DATA SHEET

NEC

PHOTOCOUPLER

PS9613,PS9613L,PS9613L1,PS9613L2

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

–NEPOC Series–

<R> **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.

The PS9613L1 is lead bending type for long creepage distance.

The PS9613L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

FEATURES

- High common mode transient immunity (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.)
- <R> Ordering number of tape product : PS9613L-E3, E4: 1 000 pcs/reel
  : PS9613L2-E3, E4: 1 000 pcs/reel
- <R> Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved (Option)

APPLICATIONS

- IPM Driver
- General purpose inverter

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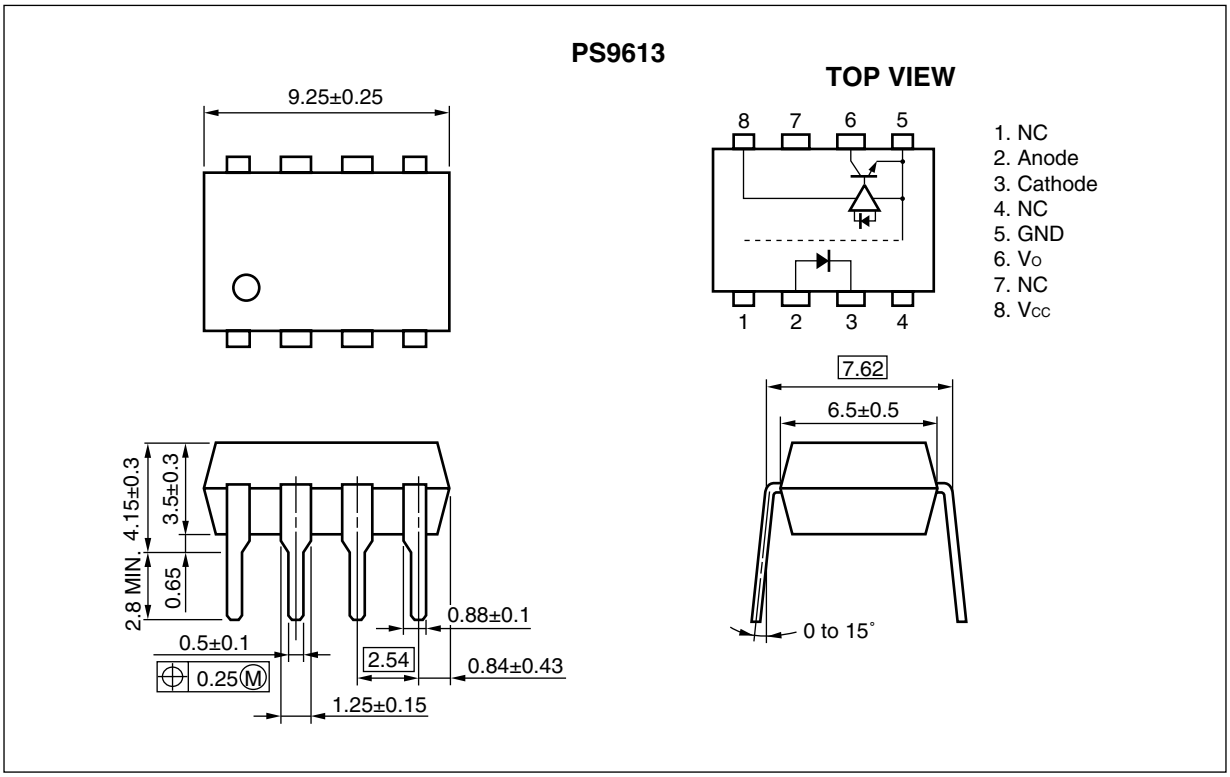
Printed in Japan

The mark <R> shows major revised points.

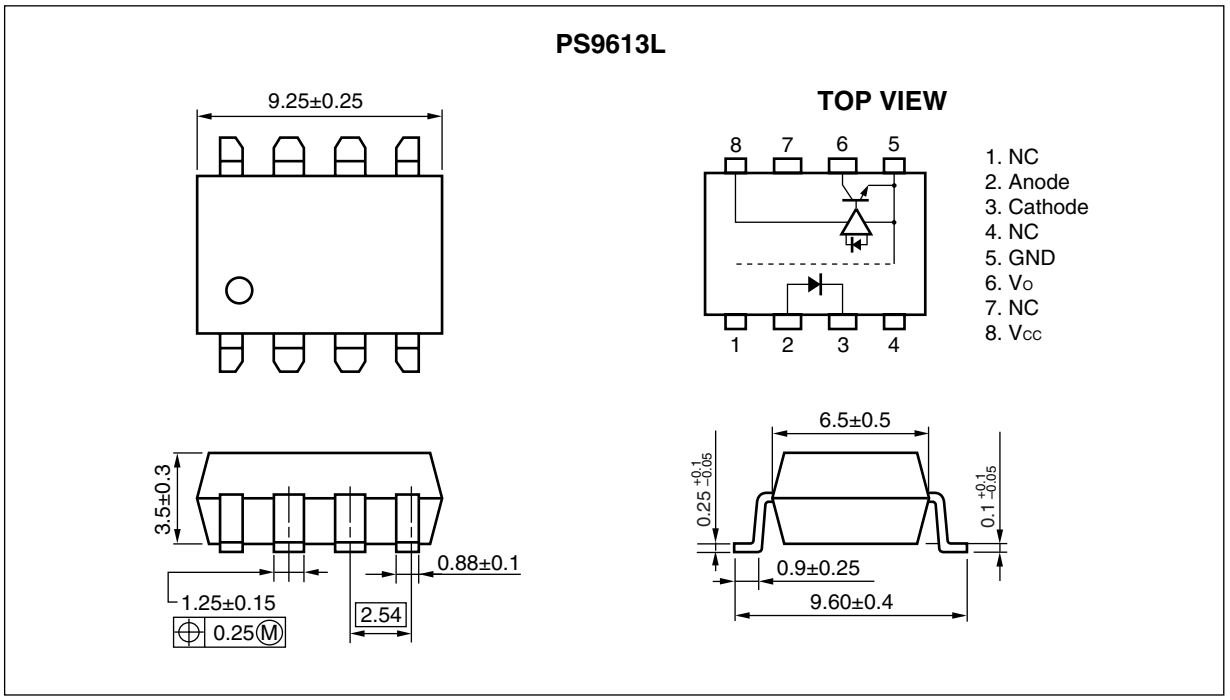
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

