



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 common mode transient immunity ($CM_H, CM_L = \pm 15 \text{ kV}/\mu\text{s MIN.}$)
- High-speed response ($t_{PHL} = 500 \text{ ns MAX.}, t_{PLH} = 750 \text{ ns MAX.}$)
- Maximum propagation delays ($t_{PLH} - t_{PHL} = 270 \text{ ns TYP.}$)
- Pulse width distortion ($|t_{PHL} - t_{PLH}| = 270 \text{ ns TYP.}$)
- Ordering number of tape product: PS9613L-E3, E4: 1 000 pcs/reel
- Safety standards
 - UL approved: File No. E72422 (S)
 - VDE0884 approved (Option) : No.91877

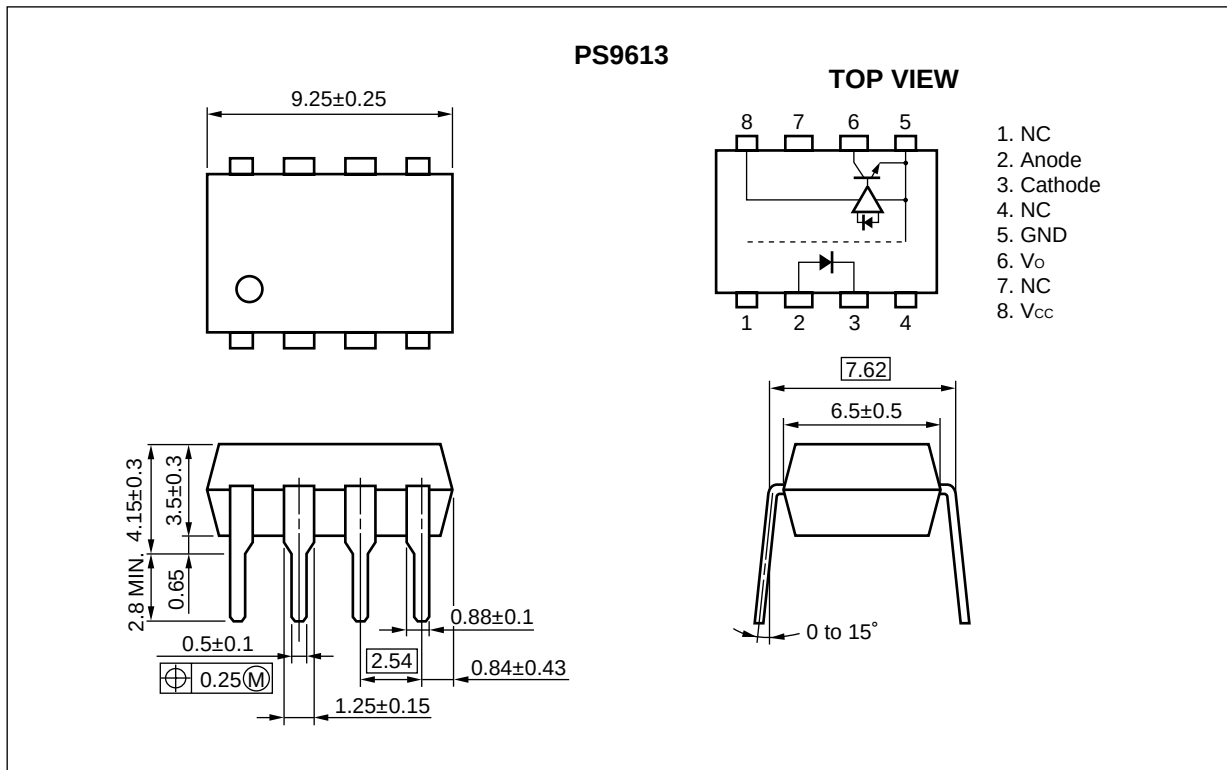
APPLICATIONS

- IPM Driver
- General purpose inverter

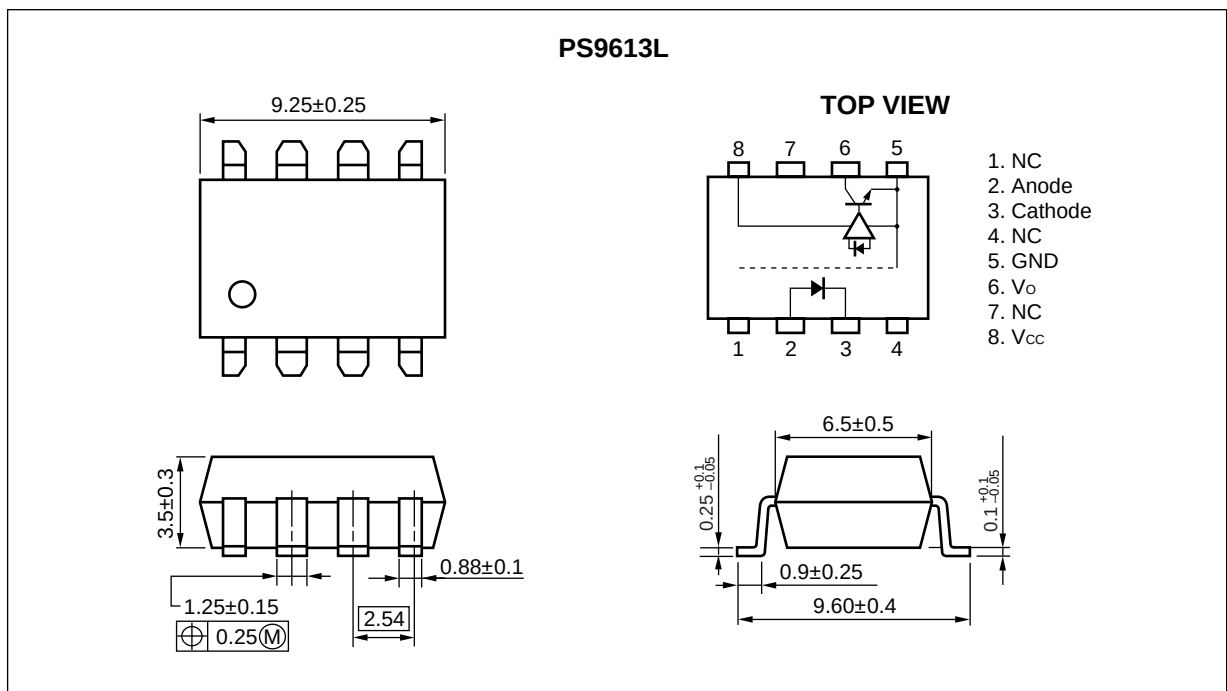
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★ **PACKAGE DIMENSIONS (UNIT: mm)**

