



# PHOTOCOUPLER PS2513-1, PS2513L-1

## HIGH-SPEED SWITCHING/HIGH ISOLATION VOLTAGE PHOTOCOUPLER SERIES

—NEPOC Series—

### DESCRIPTION

The PS2513-1 and PS2513L-1 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon phototransistor.

The PS2513-1 is in a plastic DIP (Dual In-line Package) and the PS2513L-1 is lead bending type (Gull-wing) for surface mount.

### FEATURES

- High isolation voltage ( $BV = 5\,000\text{ V r.m.s.}$ )
- High collector to emitter voltage ( $V_{CEO} = 120\text{ V}$ )
- Guaranteed maximum switching speed ( $t_{off} \leq 60\text{ }\mu\text{s}$  @  $I_F = 5\text{ mA}$ ,  $V_{CC} = 5\text{ V}$ ,  $R_L = 1.9\text{ k}\Omega$ )
- High-speed switching ( $t_{on} = 5\text{ }\mu\text{s}$  TYP. @  $I_F = 5\text{ mA}$ ,  $V_{CC} = 5\text{ V}$ ,  $R_L = 1.9\text{ k}\Omega$ )  
( $t_{off} = 25\text{ }\mu\text{s}$  TYP. @  $I_F = 5\text{ mA}$ ,  $V_{CC} = 5\text{ V}$ ,  $R_L = 1.9\text{ k}\Omega$ )
- Ordering number of tape product: PS2513L-1-E3, E4, F3, F4
- ★ • Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved (Option)

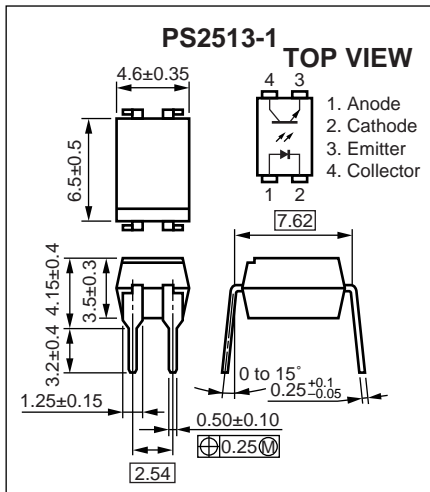
### APPLICATIONS

- Power supply
- Air conditioner
- FA equipment

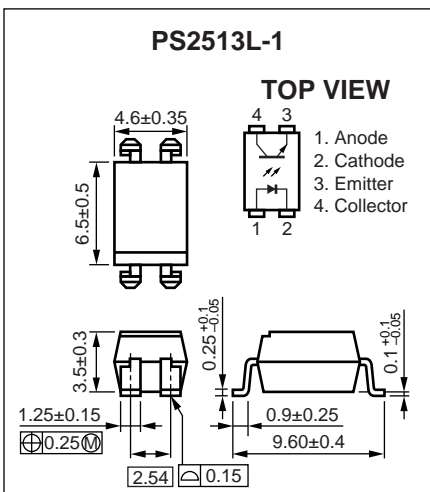
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**PACKAGE DIMENSIONS (UNIT: mm)**