PACKAGE DIMENSIONS (UNIT: mm)

DIP Type

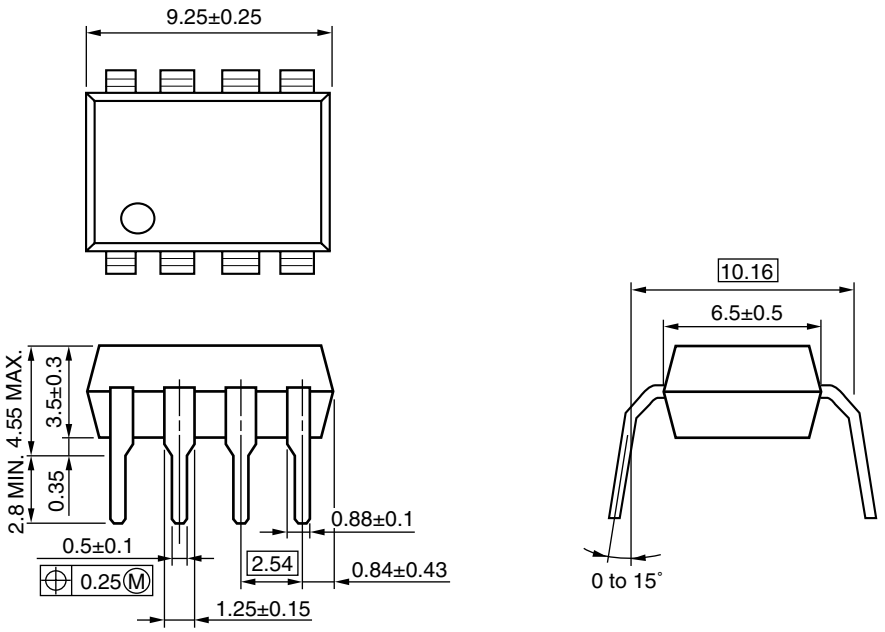


Lead Bending Type

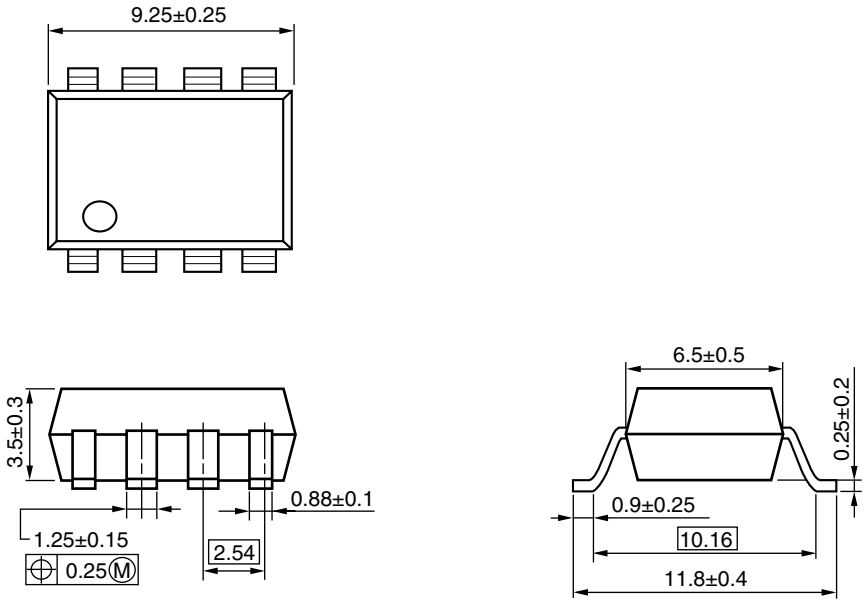


<R> **Lead Bending Type For Long Creepage Distance**

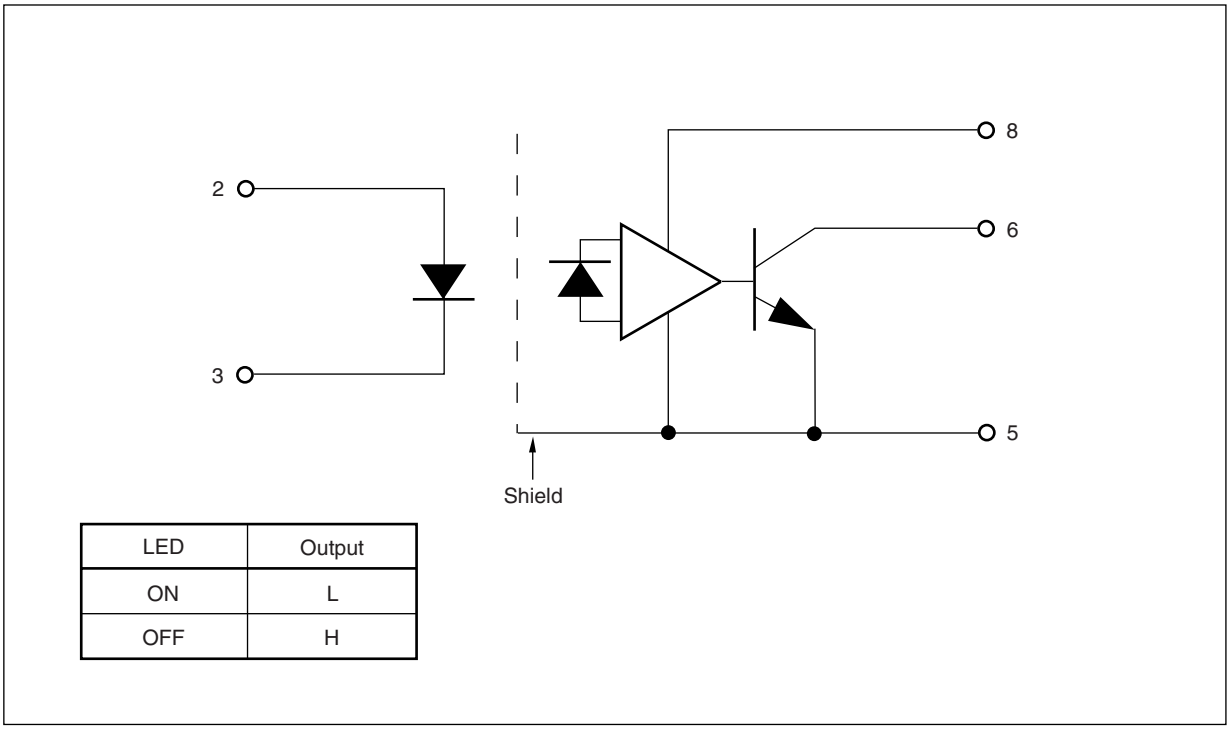
PS9613L1



PS9613L2

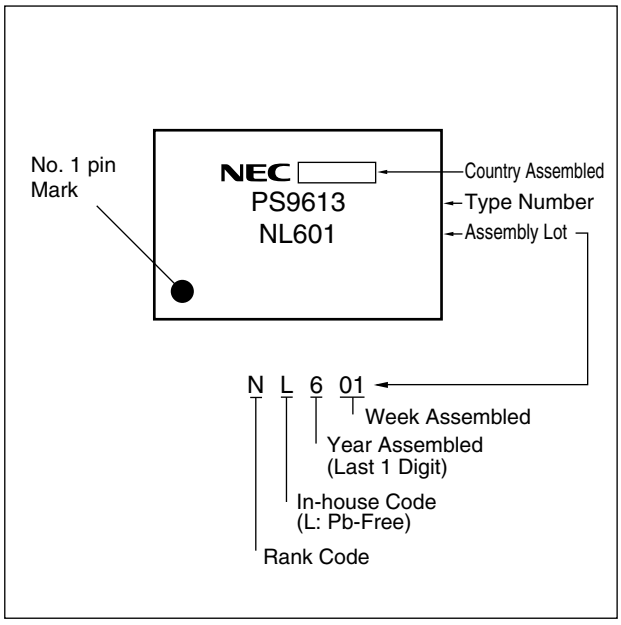


FUNCTIONAL DIAGRAM



LED	Output
ON	L
OFF	H

<R> **MARKING EXAMPLE**



<R> **ORDERING INFORMATION**

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9613	PS9613-A	Pb-Free	Magazine case 50 pcs	Standard products (UL approved)	PS9613
PS9613L	PS9613L-A				
PS9613L-E3	PS9613L-E3-A		Embossed Tape 1 000 pcs/reel		
PS9613L-E4	PS9613L-E4-A				
PS9613L1	PS9613L1-A		Magazine case 50 pcs		
PS9613L2	PS9613L2-A				
PS9613L2-E3	PS9613L2-E3-A		Embossed Tape 1 000 pcs/reel		
PS9613L2-E4	PS9613L2-E4-A				
PS9613-V	PS9613-V-A		Magazine case 50 pcs	DIN EN60747-5-2 (VDE0884 Part2) Approved (Option)	
PS9613L-V	PS9613L-V-A				
PS9613L-V-E3	PS9613L-V-E3-A		Embossed Tape 1 000 pcs/reel		
PS9613L-V-E4	PS9613L-V-E4-A				
PS9613L1-V	PS9613L1-V-A		Magazine case 50 pcs		
PS9613L2-V	PS9613L2-V-A				
PS9613L2-V-E3	PS9613L2-V-E3-A		Embossed Tape 1 000 pcs/reel		
PS9613L2-V-E4	PS9613L2-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)