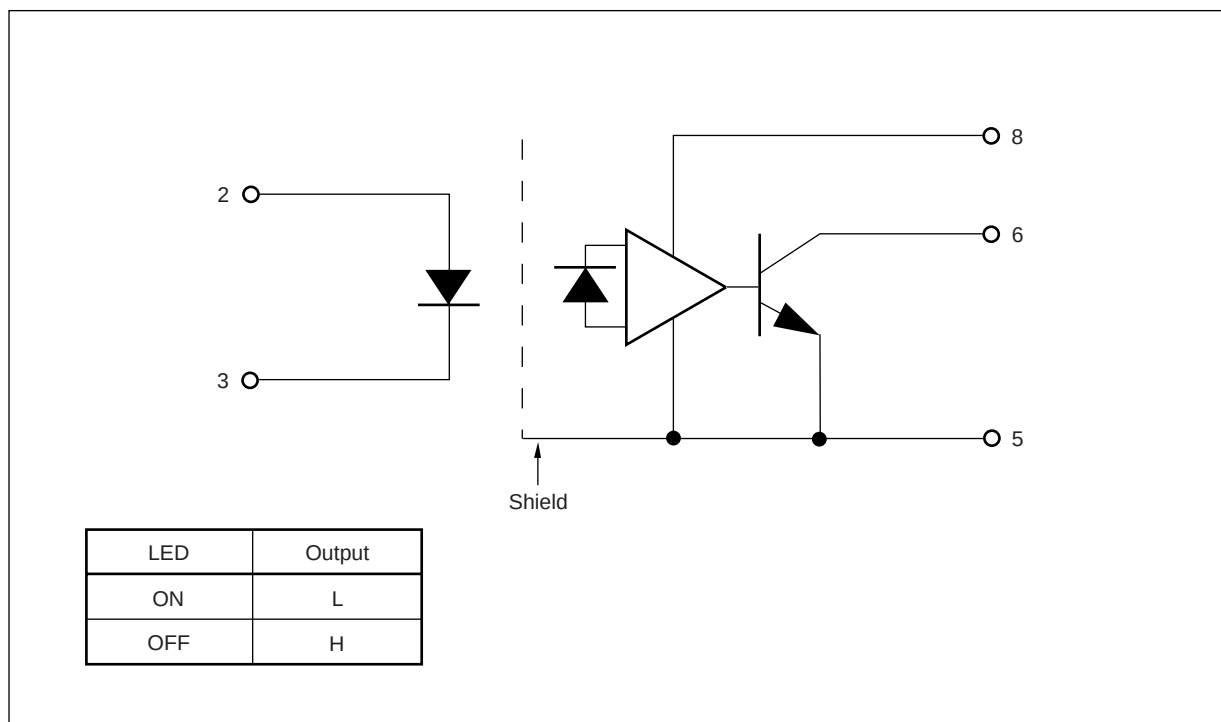
DIP Type



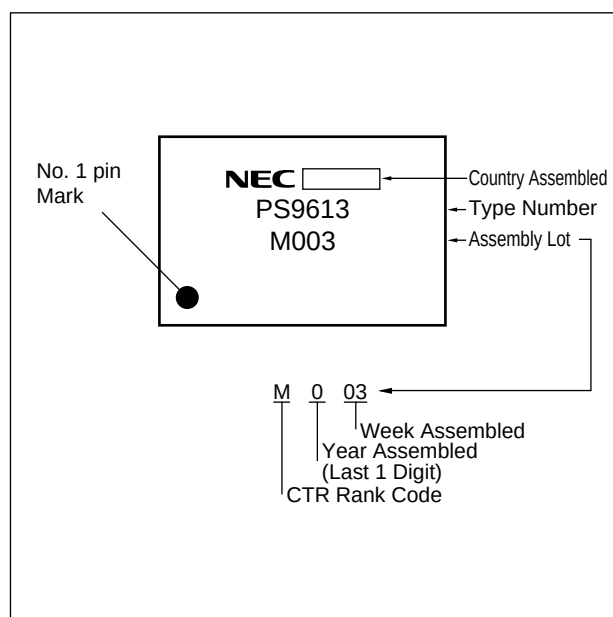
Lead Bending Type



FUNCTIONAL DIAGRAM



MARKING EXAMPLE



ORDERING INFORMATION (Solder Contains Lead)

Part Number	Package	Packing Style	Safety Standards Approval	Application Part Number ^{*1}
PS9613	8-pin DIP	Magazine case 50 pcs	Approved products other than VDE	PS9613
PS9613L				PS9613L
PS9613L-E3		Embossed Tape 1 000 pcs/reel		
PS9613L-E4				
PS9613-V		Magazine case 50 pcs	VDE0884 approved (Option)	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.

ORDERING INFORMATION (Pb-Free)

Part Number	Package	Packing Style	Safety Standards Approval	Application Part Number ^{*1}	
PS9613-A	8-pin DIP	Magazine case 50 pcs	Approved products other than VDE	PS9613	
PS9613L-A				PS9613L	
PS9613L-E3-A		Embossed Tape 1 000 pcs/reel			
PS9613L-E4-A					
PS9613-V-A		Magazine case 50 pcs	VDE0884 approved (Option)	PS9613	
PS9613L-V-A				PS9613L	
PS9613L-V-E3-A		Embossed Tape 1 000 pcs/reel			
PS9613L-V-E4-A					

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

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, 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	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55 to +125	$^\circ\text{C}$

*1 AC voltage for 1 minute at $T_A = 25^\circ\text{C}$, RH = 60% between input and output.

RECOMMENDED OPERATING CONDITIONS

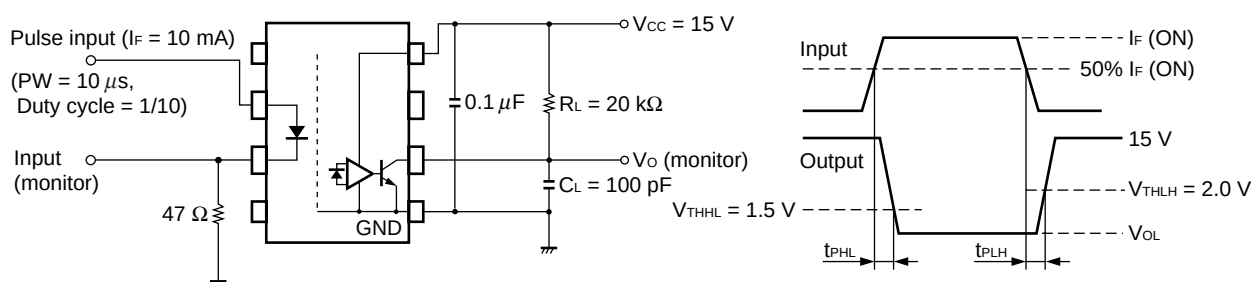
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward Current	I_F	10		20	mA
Output Voltage	V_O	0		30	V
Supply Voltage	V_{CC}	4.5	15	30	V
Input Voltage	V_F	0		0.8	V

