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**0.6 A OUTPUT CURRENT, HIGH CMR  
8-PIN DIP IGBT GATE DRIVE PHOTOCOUPLER** –NEPOC Series–

**DESCRIPTION**

The PS9553, PS9553L1, PS9553L2 and PS9553L3 are optically coupled isolators containing a GaAlAs LED on the input side and a photo diode, a signal processing circuit and a power output transistor on the output side on one chip.

The PS9553 Series is designed specifically for high common mode transient immunity (CMR) and high switching speed. It is suitable for driving IGBTs and MOS FETs.

The PS9553 Series is in a plastic DIP (Dual In-line Package).

The PS9553L1 is lead bending type for long creepage distance.

The PS9553L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

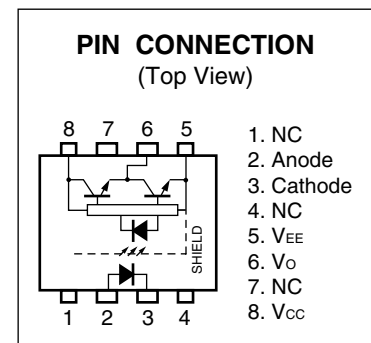
The PS9553L3 is lead bending type (Gull-wing) for surface mounting.

**FEATURES**

- Long creepage distance (8 mm MIN.: PS9553L1, PS9553L2)
- Peak output current (0.6 A MAX., 0.4 A MIN.)
- High speed switching ( $t_{PLH}$ ,  $t_{PHL}$  = 0.65  $\mu$ s MAX.)
- High common mode transient immunity ( $CM_H$ ,  $CM_L$  =  $\pm 15$  kV/ $\mu$ s MIN.)
- Ordering number of tape product: PS9553L2-E3: 1 000 pcs/reel  
: PS9553L3-E3: 1 000 pcs/reel
- Pb-Free product

**APPLICATIONS**

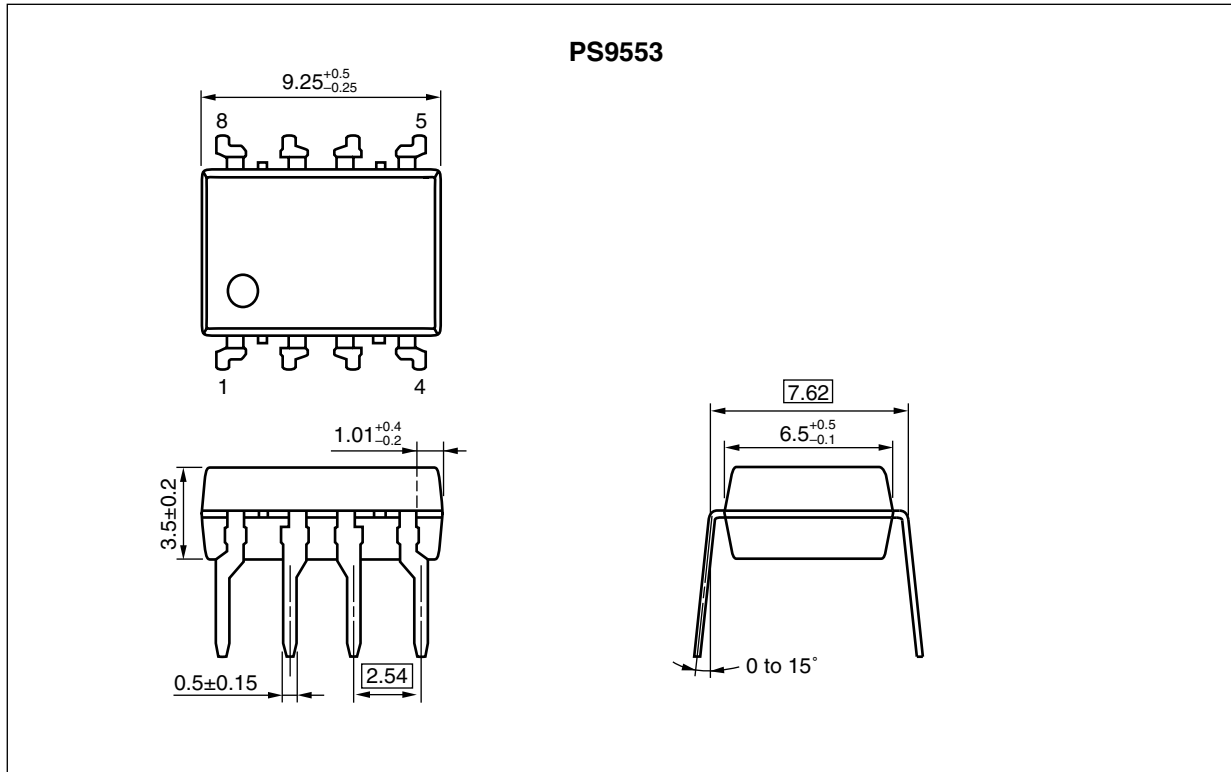
- IGBT, Power MOS FET Gate Driver
- Industrial inverter
- IH (Induction Heating)