<R>

Parameter		Symbol	Ratings	Unit
Diode	Forward Current *1	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 *2	P_C	100	mW
Isolation Voltage *3		BV	5 000	Vr.m.s.
Operating Ambient Temperature		T_A	–40 to +100	°C
Storage Temperature		T_{stg}	–55 to +125	°C

<R>

***1** Reduced to 0.33 mA/°C at T_A = 70°C or more.

***2** Reduced to 1.9 mW/°C at T_A = 70°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

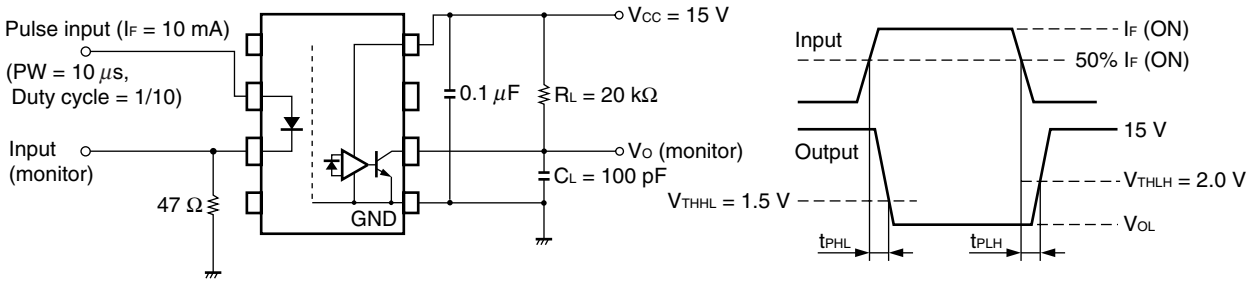
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward Current	I_F	10		20	mA
Output Voltage	V_O	0		30	V
Supply Voltage	V_{CC}	4.5	15	30	V
Input Voltage	V_F	0		0.8	V

ELECTRICAL CHARACTERISTICS (T_A = –40 to +100°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_{OL} = 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	
	Common Mode Transient Immunity at High Level Output[*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
	Common Mode Transient Immunity at Low Level Output[*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

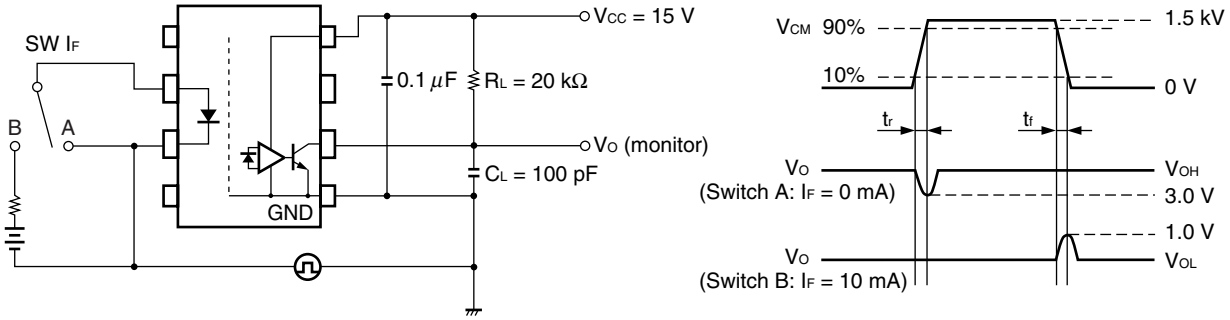
***1** Typical values at T_A = 25°C.

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



C_L includes probe and stray wiring capacitance.

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



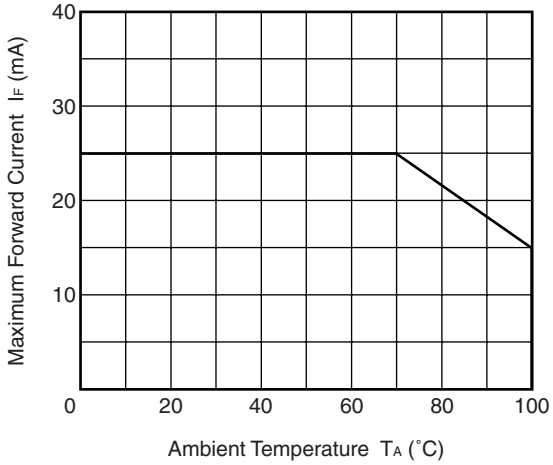
C_L includes probe and stray wiring capacitance.

