



# PHOTOCOUPLER

# PS2533-1, PS2533L-1

## HIGH COLLECTOR TO EMITTER VOLTAGE HIGH ISOLATION VOLTAGE MULTI PHOTOCOUPLER SERIES

–NEPOC Series–

### ★ DESCRIPTION

The PS2533-1 and PS2533L-1 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon darlington connected phototransistor.

The PS2533-1 is in a plastic DIP (Dual In-line Package) and the PS2533L-1 is lead bending type (Gull-wing) for surface mount.

### FEATURES

- High collector to emitter voltage ( $V_{CE0} = 350\text{ V}$ )
- High Isolation voltage ( $BV = 5\ 000\text{ Vr.m.s.}$ )
- High current transfer ratio ( $CTR = 4\ 000\%$  TYP.)
- High-speed switching ( $t_{tr} = 100\ \mu\text{s}$  TYP.)
- ★ • Ordering number of tape product: PS2533L-1-E3, E4, F3, F4
- ★ • Safety standards
  - UL approved: File No. E72422
  - BSI approved: No. 8221/8222
  - CSA approved: No. CA 101391
  - NEMKO approved: No. P98101708
  - SEMKO approved: No. 0143092/01-02
  - DEMKO approved: No. 307863
  - FIMKO approved: No. FI 17640
  - DIN EN60747-5-2 (VDE0884 Pat2) approved (Option)

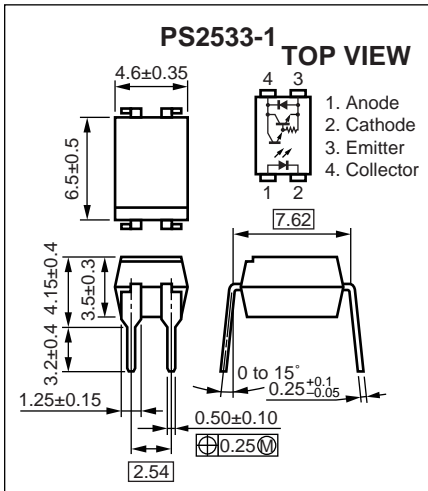
### APPLICATIONS

- Telephone, Exchange equipment
- FAX/MODEM

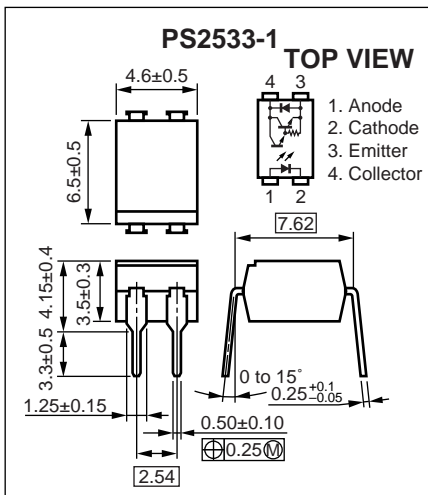
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★ PACKAGE DIMENSIONS (Unit : mm)

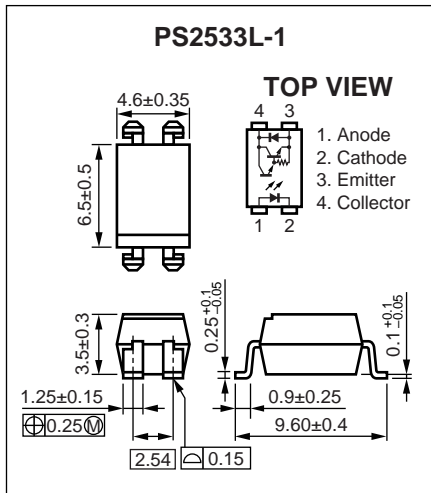
DIP Type (New package)