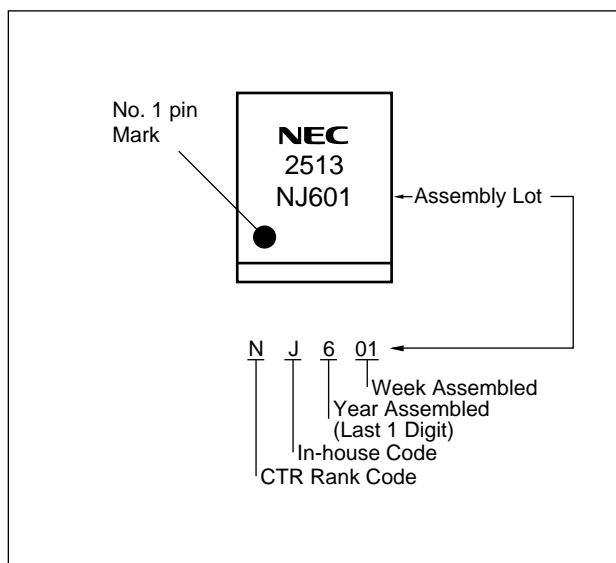
**DIP Type**



**Lead Bneiding Type**



★ **MARKING EXAMPLE**



## ★ ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>
PS2513-1	PS2513-1-A	Pb-Free	Magazine case 100 pcs	Standard products (UL Approved)	PS2513-1
PS2513L-1	PS2513L-1-A				
PS2513L-1-E3	PS2513L-1-E3-A		Embossed Tape 1 000 pcs/reel		
PS2513L-1-E4	PS2513L-1-E4-A				
PS2513L-1-F3	PS2513L-1-F3-A		Embossed Tape 2 000 pcs/reel		
PS2513L-1-F4	PS2513L-1-F4-A				
PS2513-1-V	PS2513-1-V-A		Magazine case 100 pcs	DIN EN60747-5-2 (VDE0884 Part2) approved products (Option)	
PS2513L-1-V	PS2513L-1-V-A				
PS2513L-1-V-E3	PS2513L-1-V-E3-A		Embossed Tape 1 000 pcs/reel		
PS2513L-1-V-E4	PS2513L-1-V-E4-A				
PS2513L-1-V-F3	PS2513L-1-V-F3-A		Embossed Tape 2 000 pcs/reel		
PS2513L-1-V-F4	PS2513L-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
			PS2513-1, PS2513L-1	
Diode	Reverse Voltage	V <sub>R</sub>	6	V
	Forward Current (DC)	I <sub>F</sub>	60	mA
	Power Dissipation Derating	ΔP <sub>D</sub> /°C	1.5	mW/°C
	Power Dissipation	P <sub>D</sub>	150	mW
	Peak Forward Current <sup>*1</sup>	I <sub>FP</sub>	1	A
Transistor	Collector to Emitter Voltage	V <sub>CEO</sub>	120	V
	Emitter to Collector Voltage	V <sub>ECO</sub>	6	V
	Collector Current	I <sub>C</sub>	30	mA
	Power Dissipation Derating	ΔP <sub>C</sub> /°C	1.5	mW/°C
	Power Dissipation	P <sub>C</sub>	150	mW
Isolation Voltage <sup>*2</sup>		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