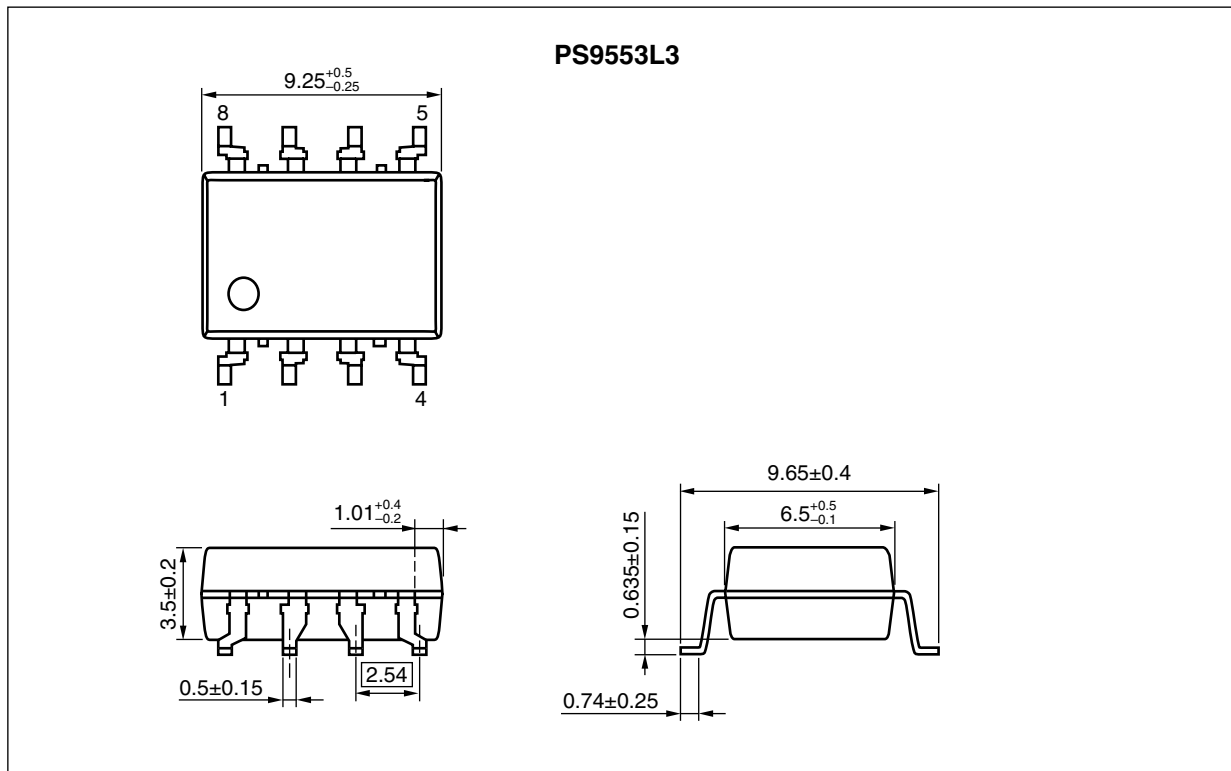
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PACKAGE DIMENSIONS (UNIT: mm)