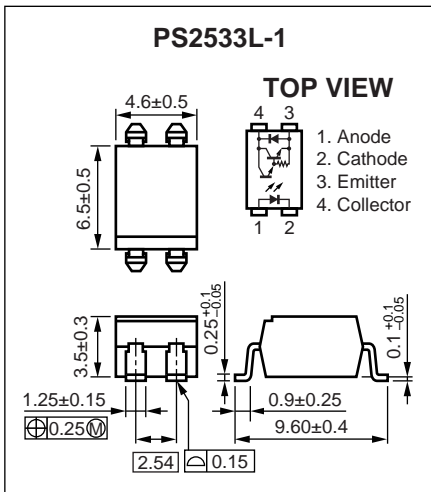
DIP Type



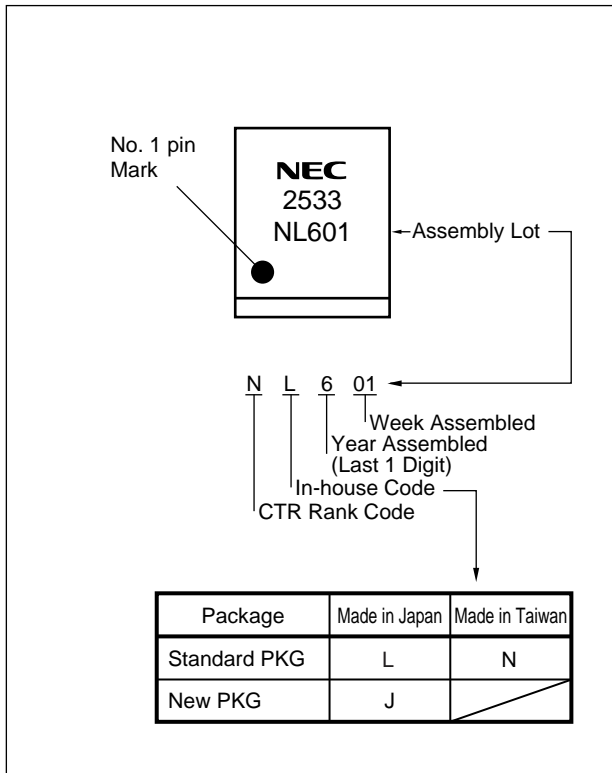
Lead Bending Type (New package)



Lead Bending Type



★ MARKING EXAMPLE



★ **ORDERING INFORMATION**

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>	
PS2533-1	PS2533-1-A	Pb-Free	Magazine case 100 pcs	Standard products (UL, CSA, BSI, NEMKO, SEMKO, DEMKO, FIMKO approved)	PS2533-1	
PS2533L-1	PS2533L-1-A		Embossed Tape 1 000 pcs/reel			
PS2533L-1-E3	PS2533L-1-E3-A					
PS2533L-1-E4	PS2533L-1-E4-A		Embossed Tape 2 000 pcs/reel			
PS2533L-1-F3	PS2533L-1-F3-A					
PS2533L-1-F4	PS2533L-1-F4-A		Magazine case 100 pcs			DIN EN60747-5-2 (VDE0884 Part2)
PS2533-1-V	PS2533-1-V-A					
PS2533L-1-V	PS2533L-1-V-A			Embossed Tape 1 000 pcs/reel		Approved (Option)
PS2533L-1-V-E3	PS2533L-1-V-E3-A					
PS2533L-1-V-E4	PS2533L-1-V-E4-A					
PS2533L-1-V-F3	PS2533L-1-V-F3-A		Embossed Tape 2 000 pcs/reel			
PS2533L-1-V-F4	PS2533L-1-V-F4-A					

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

★ **ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise specified)**

Parameter		Symbol	Ratings	Unit
Diode	Forward Current (DC)	I <sub>F</sub>	80	mA
	Reverse Voltage	V <sub>R</sub>	6	V
	Power Dissipation Derating	ΔP <sub>D</sub> /°C	1.5	mW/°C
	Power Dissipation	P <sub>D</sub>	150	mW
	Peak Forward Current *1	I <sub>FP</sub>	1	A
Transistor	Collector to Emitter Voltage	V <sub>CEO</sub>	350	V
	Emitter to Collector Voltage	V <sub>ECO</sub>	0.6	V
	Collector Current	I <sub>C</sub>	150	mA
	Power Dissipation Derating	ΔP <sub>C</sub> /°C	3.0	mW/°C
	Power Dissipation	P <sub>C</sub>	300	mW
Isolation Voltage*2		BV	5 000	Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	-55 to +100	°C
Storage Temperature		T <sub>stg</sub>	-55 to +150	°C