ELECTRICAL CHARACTERISTICS ($T_A = -40$ to $+100^\circ\text{C}$, $V_{CC} = 15\text{ V}$, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP.* ¹	MAX.	Unit
Diode	Forward Voltage	V_F	$I_F = 10\text{ mA}$	1.3	1.65	2.1	V
	Reverse Current	I_R	$V_R = 3\text{ V}$			200	μA
	Terminal Capacitance	C_t	$V = 0\text{ V}$, $f = 1\text{ MHz}$, $T_A = 25^\circ\text{C}$		30		pF
Detector	Low Level Output Voltage	V_{OL}	$I_F = 10\text{ mA}$, $V_{CC} = 5\text{ V}$, $I_{OL} = 2.4\text{ mA}$		0.13	0.6	V
	High Level Output Current	I_{OH}	$V_{CC} = 30\text{ V}$, $V_F = 0.8\text{ V}$		1.0	50	μA
	High Level Supply Current	I_{CCH}	$V_{CC} = 30\text{ V}$, $V_F = 0.8\text{ V}$, $V_O = \text{open}$		0.6	1.3	mA
	Low Level Supply Current	I_{CCL}	$V_{CC} = 30\text{ V}$, $I_F = 10\text{ mA}$, $V_O = \text{open}$		0.6	1.3	mA
Coupled	Threshold Input Current ($H \rightarrow L$)	I_{FHL}	$V_O = 0.8\text{ V}$, $I_O = 0.75\text{ mA}$		1.5	5.0	mA
	Current Transfer Ratio (I_C/I_F)	CTR	$I_F = 10\text{ mA}$, $V_O = 0.6\text{ V}$	44	110		%
	Isolation Resistance	R_{I-O}	$V_{I-O} = 1\text{ kV}_{DC}$, $R_H = 40$ to 60% , $T_A = 25^\circ\text{C}$	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	$V = 0\text{ V}$, $f = 1\text{ MHz}$, $T_A = 25^\circ\text{C}$		0.6		pF
	Propagation Delay Time ($H \rightarrow L$)* ²	t_{PHL}	$I_F = 10\text{ mA}$, $R_L = 20\text{ k}\Omega$, $C_L = 100\text{ pF}$, $V_{THHL} = 1.5\text{ V}$, $V_{THLH} = 2.0\text{ V}$		250	500	ns
	Propagation Delay Time ($L \rightarrow H$)* ²	t_{PLH}			520	750	
	Maximum Propagation Delays	$t_{PLH}-t_{PHL}$		-200	270	650	
	Pulse Width Distortion (PWD)* ²	$ t_{PHL}-t_{PLH} $			270	650	
	Common Mode Transient Immunity at High Level Output* ³	CM_H	$T_A = 25^\circ\text{C}$, $I_F = 0\text{ mA}$, $V_O > 3.0\text{ V}$, $V_{CM} = 1.5\text{ kV}$, $R_L = 20\text{ k}\Omega$, $C_L = 100\text{ pF}$	15			kV/ μs
	Common Mode Transient Immunity at Low Level Output* ³	CM_L	$T_A = 25^\circ\text{C}$, $I_F = 10\text{ mA}$, $V_O < 1.0\text{ V}$, $V_{CM} = 1.5\text{ kV}$, $R_L = 20\text{ k}\Omega$, $C_L = 100\text{ pF}$	15			kV/ μs

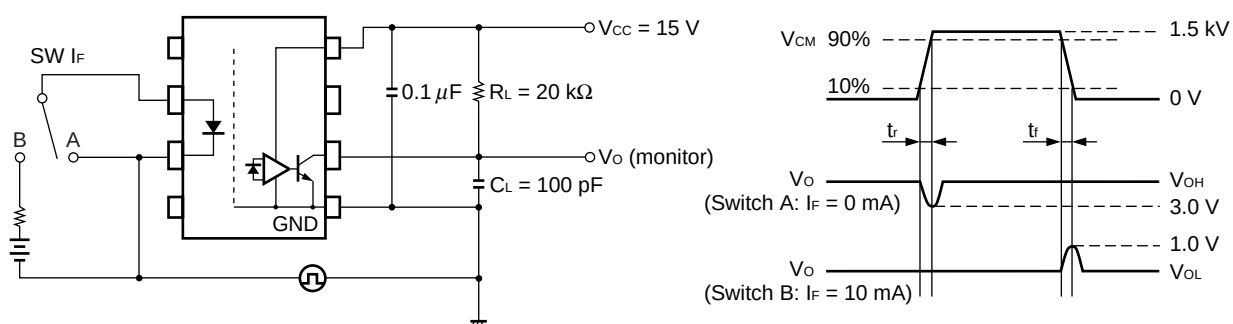
*1 Typical values at $T_A = 25^\circ\text{C}$.

*2 Test circuit for propagation delay time



C_L includes probe and stray wiring capacitance.

