

HIGH NOISE REDUCTION, 15 Mbps CMOS OUTPUT TYPE 8-PIN SSOP PHOTOCOUPLER

–NEPOC Series–

DESCRIPTION

The PS9851-1, -2 are optically coupled isolators containing GaAlAs LED on the input side and a CMOS output IC on the output side.

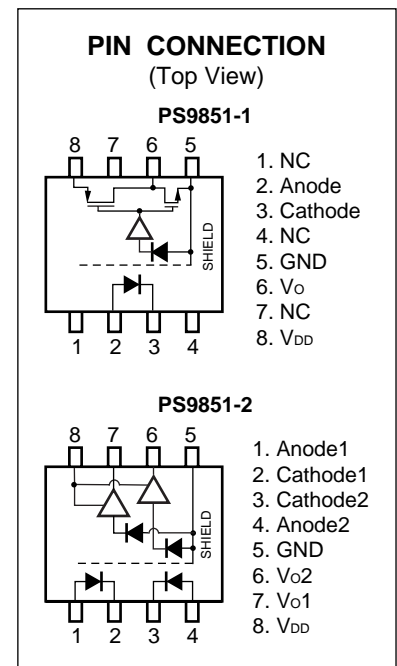
They are high common mode transient immunity (CMR), high-speed CMOS output type photocouplers designed for high-speed logic interface circuits.

★ FEATURES

- High-speed response (15 Mbps)
- Operable at high temperature (–40 to +100°C)
- High common mode transient immunity (CMH, CML = ±20 kV/μs TYP.)
- High isolation voltage (BV = 2 500 Vr.m.s.)
- Pulse width distortion ($|t_{PHL}-t_{PLH}| = 3 \text{ ns TYP.}$)
- Ordering number of tape product : PS9851-1-F3, F4: 1 500 pcs/reel
: PS9851-2-F3, F4: 1 500 pcs/reel
- Pb-Free product
- Safety standards
 - UL approved: File No. E72422
 - DIN EN60747-5-2 (VDE0884 Part2) approved No.40008347 (Option)