USAGE CAUTIONS

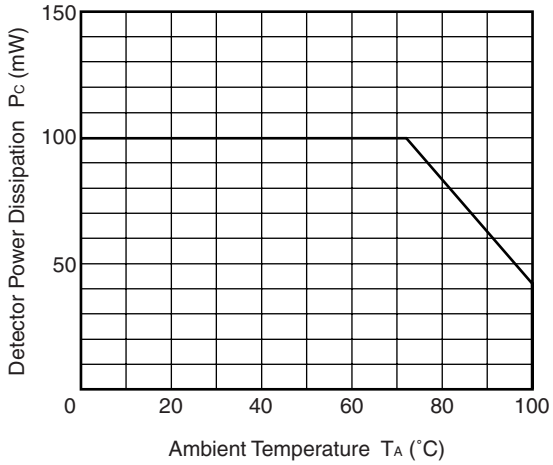
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler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

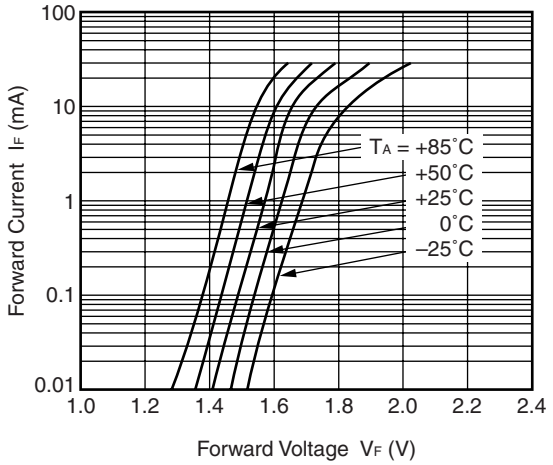
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



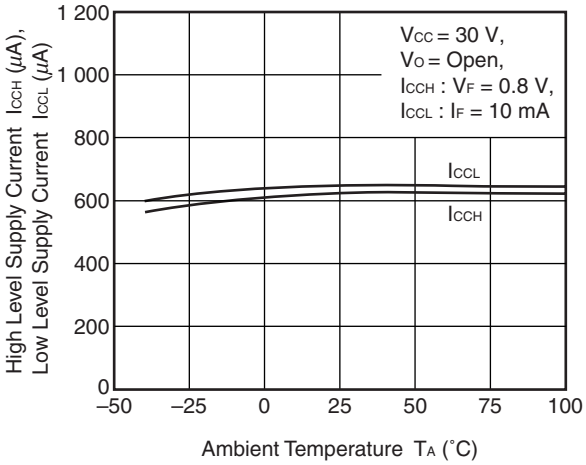
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



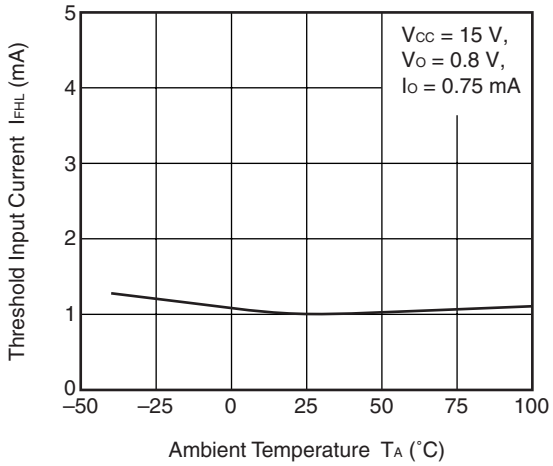
FORWARD CURRENT vs. FORWARD VOLTAGE



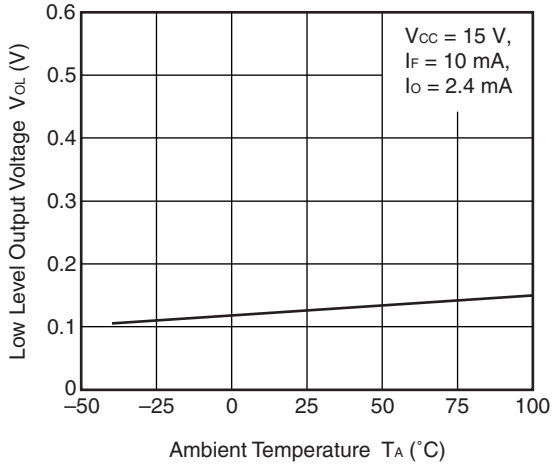
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE

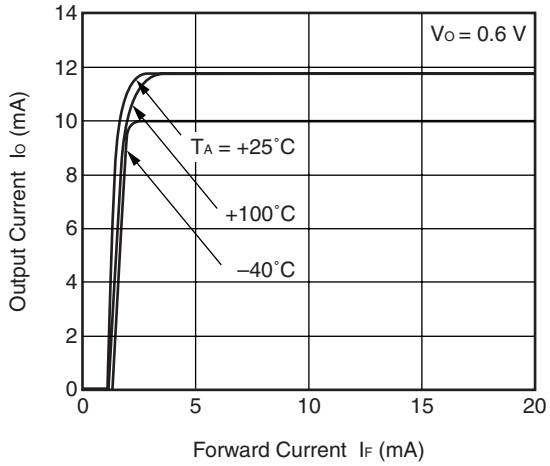


LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

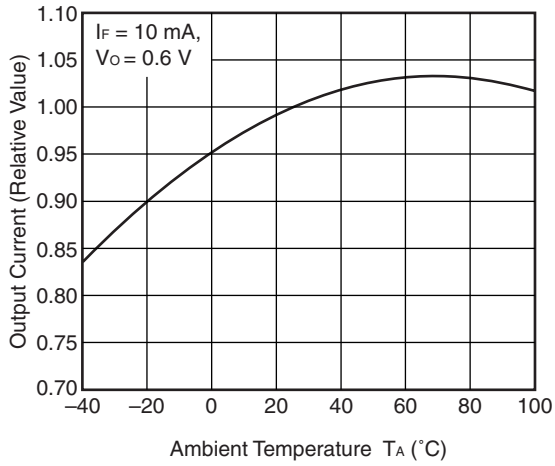


Remark The graphs indicate nominal characteristics.