*3 Test circuit for common mode transient immunity

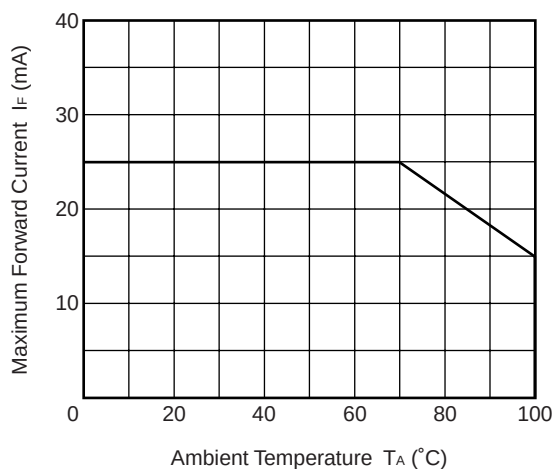
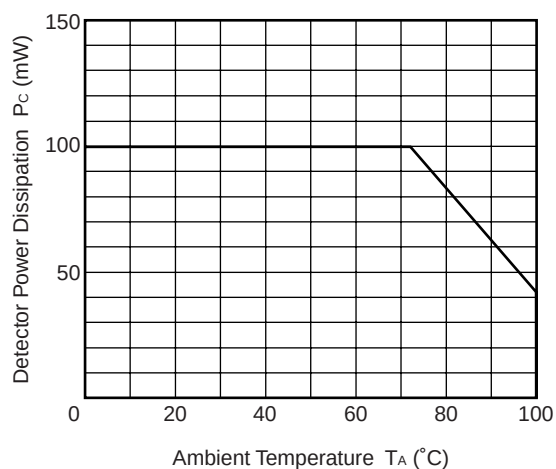
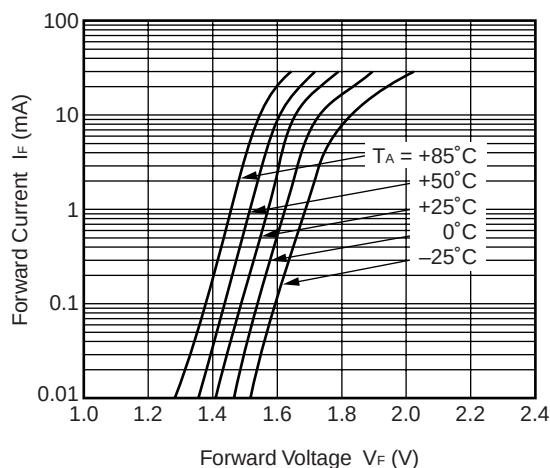
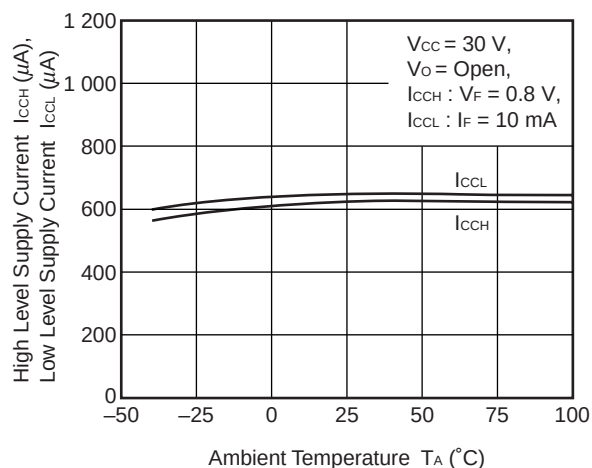
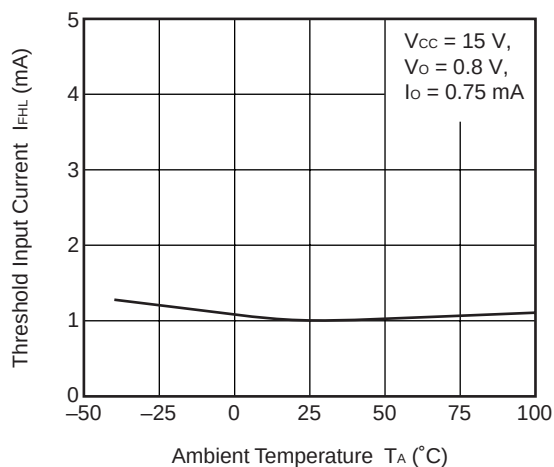
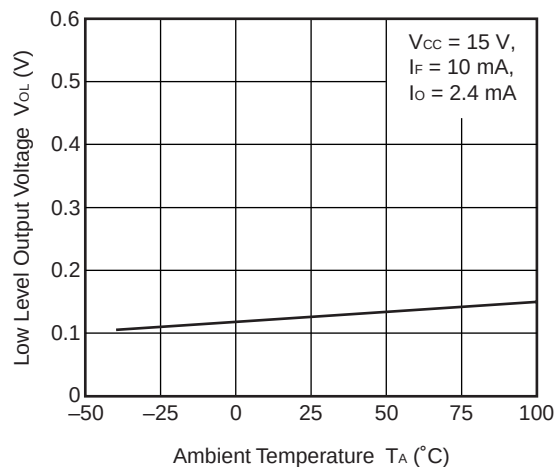


C_L includes probe and stray wiring capacitance.