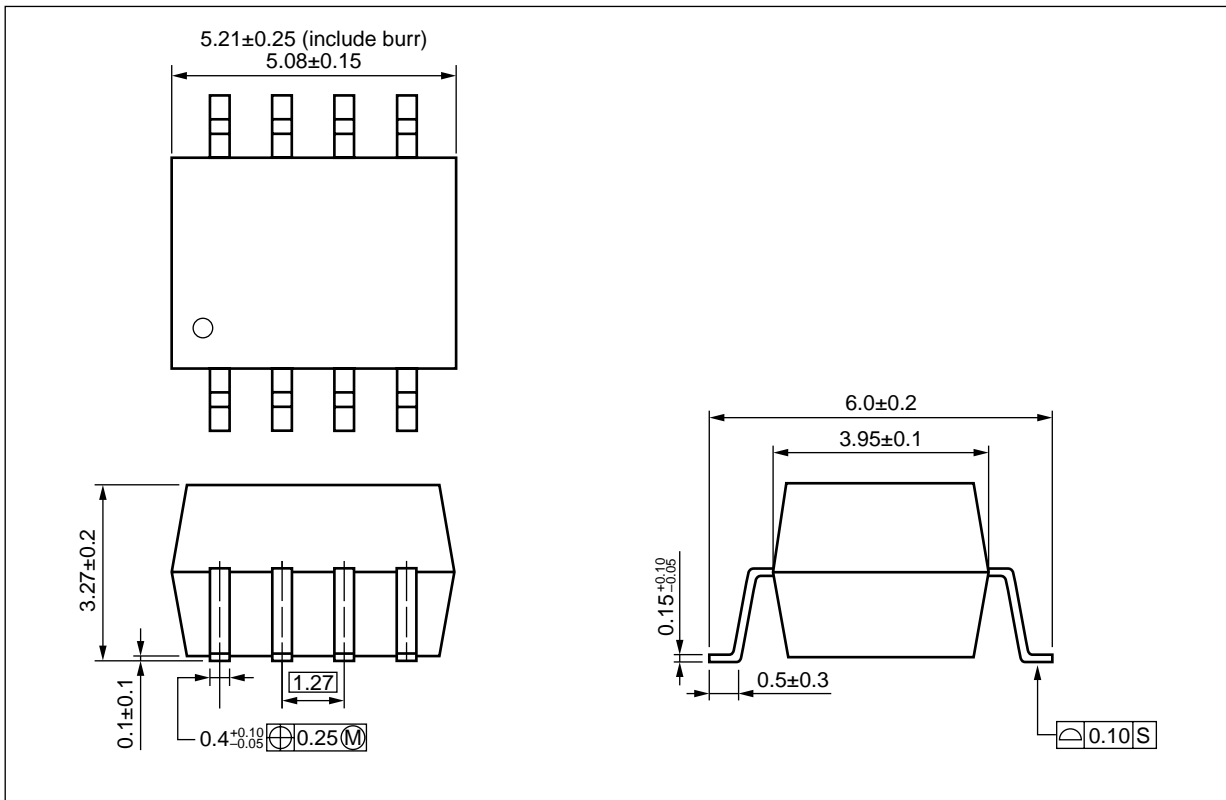
APPLICATIONS

- FA Network
- Measurement equipment
- PDP

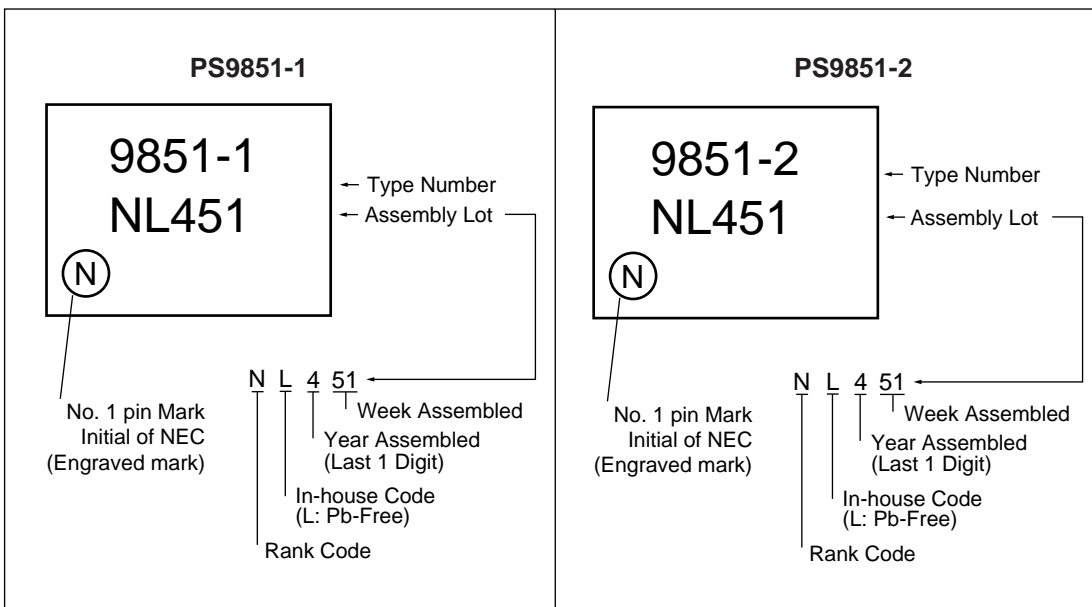


The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

PACKAGE DIMENSIONS (UNIT: mm)