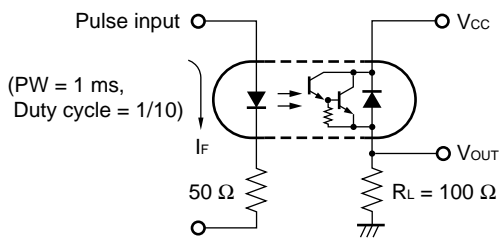
\*1 PW = 100 μs, Duty Cycle = 1%

\*2 AC voltage for 1 minute at T<sub>A</sub> = 25°C, RH = 60% between input and output  
Pins 1-2 shorted together, 3-4 shorted together.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

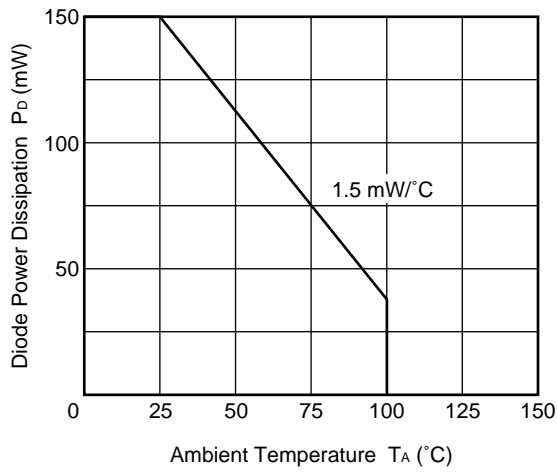
Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA		1.15	1.40	V
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 5 V			5	μA
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1.0 MHz		30		pF
Transistor	Collector to Emitter Dark Current	I <sub>CEO</sub>	V <sub>CE</sub> = 350 V, I <sub>F</sub> = 0 mA			400	nA
Coupled	Current Transfer Ratio (I <sub>c</sub> /I <sub>F</sub> )	CTR	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 2 V	1 500	4 000	6 500	%
	Collector Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>F</sub> = 1 mA, I <sub>c</sub> = 2 mA			1.0	V
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1.0 kV <sub>DC</sub>	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1.0 MHz		0.6		pF
	Rise Time <sup>*1</sup>	t <sub>r</sub>	V <sub>CC</sub> = 5 V, I <sub>c</sub> = 10 mA, R <sub>L</sub> = 100 Ω		100		μs
	Fall Time <sup>*1</sup>	t <sub>f</sub>			100		

\*1 Test circuit for switching time

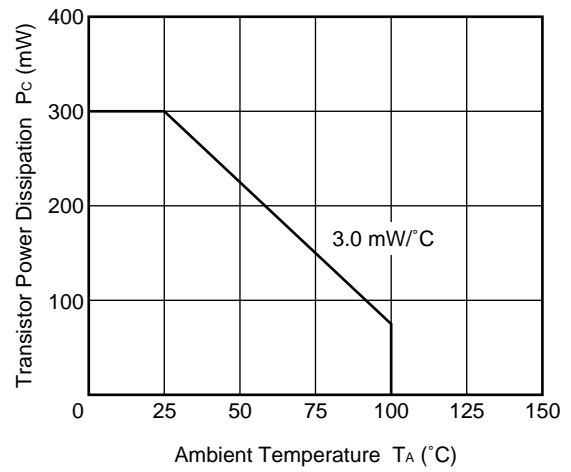


★ TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

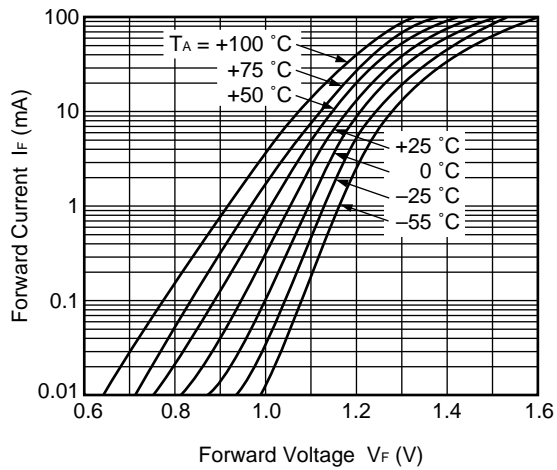
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



