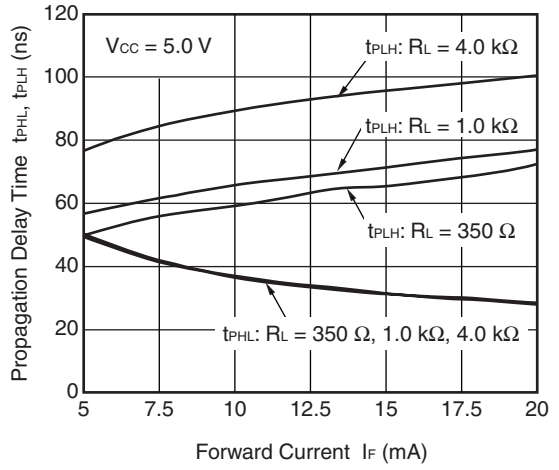
PULSE WIDTH DISTORTION vs.
AMBIENT TEMPERATURE



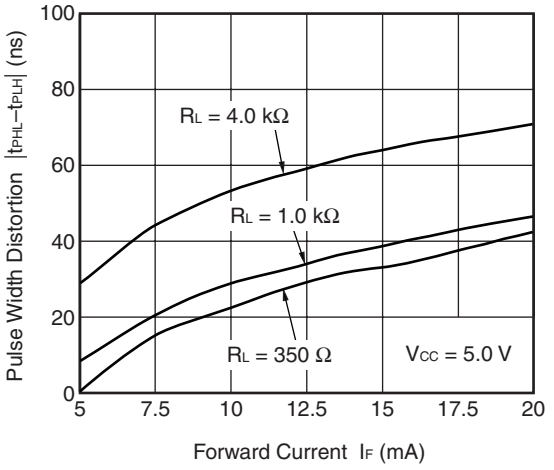
SWITCHING TIME vs.
AMBIENT TEMPERATURE



PROPAGATION DELAY TIME vs.
FORWARD CURRENT



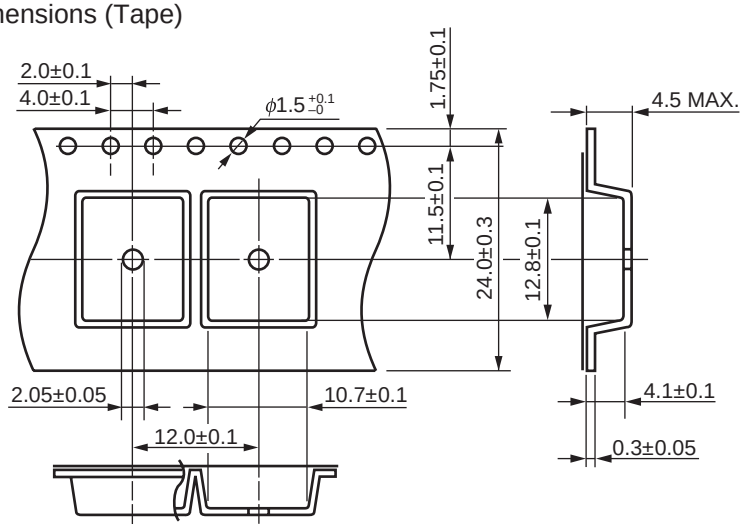
PULSE WIDTH DISTORTION vs.
FORWARD CURRENT



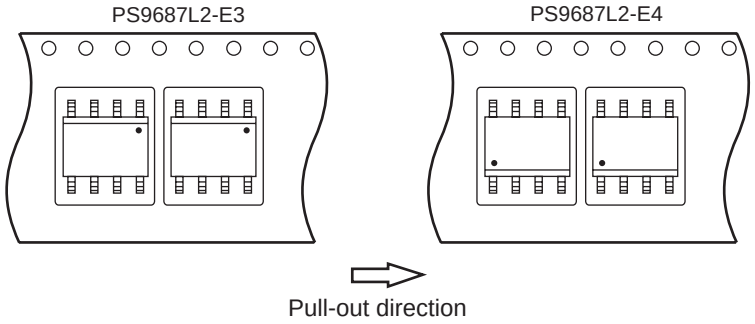
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