★ MARKING EXAMPLE



★ **ORDERING INFORMATION**

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number* ¹
PS9851-1	PS9851-1-A	Pb-Free	20 pcs (Tape 20 pcs cut)	Standard products (UL approved)	PS9851-1
PS9851-1-F3	PS9851-1-F3-A		Embossed Tape 1 500 pcs/reel		
PS9851-1-F4	PS9851-1-F4-A				
PS9851-2	PS9851-2-A		20 pcs (Tape 20 pcs cut)		PS9851-2
PS9851-2-F3	PS9851-2-F3-A		Embossed Tape 1 500 pcs/reel		
PS9851-2-F4	PS9851-2-F4-A				
PS9851-1-V	PS9851-1-V-A		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2 (VDE0884 Part2) approved (Option)	PS9851-1
PS9851-1-V-F3	PS9851-1-V-F3-A		Embossed Tape 1 500 pcs/reel		
PS9851-1-V-F4	PS9851-1-V-F4-A				
PS9851-2-V	PS9851-2-V-A		20 pcs (Tape 20 pcs cut)		PS9851-2
PS9851-2-V-F3	PS9851-2-V-F3-A		Embossed Tape 1 500 pcs/reel		
PS9851-2-V-F4	PS9851-2-V-F4-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	20	mA
	Reverse Voltage	V _R	5	V
Detector	Supply Voltage	V _{DD}	0 to 5.5	V
	Output Voltage	V _O	-0.5 to V _{DD} +0.5	V
	Output Current	I _O	2	mA
Isolation Voltage ^{*2}		BV	2 500	V _{r.m.s.}
Operating Ambient Temperature		T _A	-40 to +100	°C
Storage Temperature		T _{stg}	-55 to +125	°C

*1 Reduced to 0.33 mA/°C at T_A = 85°C or more for PS9851-2.

*2 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
Forward Current	I _F	10		16	mA
Supply Voltage	V _{DD}	4.5	5.0	5.5	V

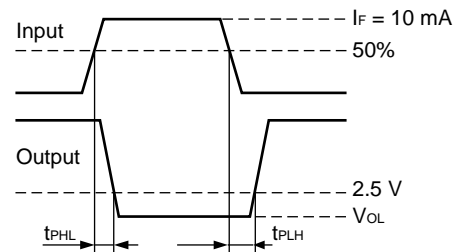
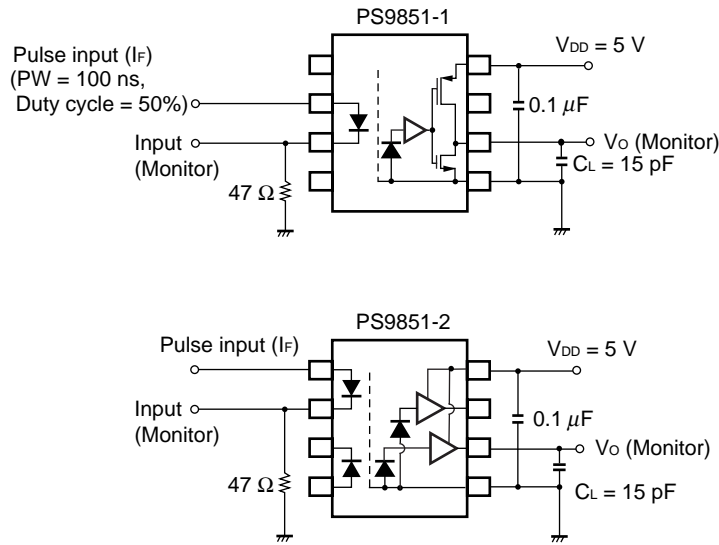
★ ELECTRICAL CHARACTERISTICS (T_A = -40 to +100°C, V_{DD} = 4.5 to 5.5 V, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP. *1	MAX.	Unit	
Diode	Forward Voltage	V _F	I _F = 10 mA, T _A = 25°C		1.6	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 Supply Current	I _{DDH}	I _F = 0 mA (1ch)		2.5	5	mA/ch	
	Low Level Supply Current	I _{DDL}	I _F = 10 mA (1ch)		2	5		
	High Level Output Voltage	V _{OH}	I _O = -20μA, I _F = 0 mA	4.0	5.0		V	
	Low Level Output Voltage *2	V _{OL}	I _O = 20μA, I _F = 10 mA		0	0.1		
Coupled	Threshold Input Current	I _{FHL}	V _O < 1 V		2.8	6	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}	I _F = 10 mA, V _{DD} = 5 V, C _L = 15 pF, CMOS Levels		34	60	ns	
	Propagation Delay Time (L → H) *3	t _{PLH}			37	60		
	Pulse Width	PW			100			
	Pulse Width Distortion (PWD) *3	t _{PHL} - t _{PLH}				3		30
	Propagation Delay Skew	t _{PSK}						40
	Rise Time	t _r				4		
	Fall Time	t _f				4		
	Common Mode Transient Immunity at High Level Output *4	CM _H		V _{DD} = 5 V, I _F = 0 mA, V _{CM} = 1 kV, V _O > 4 V, T _A = 25°C	10	20		
Common Mode Transient Immunity at Low Level Output *4	CM _L	V _{DD} = 5 V, I _F = 10 mA, V _{CM} = 1 kV, V _O < 1 V, T _A = 25°C		10	20			