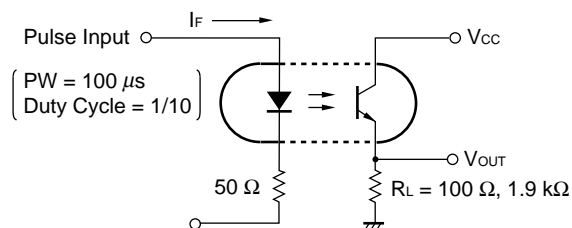
\*1 PW = 100 μs, Duty Cycle = 1%

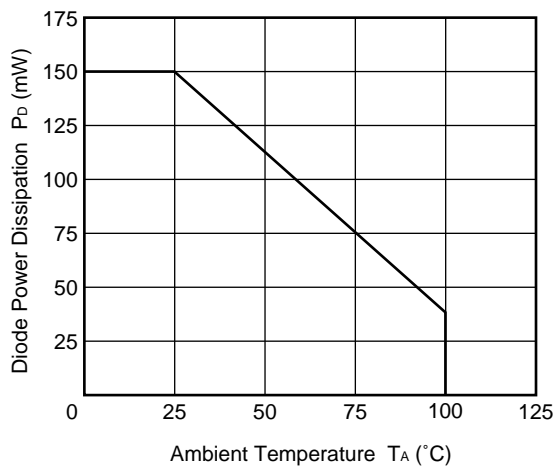
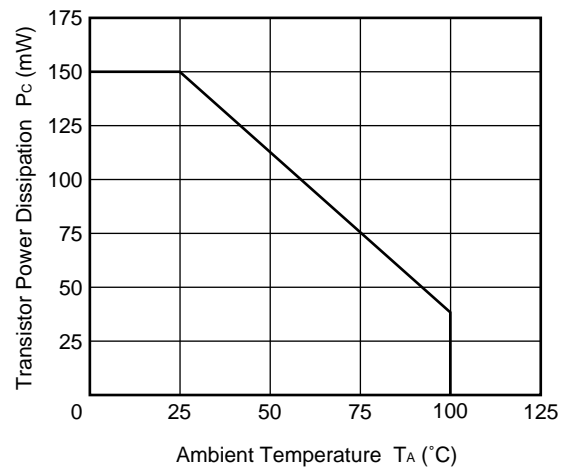
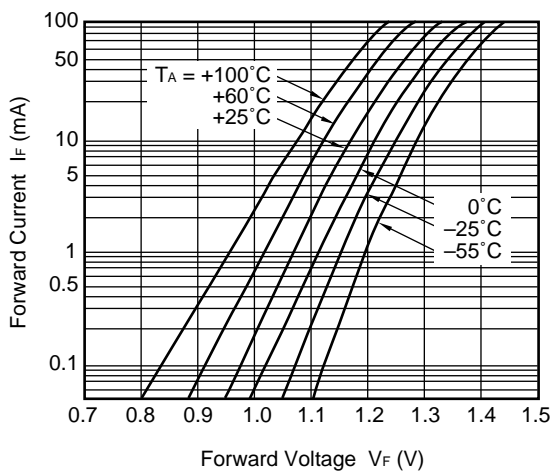
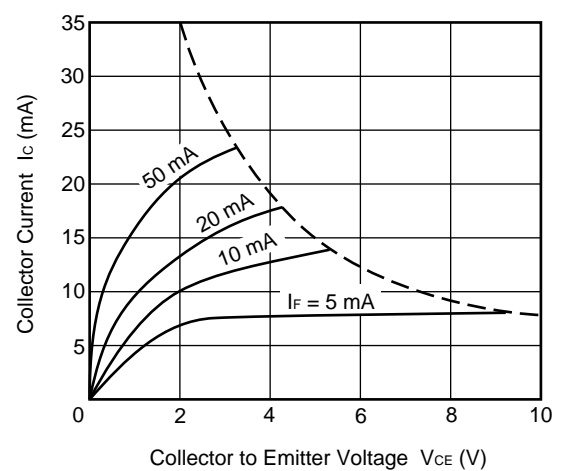
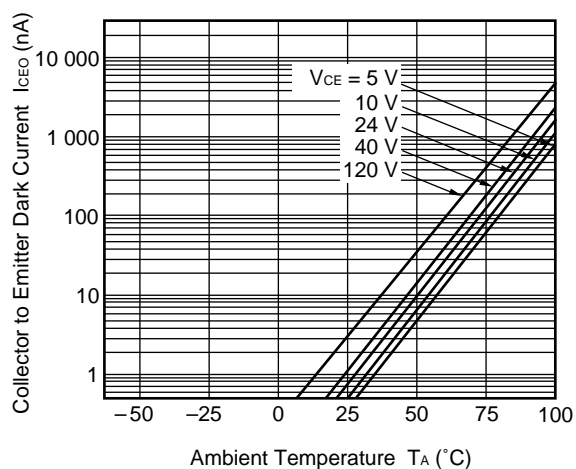
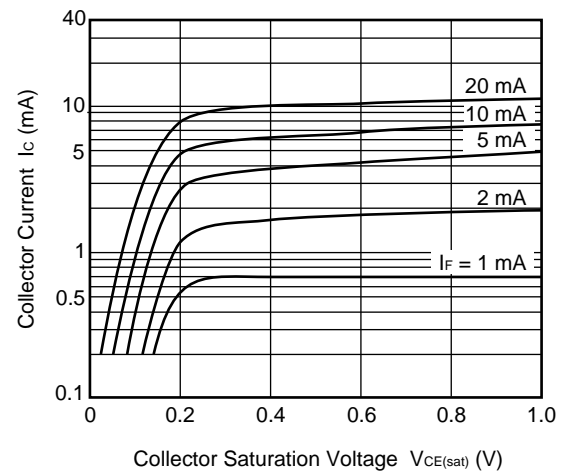
\*2 AC voltage for 1 minute at T<sub>A</sub> = 25°C, RH = 60% between input and output  
Pins 1-2 shorted together, 3-4 shorted together.

ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	$V_F$	$I_F = 5\text{ mA}$		1.1	1.3	V
	Reverse Current	$I_R$	$V_R = 5\text{ V}$			5	$\mu\text{A}$
	Terminal Capacitance	$C_t$	$V = 0\text{ V}$ , $f = 1.0\text{ MHz}$		30		pF
Transistor	Collector to Emitter Dark Current	$I_{CEO}$	$V_{CE} = 120\text{ V}$ , $I_F = 0\text{ mA}$			100	nA
Coupled	Current Transfer Ratio ( $I_C/I_F$ )	CTR1	$I_F = 1\text{ mA}$ , $V_{CE} = 5\text{ V}$	25	75	100	%
		CTR2	$I_F = 5\text{ mA}$ , $V_{CE} = 5\text{ V}$	50	125	200	%
	Collector Saturation Voltage	$V_{CE(sat)}$	$I_F = 10\text{ mA}$ , $I_C = 2\text{ mA}$			0.3	V
	Isolation Resistance	$R_{I-O}$	$V_{I-O} = 1.0\text{ kV}_{DC}$	$10^{11}$			$\Omega$
	Isolation Capacitance	$C_{I-O}$	$V = 0\text{ V}$ , $f = 1.0\text{ MHz}$		0.5		pF
	Rise Time <sup>*1</sup>	$t_r$	$V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$		3		$\mu\text{s}$
	Fall Time <sup>*1</sup>	$t_f$			4		
	Turn-on Time <sup>*1</sup>	$t_{on}$	$V_{CC} = 5\text{ V}$ , $I_F = 5\text{ mA}$ , $R_L = 1.9\text{ k}\Omega$		5	60	$\mu\text{s}$
	Turn-off Time <sup>*1</sup>	$t_{off}$			25	60	

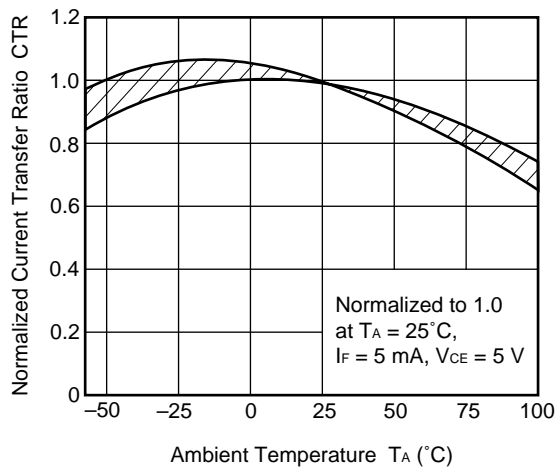
\*1 Test circuit for switching time



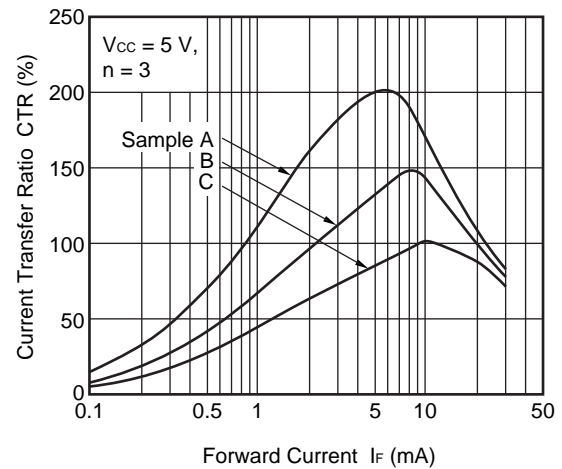
**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)****DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE****TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE****FORWARD CURRENT vs. FORWARD VOLTAGE****COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE****COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE****COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE**