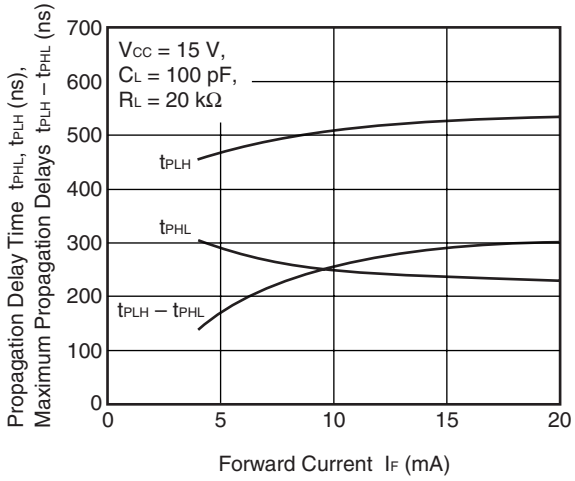
OUTPUT CURRENT vs. FORWARD CURRENT



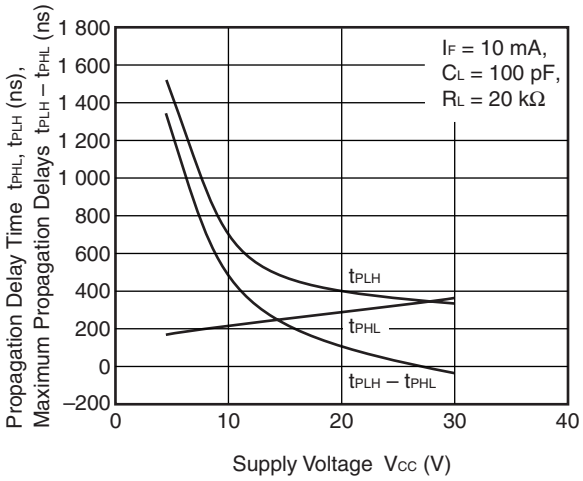
OUTPUT CURRENT vs. AMBIENT TEMPERATURE



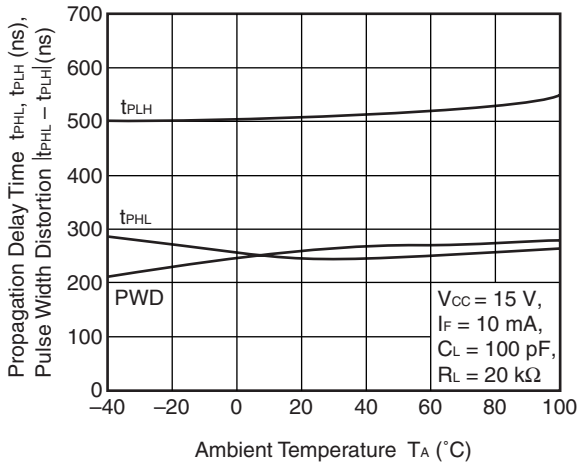
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. FORWARD CURRENT



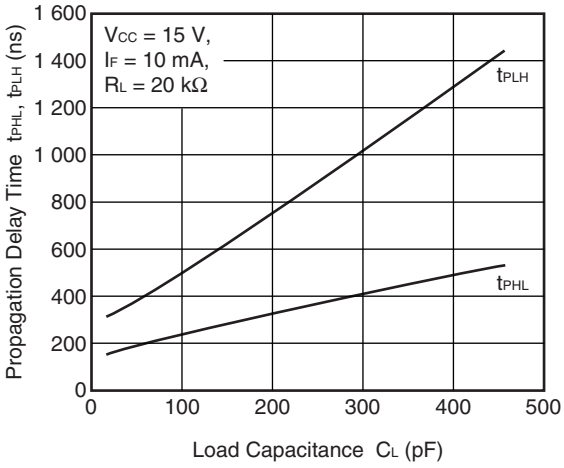
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE



PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE

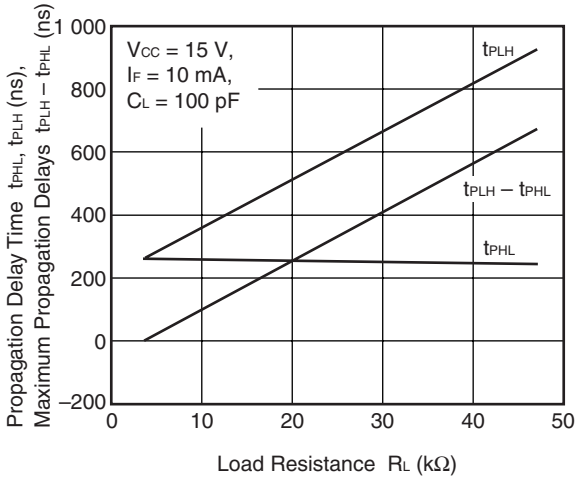


PROPAGATION DELAY TIME vs. LOAD CAPACITANCE

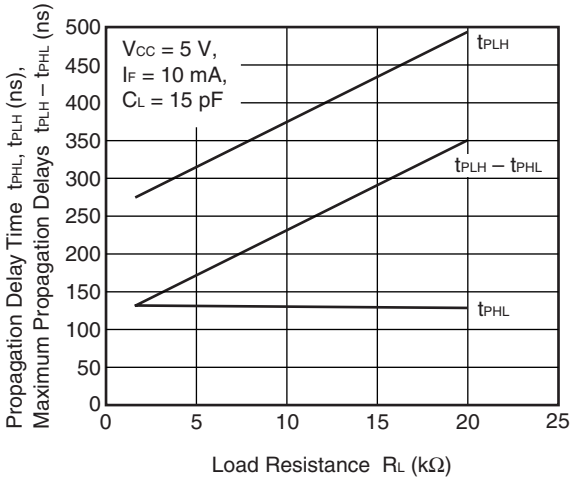


Remark The graphs indicate nominal characteristics.

PROPAGATION DELAY TIME,
MAXIMUM PROPAGATION DELAYS
vs. LOAD RESISTANCE



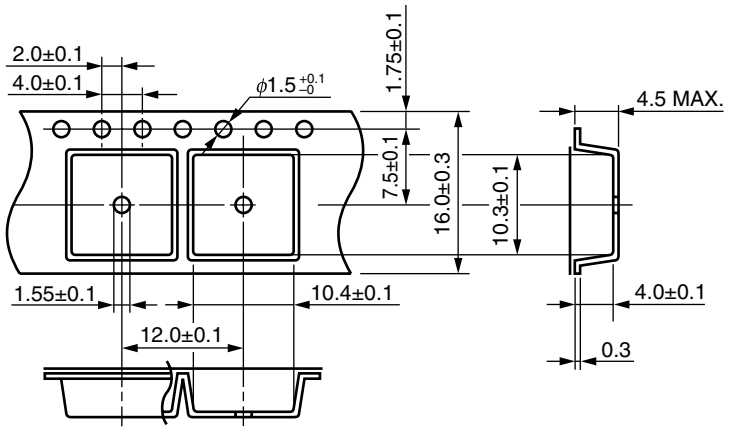
PROPAGATION DELAY TIME,
MAXIMUM PROPAGATION DELAYS
vs. LOAD RESISTANCE



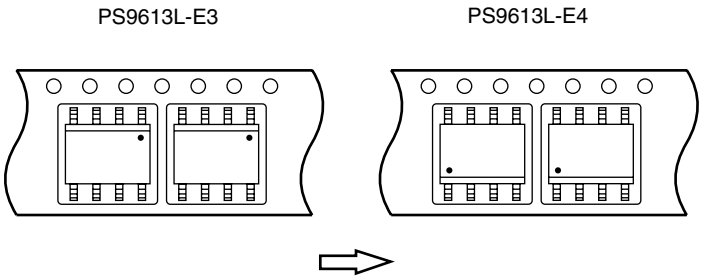
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

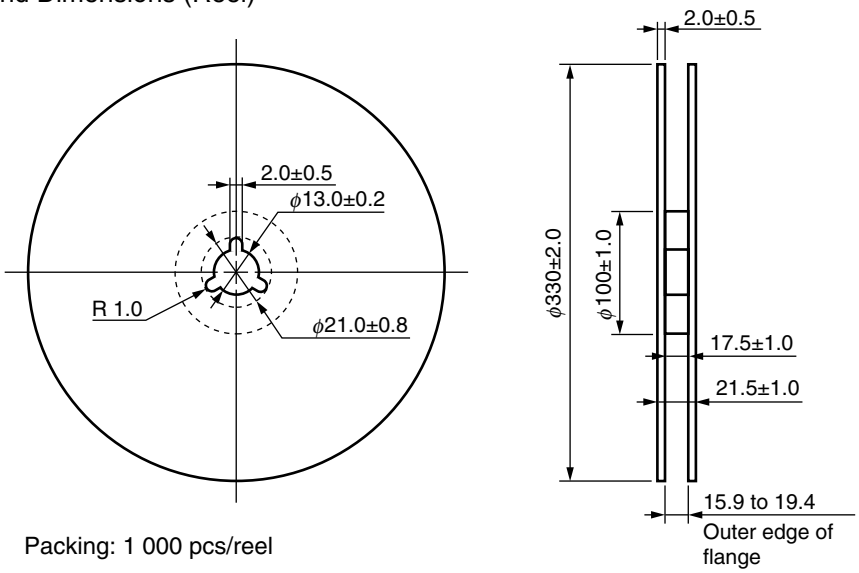
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