*1 Typical values at T_A = 25°C

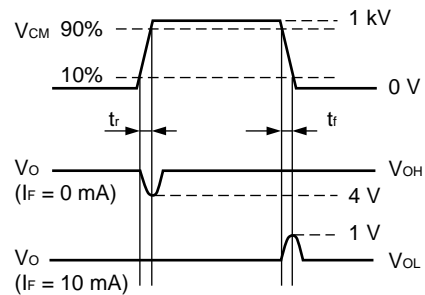
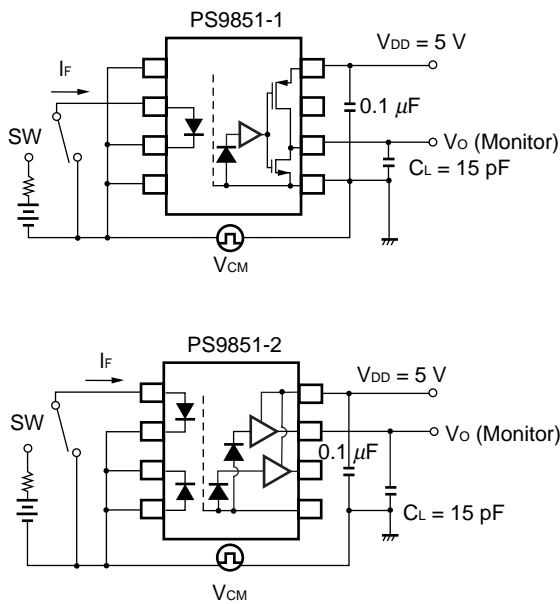
*2 Because V_{OL} of 2 V or more may be output when LED current input and when output supply, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

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



Remark C_L includes probe and stray wiring capacitance.

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



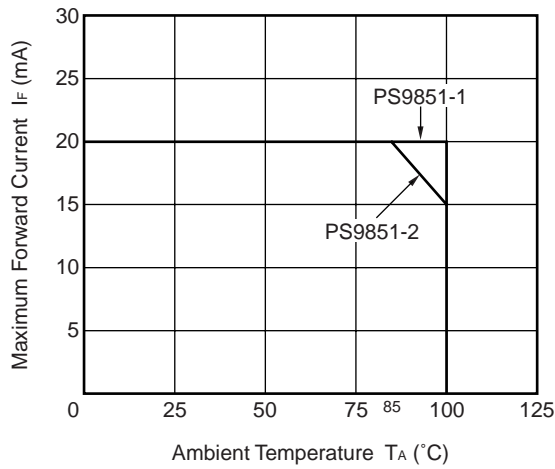
Remark C_L includes probe and stray wiring capacitance.