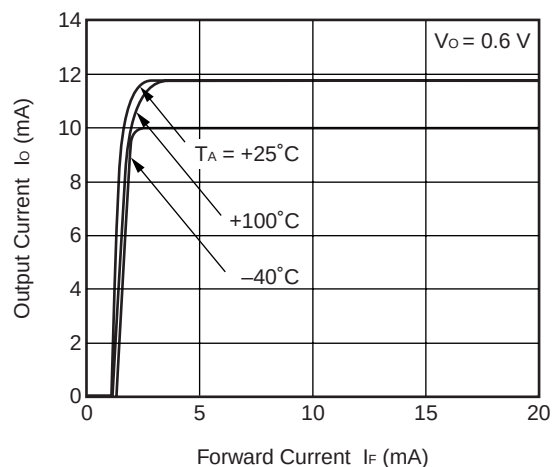
USAGE CAUTIONS

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 $0.1\text{ }\mu\text{F}$ 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.

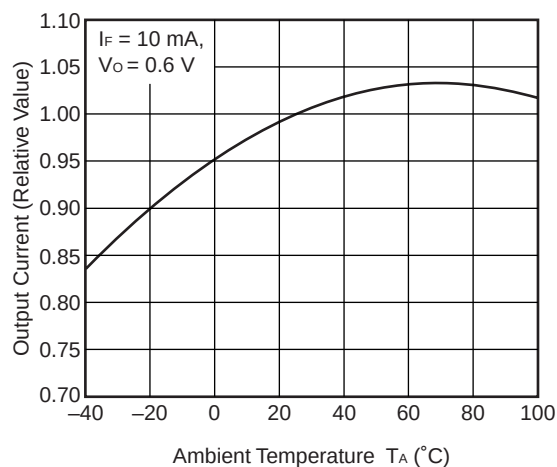
★

TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)MAXIMUM FORWARD CURRENT
vs. AMBIENT TEMPERATUREDETECTOR POWER DISSIPATION
vs. AMBIENT TEMPERATUREFORWARD CURRENT vs.
FORWARD VOLTAGESUPPLY CURRENT vs.
AMBIENT TEMPERATURETHRESHOLD INPUT CURRENT vs.
AMBIENT TEMPERATURELOW LEVEL OUTPUT VOLTAGE vs.
AMBIENT TEMPERATURE