Packing: 1 000 pcs/reel

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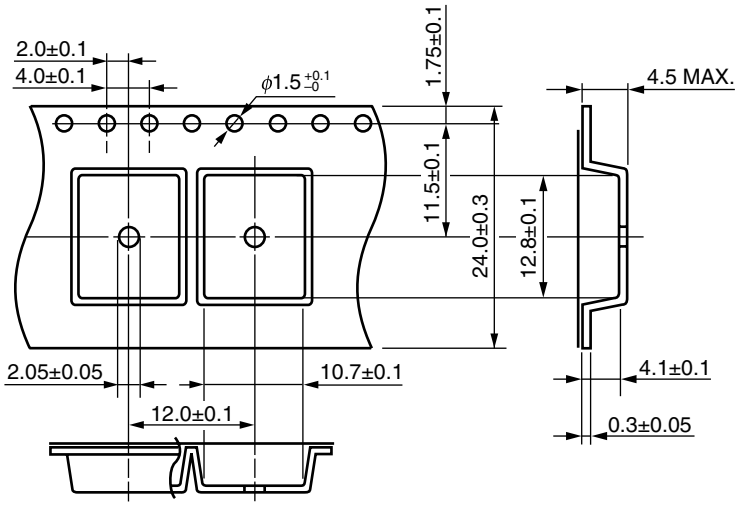
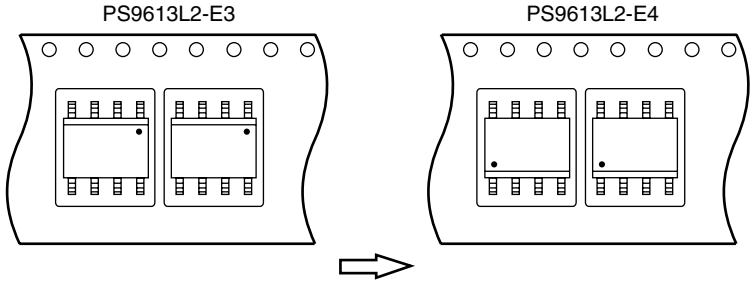
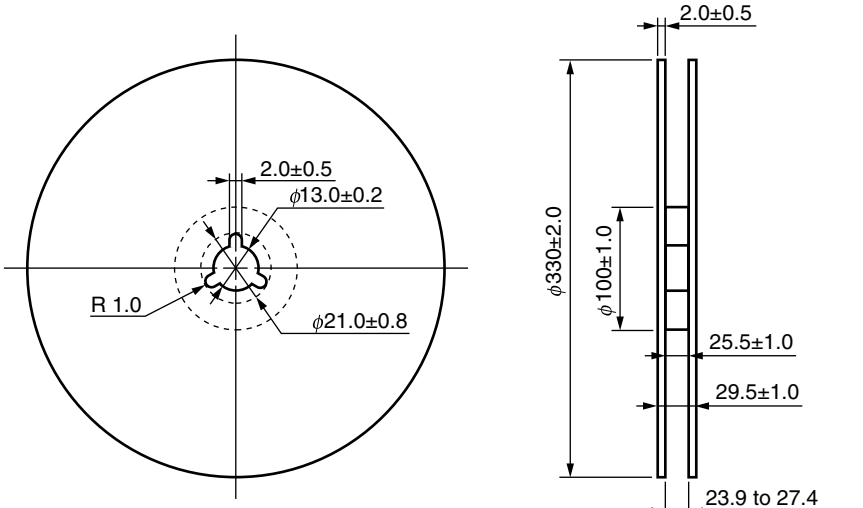
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



Packing: 1 000 pcs/reel

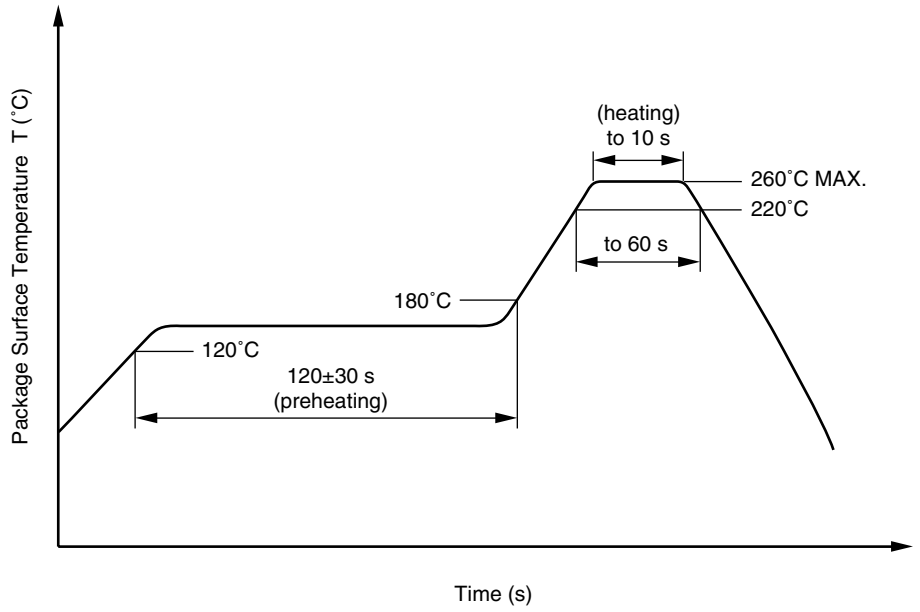
NOTES ON HANDLING

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.)

<R> **(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.

- **The information in this document is current as of May, 2006. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
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(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

M8E 02. 11-1

Caution GaAs Products	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. • 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. 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 Hong Kong Limited
E-mail: contact@ncsd-hk.necel.com
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.eu.necel.com/
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

Compound Semiconductor Devices Division
NEC Electronics Corporation
URL: http://www.ncsd.necel.com/

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