USAGE CAUTIONS

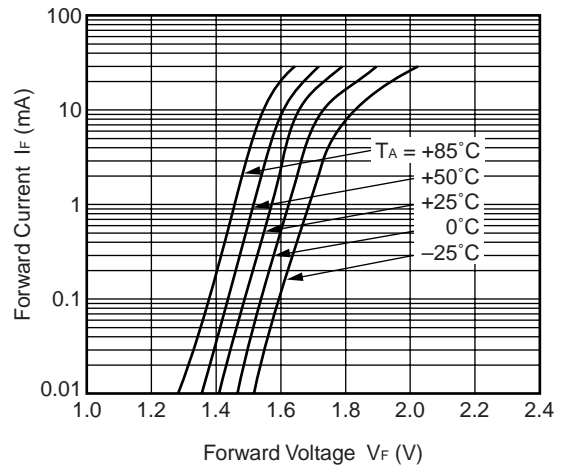
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 μF is used between V_{DD} and GND near device. Also, ensure that the distance between the leads of the photocoupler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

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

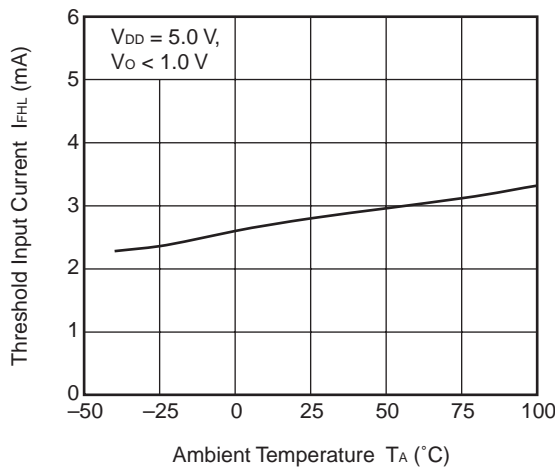
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



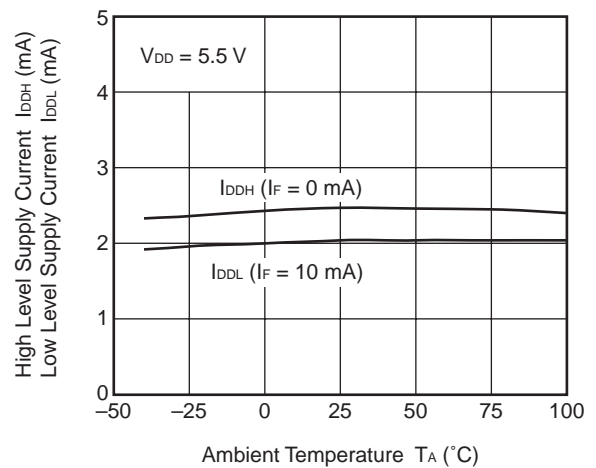
FORWARD CURRENT vs. FORWARD VOLTAGE



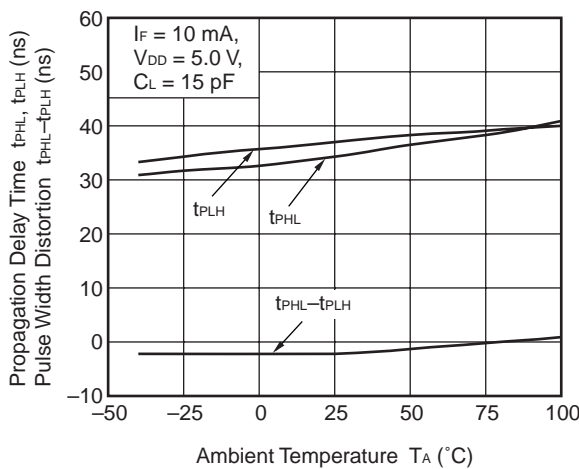
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