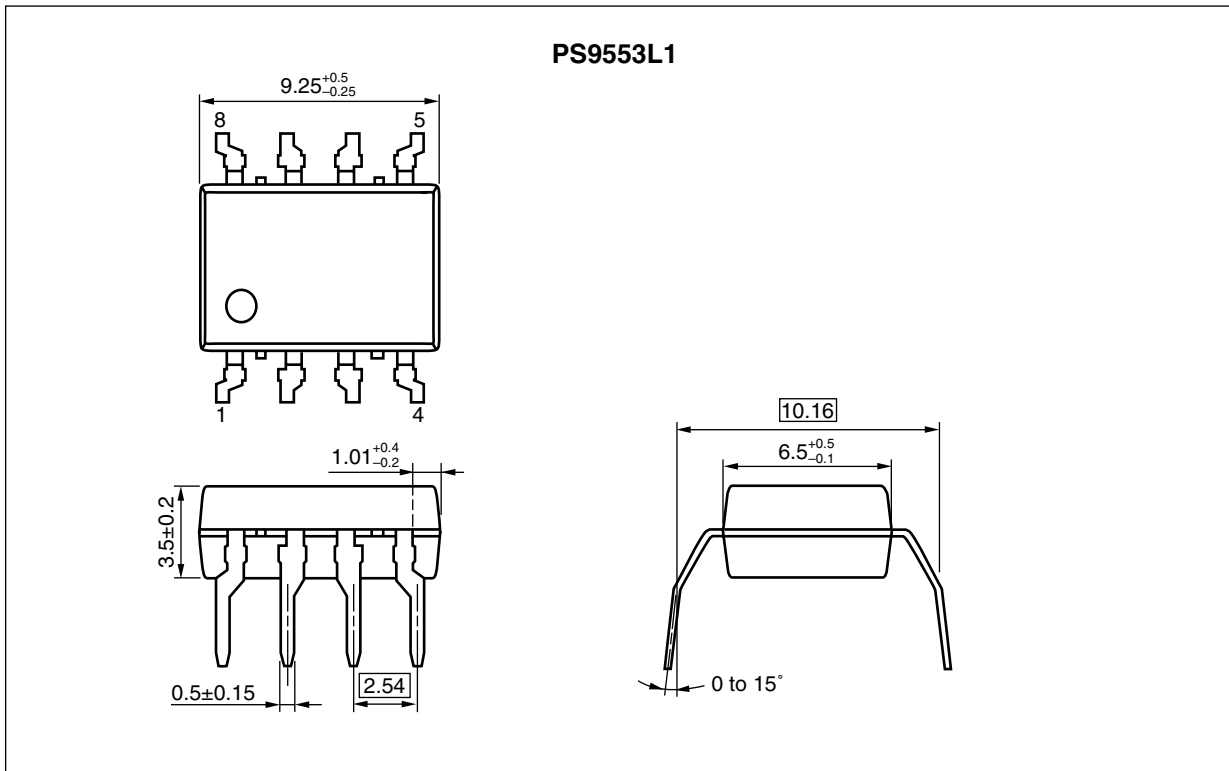
DIP Type



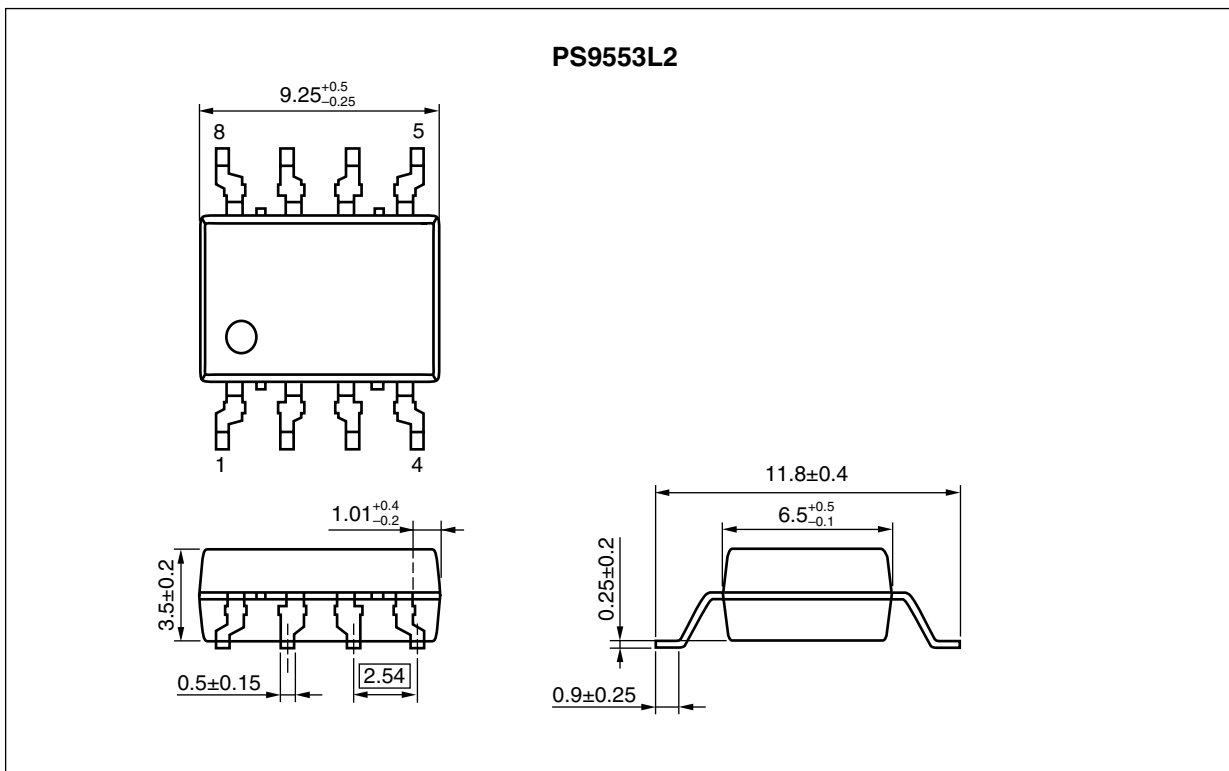
Lead Bending Type (Gull-wing) For Surface Mount



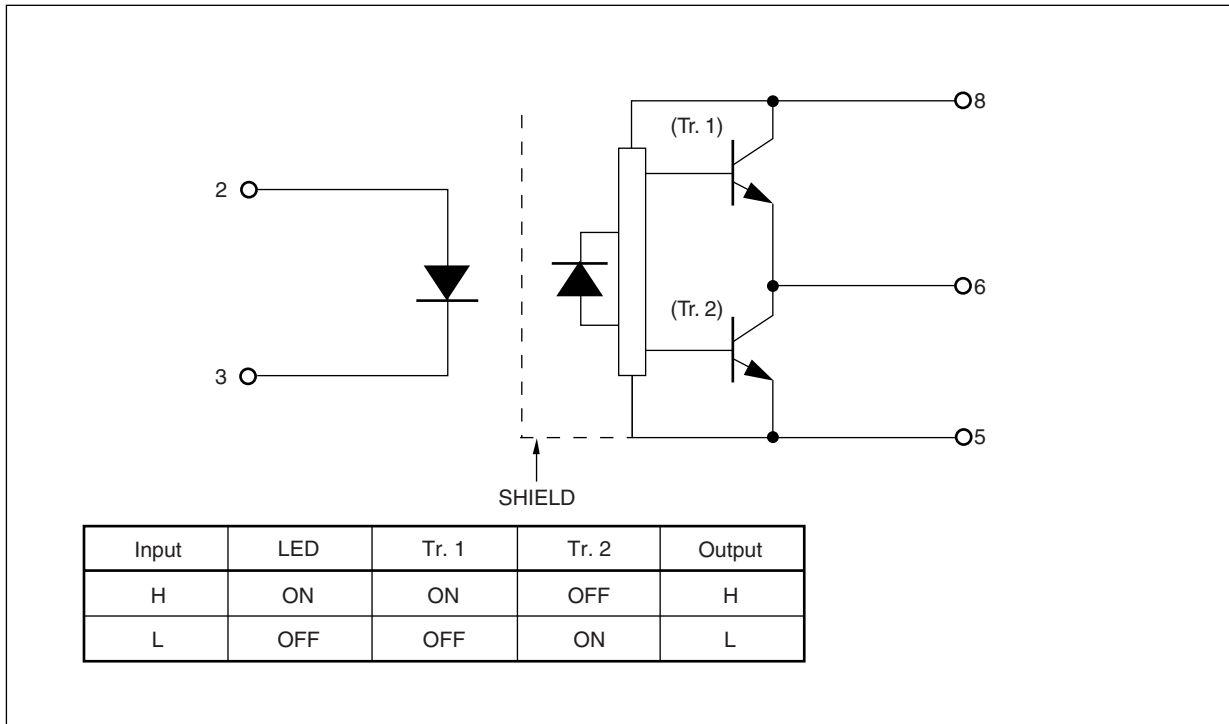
Lead Bending Type For Long Creepage Distance