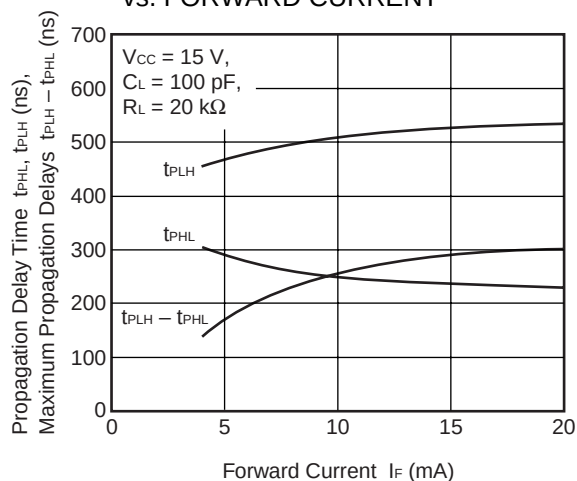
OUTPUT CURRENT vs. FORWARD CURRENT



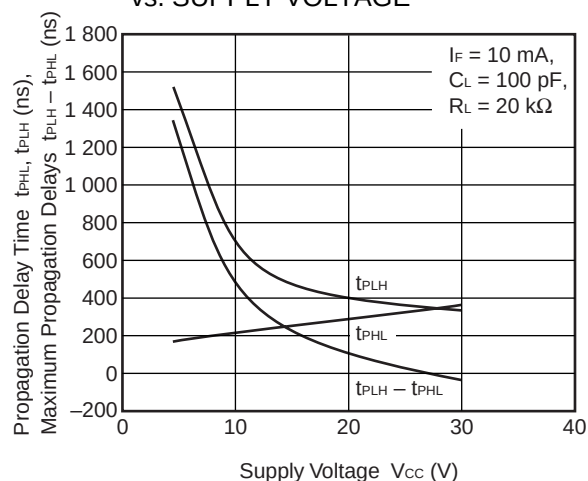
OUTPUT CURRENT vs. AMBIENT TEMPERATURE



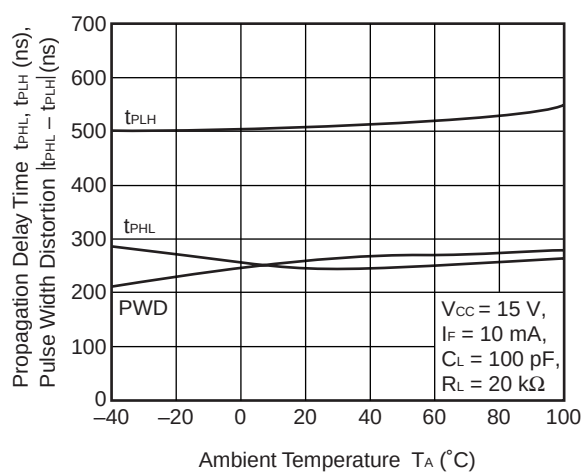
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. FORWARD CURRENT



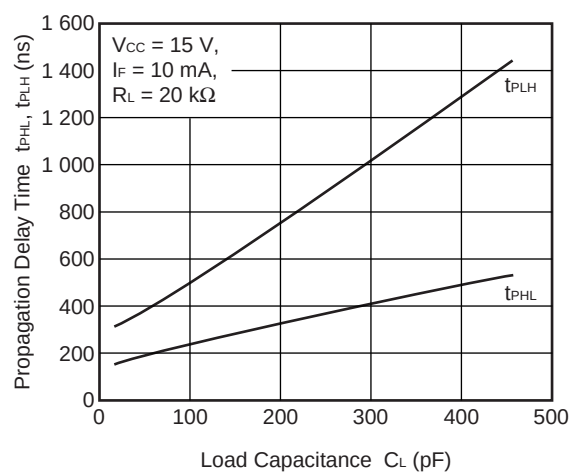