**Remark** The graphs indicate nominal characteristics.

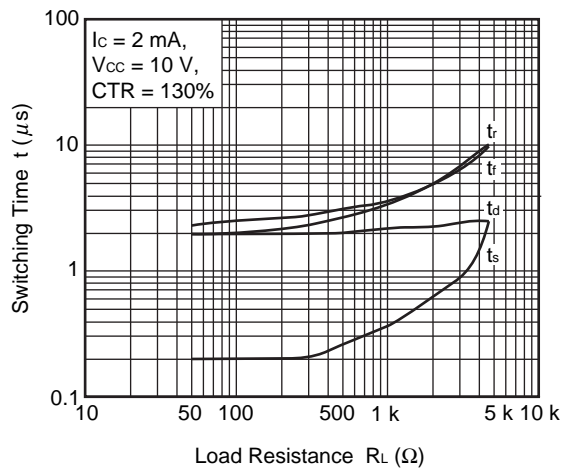
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



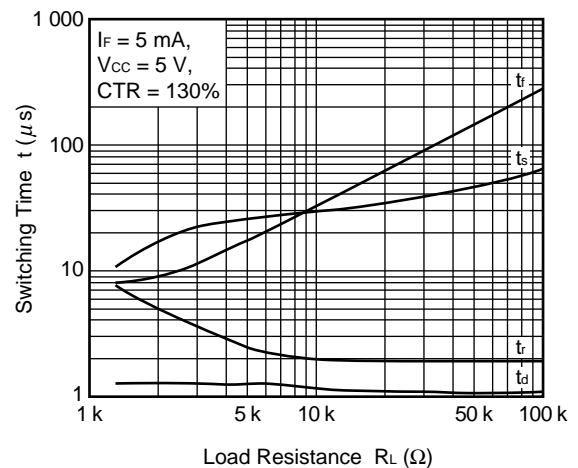
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