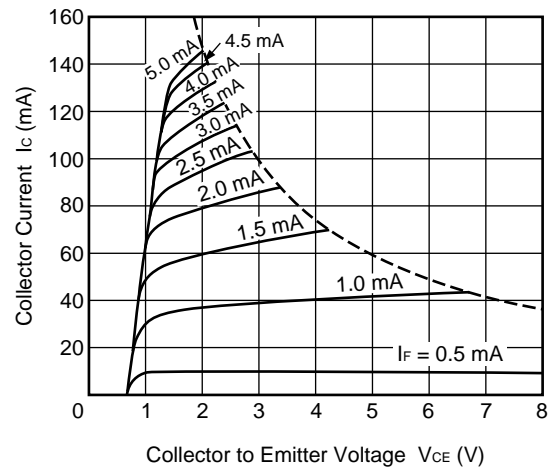
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



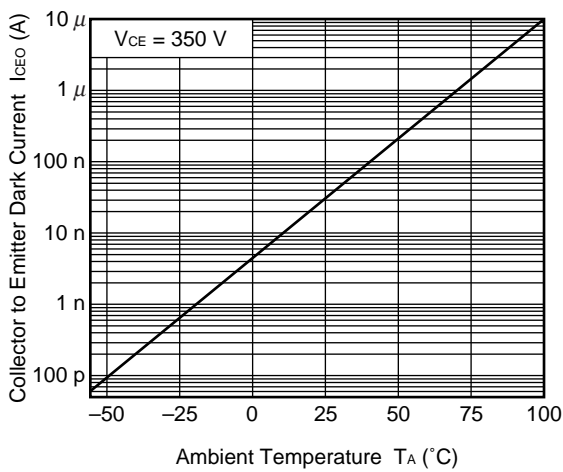
FORWARD CURRENT vs. FORWARD VOLTAGE



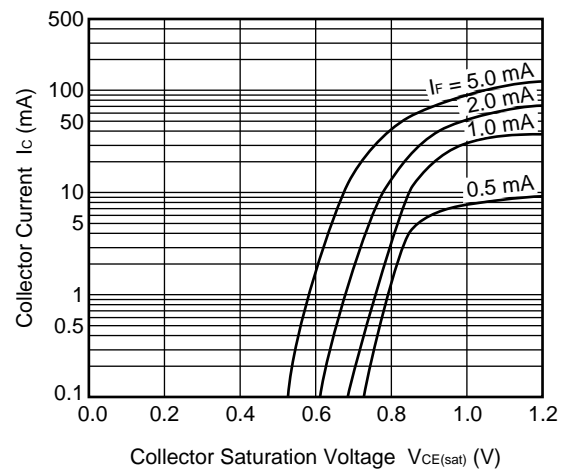
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE



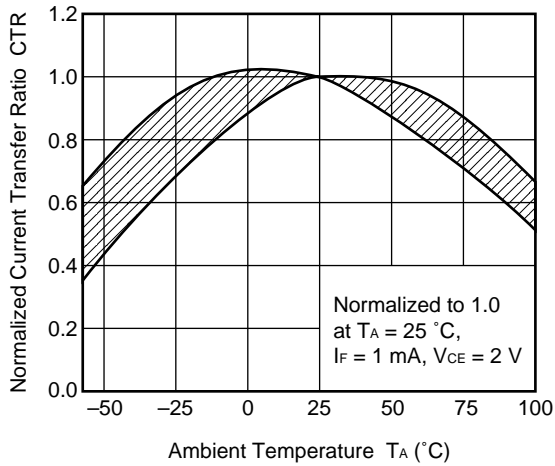
COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE



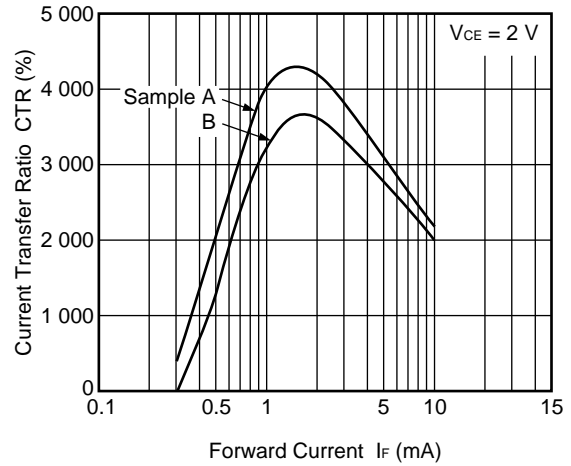
**Remark** The graphs indicate nominal characteristics.