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE

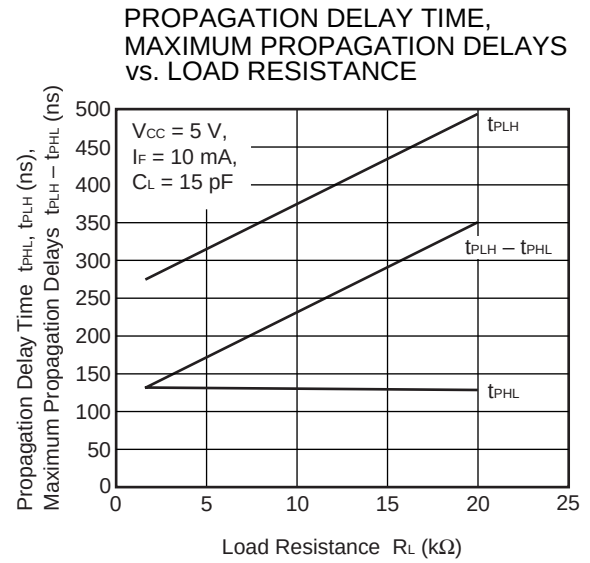
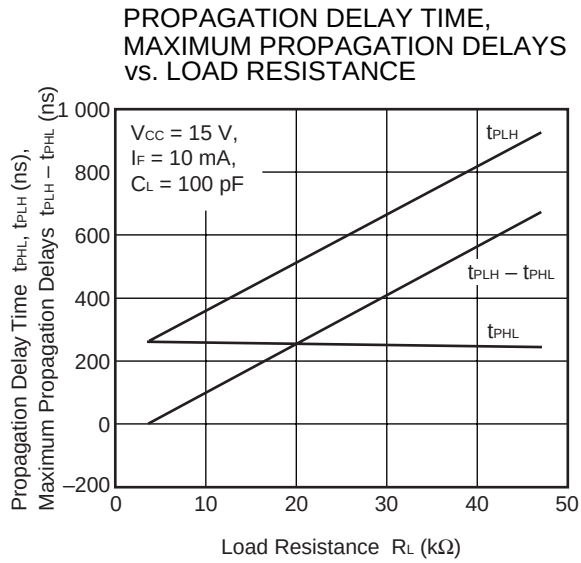


PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



PROPAGATION DELAY TIME vs. LOAD CAPACITANCE

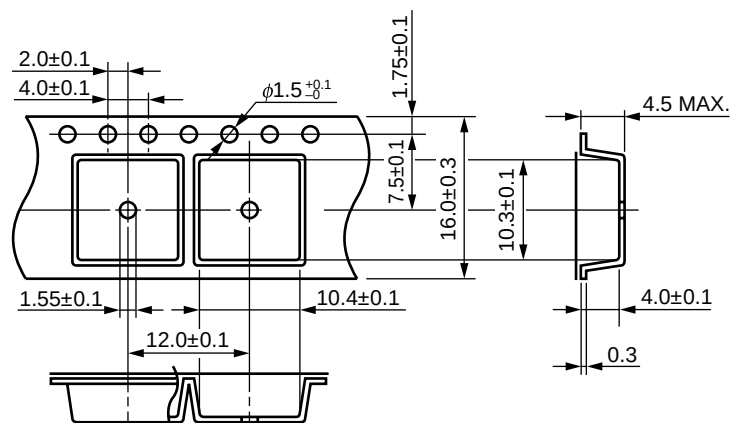




Remark The graphs indicate nominal characteristics.