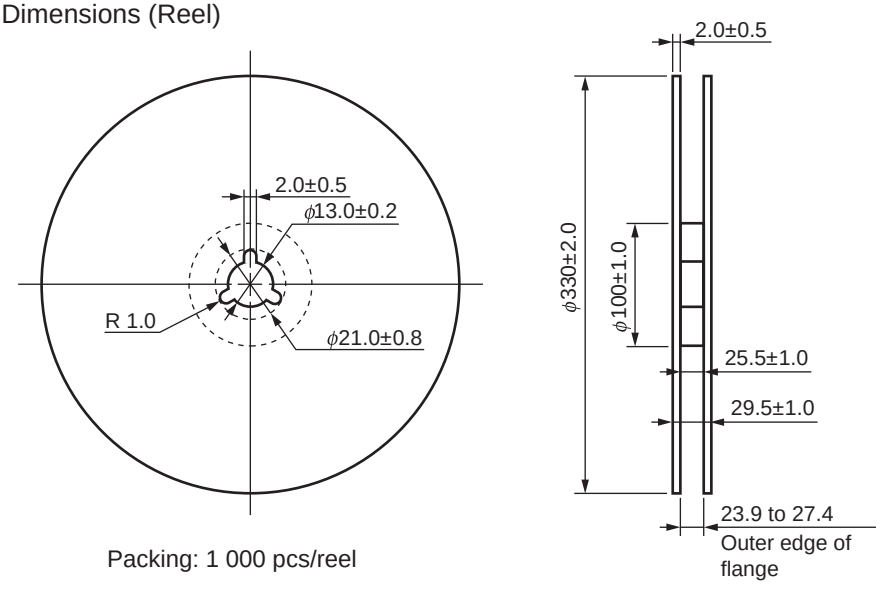
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



Packing: 1 000 pcs/reel

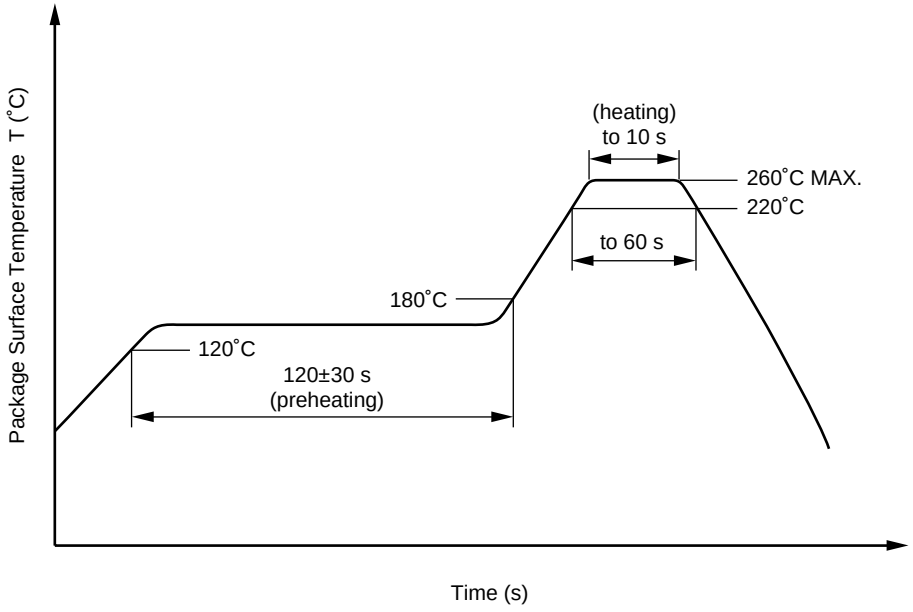
NOTES ON HANDLING

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.

CEL California Eastern Laboratories

4590 Patrick Henry Drive
Santa Clara, CA 95054-1817
Telephone: (408) 919-2500
Facsimile: (408) 988-0279

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL's understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
Lead (Pb)	< 1000 PPM	-A	-AZ
		Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.