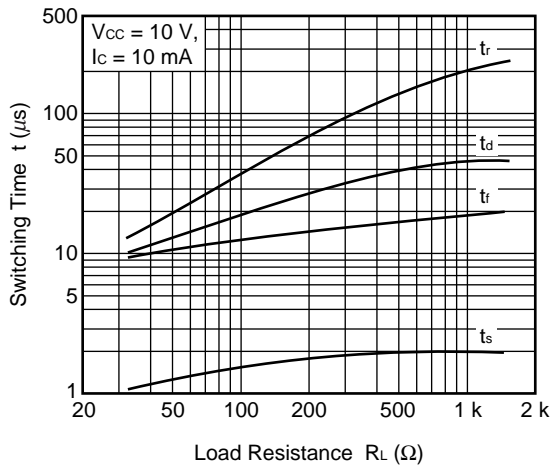
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



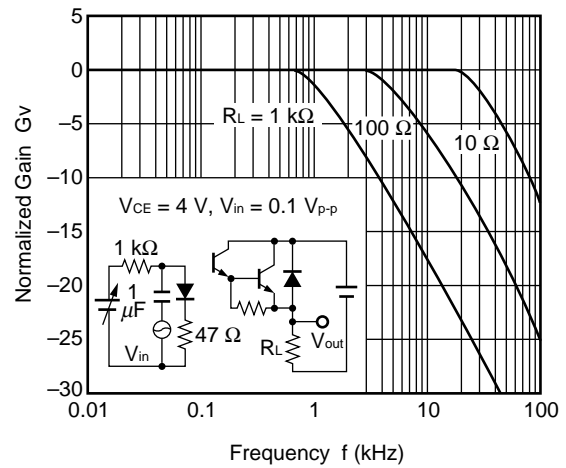
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



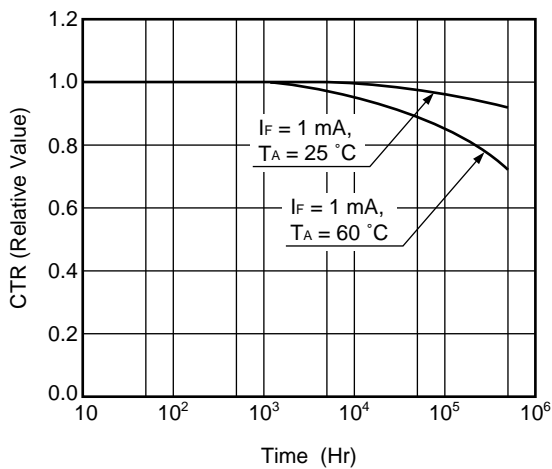
SWITCHING TIME vs. LOAD RESISTANCE



FREQUENCY RESPONSE



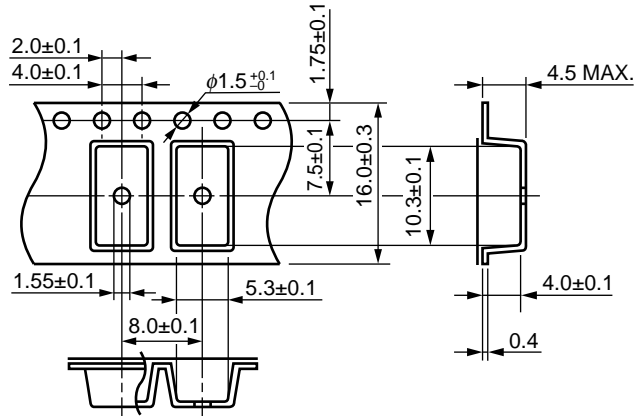
LONG TERM CTR DEGRADATION



**Remark** The graphs indicate nominal characteristics.

★ TAPING SPECIFICATIONS (Unit : mm)

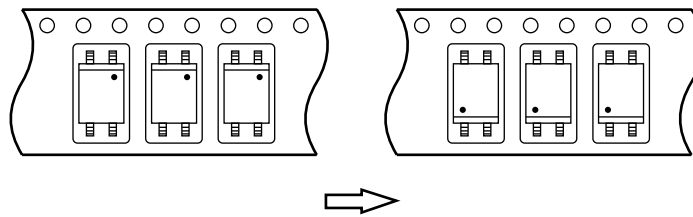
Outline and Dimensions (Tape)