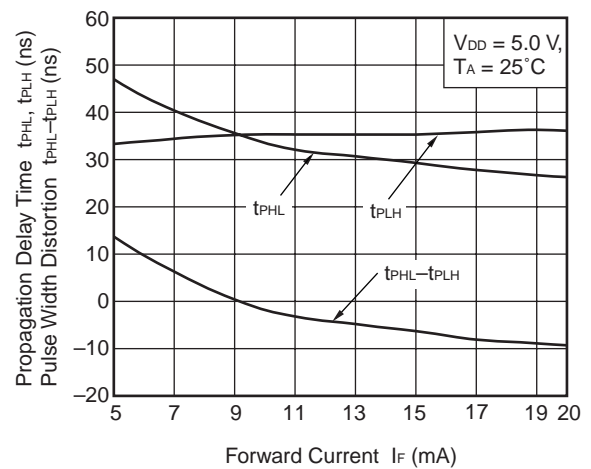
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



tPHL, tPLH, tPHL-tPLH vs. AMBIENT TEMPERATURE



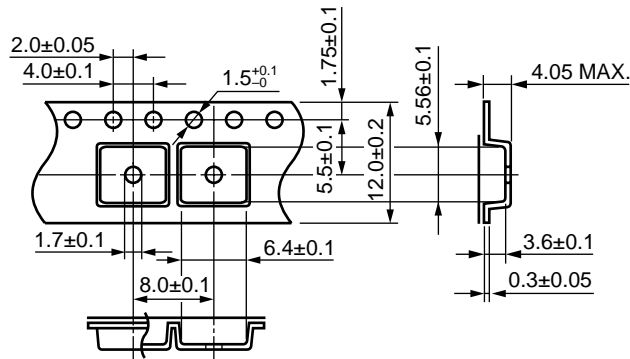
tPHL, tPLH, tPHL-tPLH vs. FORWARD CURRENT



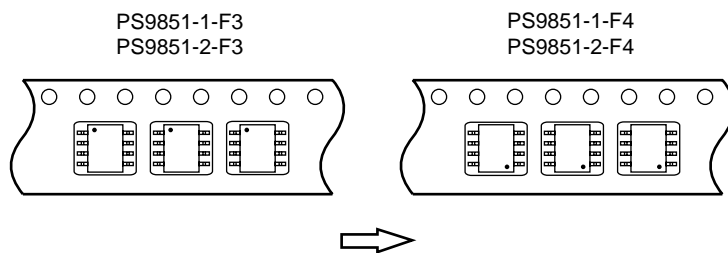
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

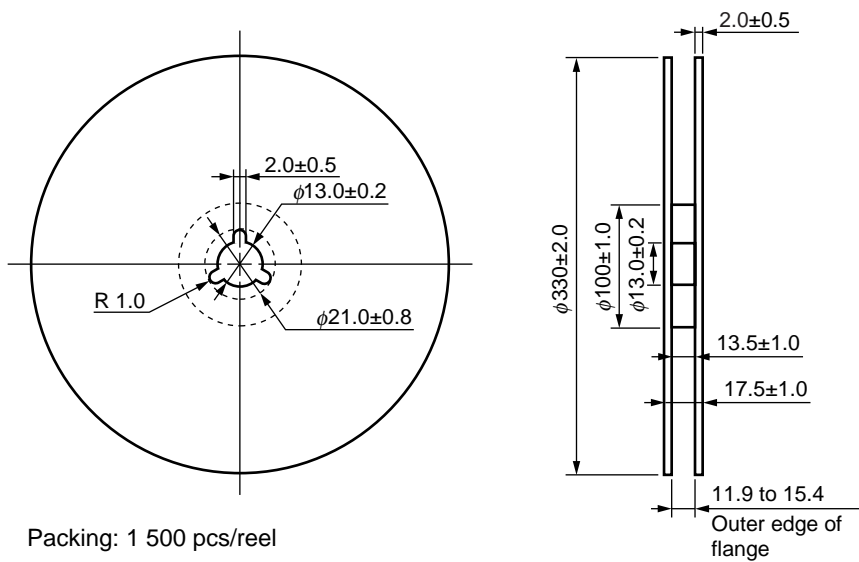
Outline and Dimensions (Tape)