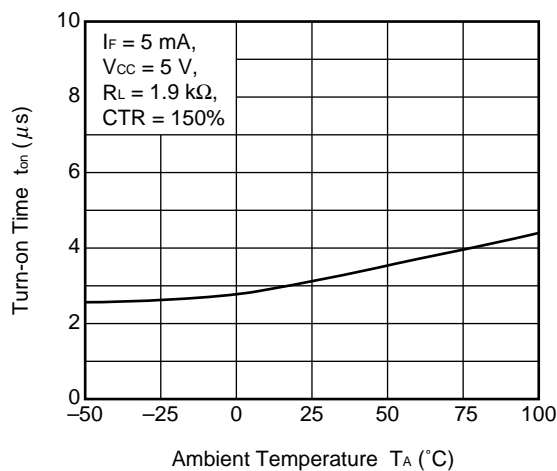
SWITCHING TIME vs. LOAD RESISTANCE



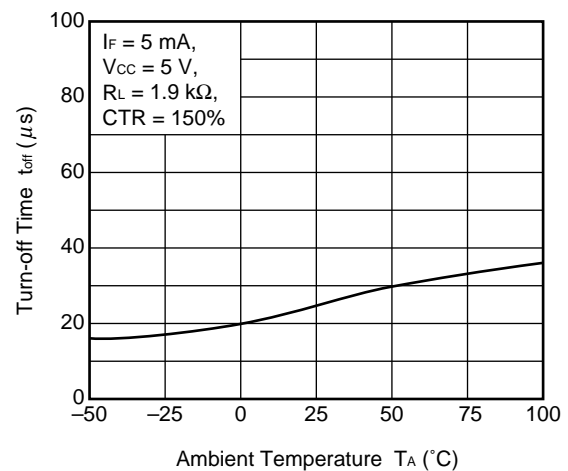
SWITCHING TIME vs. LOAD RESISTANCE



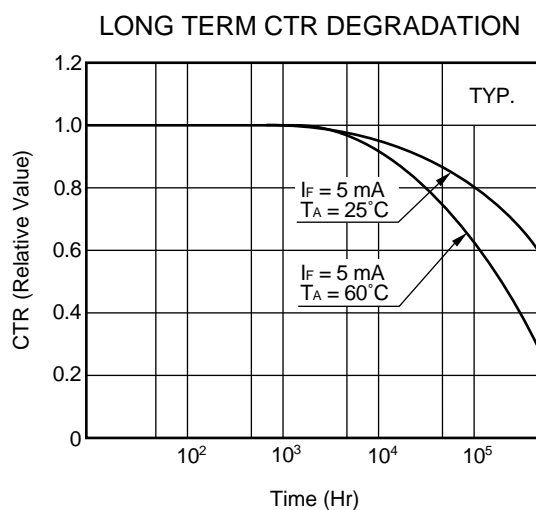
TURN-ON TIME vs. AMBIENT TEMPERATURE



TURN-OFF TIME vs. AMBIENT TEMPERATURE



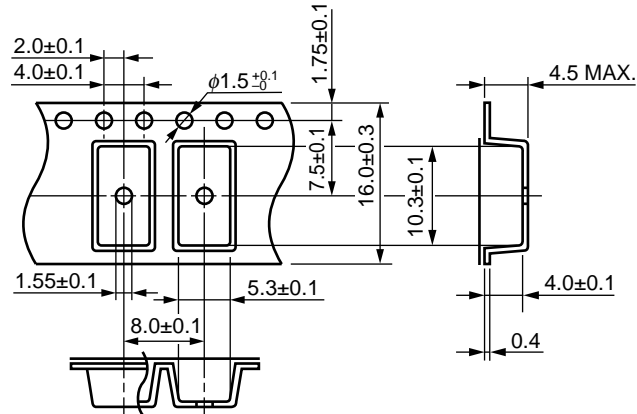
**Remark** The graphs indicate nominal characteristics.



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TAPING SPECIFICATIONS (UNIT: mm)

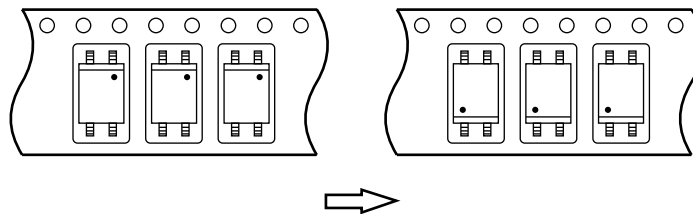
Outline and Dimensions (Tape)



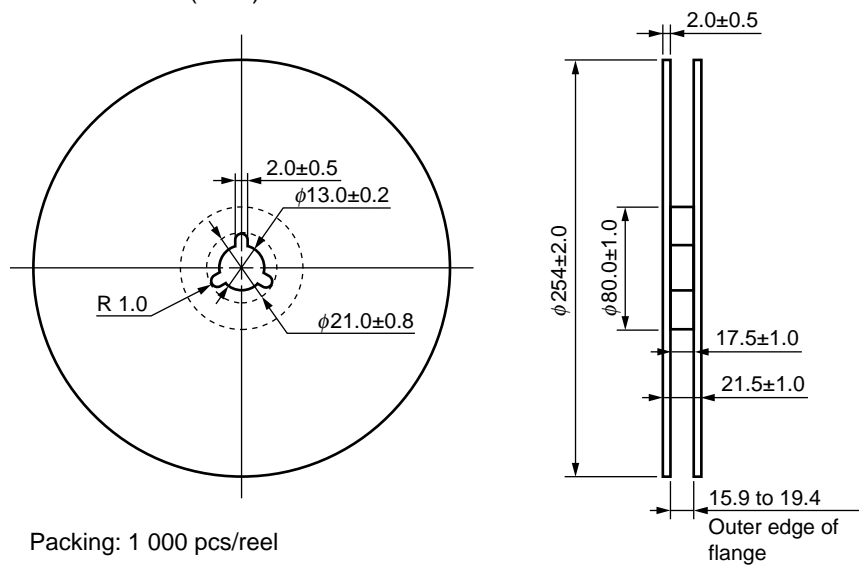
Tape Direction

PS2513L-1-E3

PS2513L-1-E4



Outline and Dimensions (Reel)



Technical drawing of a mechanical part, showing a front view and a side view. The part features a central rectangular slot and two smaller rectangular slots on either side. Dimensions and tolerances are specified in millimeters.