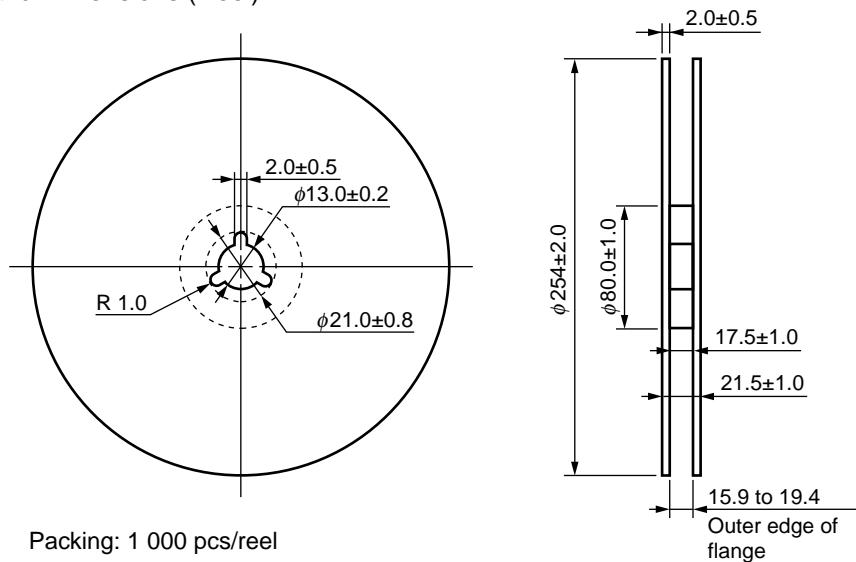
Tape Direction

PS2533L-1-E3

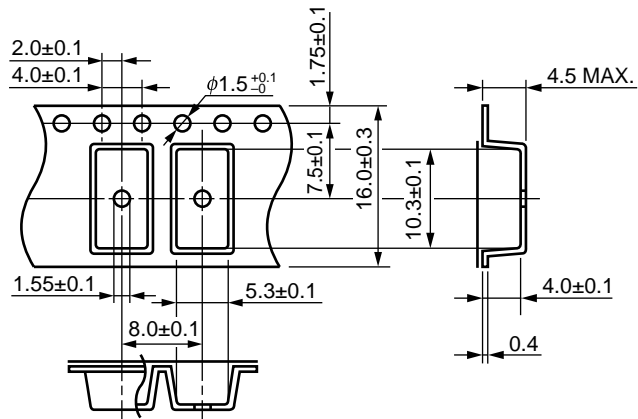
PS2533L-1-E4



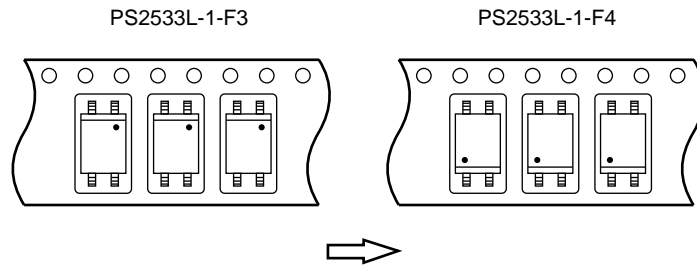
Outline and Dimensions (Reel)



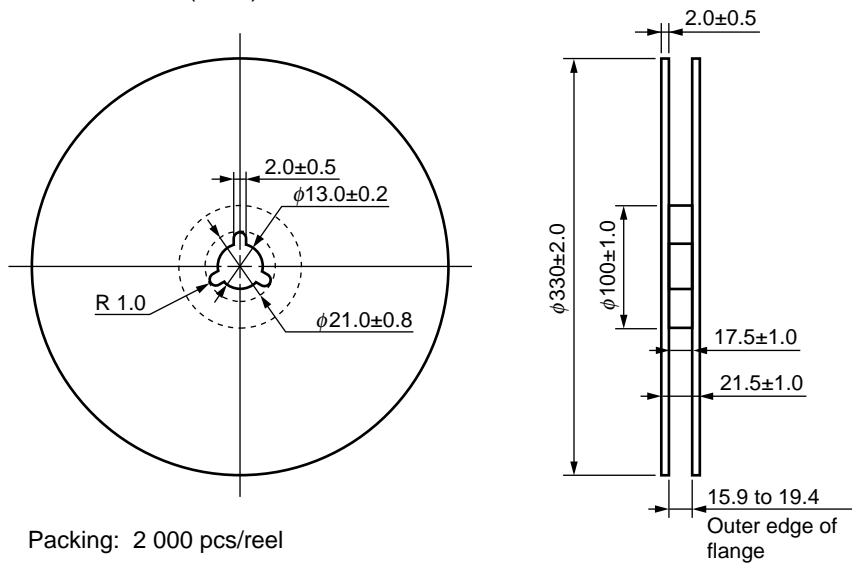
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