★ TAPING SPECIFICATIONS (UNIT: mm)

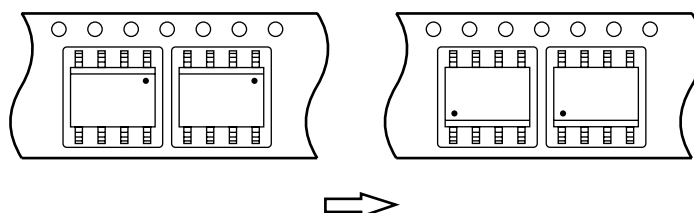
Outline and Dimensions (Tape)



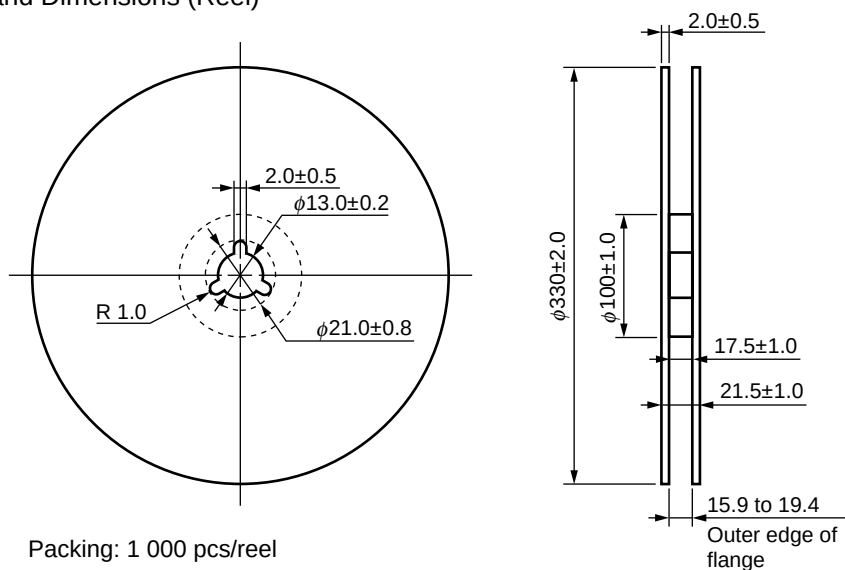
Tape Direction

PS9613L-E3

PS9613L-E4



Outline and Dimensions (Reel)



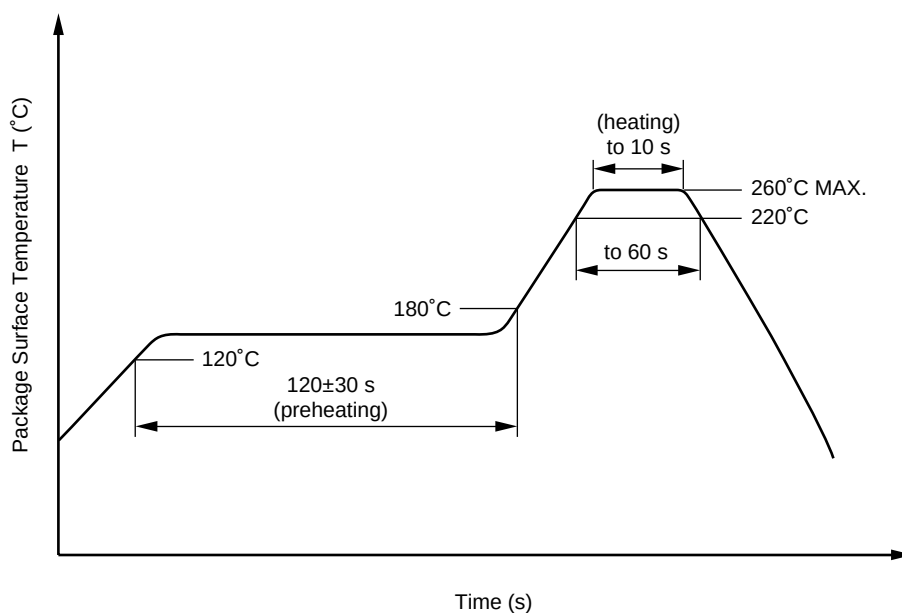
NOTES ON HANDLING

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) 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.

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	
		-A	-AZ
Lead (Pb)	< 1000 PPM	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.

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