**Dimensions and Tolerances:**

- Top horizontal dimensions:  $2.0 \pm 0.1$ ,  $4.0 \pm 0.1$
- Top vertical dimensions:  $1.75 \pm 0.1$ ,  $7.5 \pm 0.1$
- Right vertical dimensions:  $16.0 \pm 0.3$ ,  $10.3 \pm 0.1$
- Bottom horizontal dimensions:  $1.55 \pm 0.1$ ,  $5.3 \pm 0.1$ ,  $8.0 \pm 0.1$
- Bottom vertical dimensions:  $4.0 \pm 0.1$ ,  $0.4$
- Right vertical dimension:  $4.5 \text{ MAX.}$
- Feature specification:  $\phi 1.5^{+0.1}_{-0}$

Technical drawing of a circular flange. The front view (left) shows a circular flange with a central hole. Dimensions include: outer diameter  $\phi 21.0 \pm 0.8$ , inner diameter  $\phi 13.0 \pm 0.2$ , and a central hole diameter of  $2.0 \pm 0.5$ . A fillet radius of  $R 1.0$  is indicated. The side view (right) shows the flange's profile with a total thickness of  $2.0 \pm 0.5$ , a central hole diameter of  $\phi 100 \pm 1.0$ , and a flange thickness of  $17.5 \pm 1.0$ . The outer edge of the flange is dimensioned as  $21.5 \pm 1.0$  and  $15.9$  to  $19.4$ .

Packing: 2 000 pcs/reel

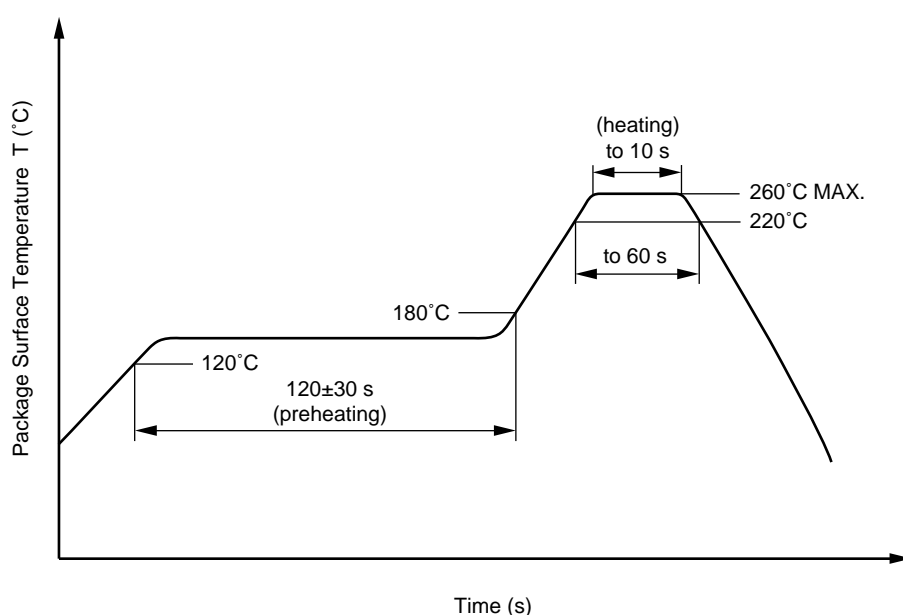
## NOTES ON HANDLING

## 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.

**★ 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

Parameter	Symbol	Speck	Unit
Application classification (DIN VDE 0109) for rated line voltages $\leq 300$ Vr.m.s. for rated line voltages $\leq 600$ 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) $U_{pr} = 1.2 \times U_{IORM}$ , $P_d < 5$ pC	$U_{IORM}$ $U_{pr}$	890 1 068	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices test) $U_{pr} = 1.6 \times U_{IORM}$ , $P_d < 5$ 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 $V_{IO} = 500$ V dc at $T_A = 25$ °C $V_{IO} = 500$ V dc at $T_A$ MAX. at least 100 °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 $I_F$ , $P_{si} = 0$ ) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500$ V dc at $T_A = 175$ °C ( $T_{si}$ )	$T_{si}$ $I_{si}$ $P_{si}$ Ris MIN.	175 400 700 $10^9$	°C mA mW $\Omega$

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M8E 00.4-0110

<b>Caution</b>	<b>GaAs Products</b>	<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

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