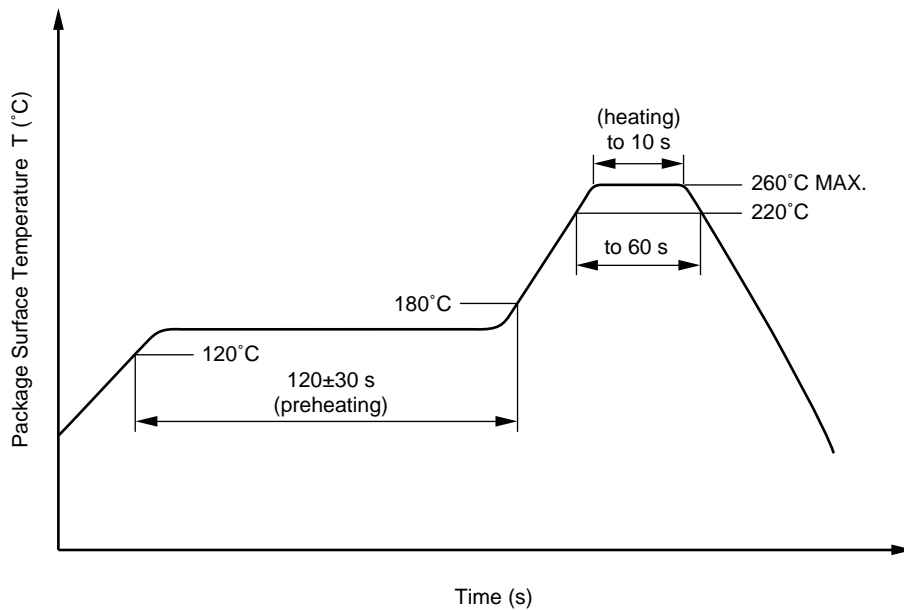
**NOTES ON HANDLING**

**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 or between collector-emitters at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

**★ 3. Measurement conditions of current transfer ratios (CTR), which differ according to photocoupler**

Check the setting values before use, since the forward current conditions at CTR measurement differ according to product.

When using products other than at the specified forward current, the characteristics curves may differ from the standard curves due to CTR value variations or the like. Therefore, check the characteristics under the actual operating conditions and thoroughly take variations or the like into consideration before use.