Taping Direction



Outline and Dimensions (Reel)



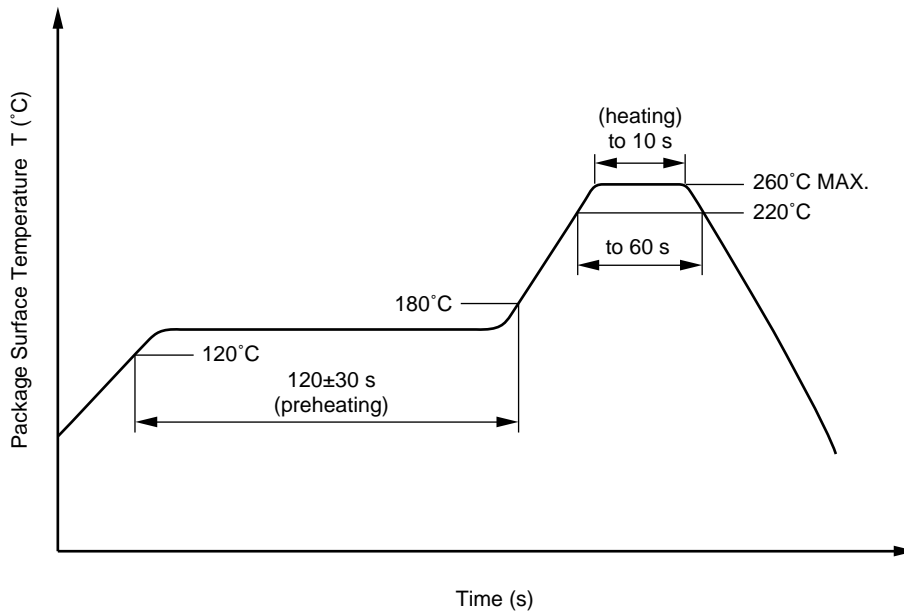
NOTES ON HANDLING

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) 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 at startup, the CMOS IC on output side 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.

When the product(s) listed in this document is subject to any applicable import or export control laws and regulation of the authority having competent jurisdiction, such product(s) shall not be imported or exported without obtaining the import or export license.

- **The information in this document is current as of June, 2005. 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, NEC Compound Semiconductor Devices, Ltd. 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 00.4-0110

<p>Caution</p>	<p>GaAs Products</p>	<p>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.</p> <ul style="list-style-type: none"> • 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. <ol style="list-style-type: none"> 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

NEC Compound Semiconductor Devices, Ltd. <http://www.ncsd.necel.com/>

E-mail: salesinfo@ml.ncsd.necel.com (sales and general)

techinfo@ml.ncsd.necel.com (technical)

Sales Division TEL: +81-44-435-1573 FAX: +81-44-435-1579

NEC Compound Semiconductor Devices Hong Kong Limited

E-mail: ncsd-hk@elhk.nec.com.hk (sales, technical and general)

Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309

Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859

Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

NEC Electronics (Europe) GmbH <http://www.ee.nec.de/>

TEL: +49-211-6503-0 FAX: +49-211-6503-1327

California Eastern Laboratories, Inc. <http://www.cel.com/>

TEL: +1-408-988-3500 FAX: +1-408-988-0279

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	
		-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.

Important Information and Disclaimer: Information provided by CEL on its website or in other communications concerning the substance content of its products represents knowledge and belief as of the date that it is provided. CEL bases its knowledge and belief on information provided by third parties and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. CEL has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. CEL and CEL suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall CEL’s liability arising out of such information exceed the total purchase price of the CEL part(s) at issue sold by CEL to customer on an annual basis.

See CEL Terms and Conditions for additional clarification of warranties and liability.