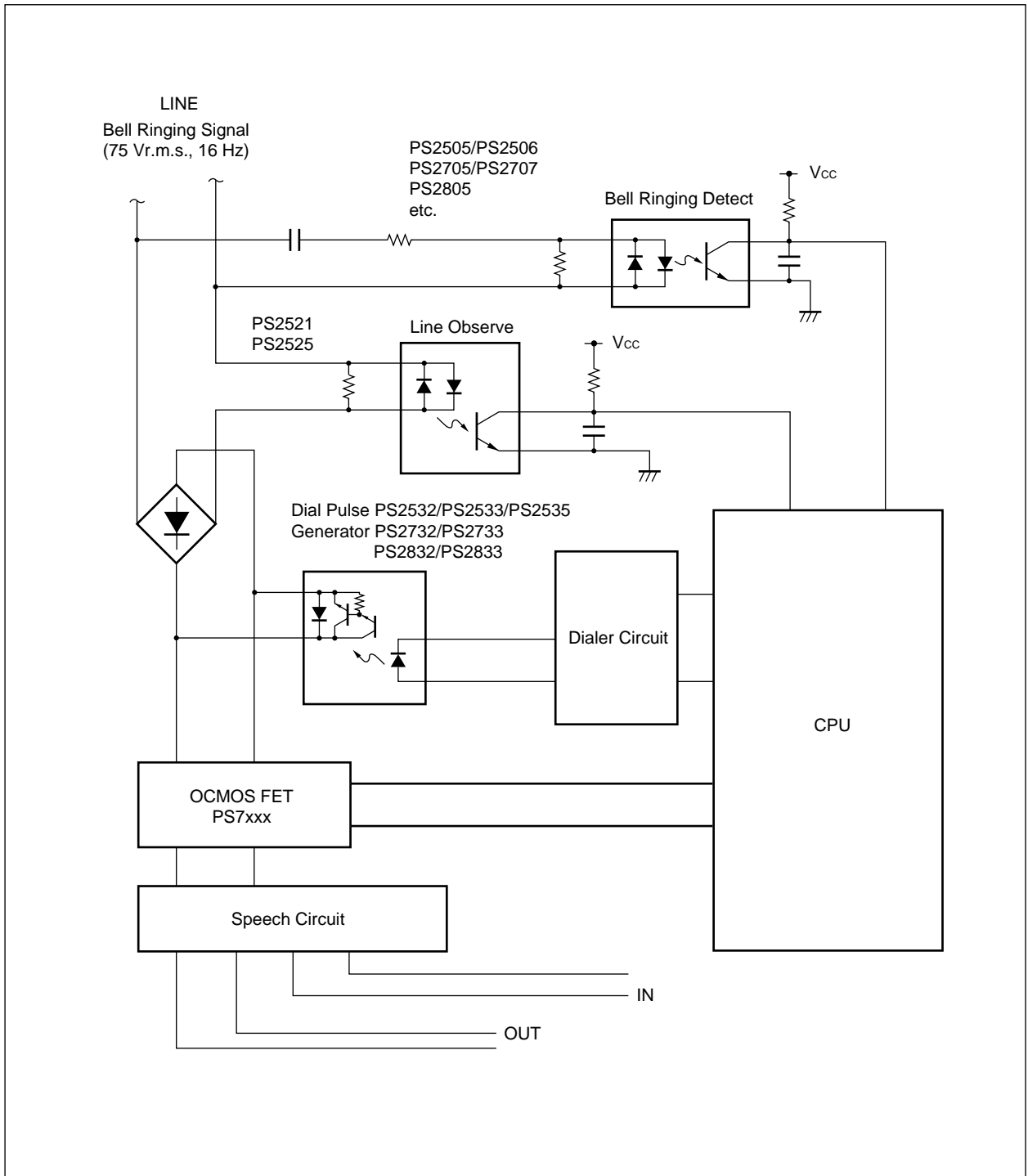
**USAGE CAUTIONS**

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.

**SPECIFICATION OF VDE MARKS LICENSE DOCUMENT (VDE0884)**

Parameter	Symbol	Speck	Unit
Application classification (DIN VDE 0109) for rated line voltages ≤ 300 Vr.m.s. for rated line voltages ≤ 600 Vr.m.s.		IV III	
Climatic test class (DIN IEC 68 Teil 1/09.80)		55/100/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.2 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	890 1 068	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices test) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{pr}$	1 424	$V_{peak}$
★ Highest permissible overvoltage	$U_{TR}$	8 000	$V_{peak}$
Degree of pollution (DIN VDE 0109)		2	
Clearance distance		> 7.0	mm
Creepage distance		> 7.0	mm
Comparative tracking index (DIN IEC 112/VDE 0303 part 1)	CTI	175	
Material group (DIN VDE 0109)		III a	
Storage temperature range	$T_{stg}$	-55 to +150	°C
Operating temperature range	$T_A$	-55 to +100	°C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	Ris MIN. Ris MIN.	$10^{12}$ $10^{11}$	$\Omega$ $\Omega$
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) Package temperature Current (input current $I_F$ , $\Psi_i = 0$ ) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = 175^\circ\text{C} (T_{si})$	$T_{si}$ $I_{si}$ $\Psi_{si}$ Ris MIN.	175 400 700 $10^9$	°C mA mW $\Omega$

★ APPLICATION FOR TELEPHONE (EXAMPLE)



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M8E 00.4-0110



<p><b>Caution</b></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"> <li>• 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"> <li>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.</li> <li>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.</li> </ol> </li> <li>• Do not burn, destroy, cut, crush, or chemically dissolve the product.</li> <li>• Do not lick the product or in any way allow it to enter the mouth.</li> </ul>
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► **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.

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