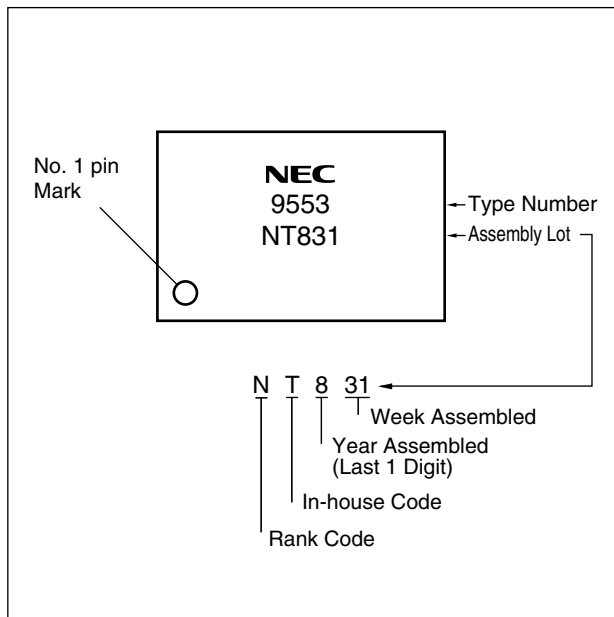
Lead Bending Type (Gull-wing) For Long Creepage Distance (Surface Mount)



**FUNCTIONAL DIAGRAM**



**MARKING EXAMPLE**



**PHOTOCOUPLER CONSTRUCTION**

Parameter	PS9553, PS9553L3	PS9553L1, PS9553L2
Air Distance (MIN.)	7 mm	8 mm
Outer Creepage Distance (MIN.)	7 mm	8 mm
Isolation Distance (MIN.)	0.4 mm	0.4 mm

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

Parameter		Symbol	Ratings	Unit
Diode	Forward Current	I <sub>F</sub>	25	mA
	Peak Transient Forward Current (Pulse Width < 1 μs)	I <sub>F (TRAN)</sub>	1.0	A
	Reverse Voltage	V <sub>R</sub>	5	V
	Power Dissipation <sup>*1</sup>	P <sub>D</sub>	45	mW
Detector	High Level Peak Output Current <sup>*2</sup>	I <sub>OH (PEAK)</sub>	0.6	A
	Low Level Peak Output Current <sup>*2</sup>	I <sub>OL (PEAK)</sub>	0.6	A
	Supply Voltage	(V <sub>CC</sub> - V <sub>EE</sub> )	0 to 35	V
	Output Voltage	V <sub>O</sub>	0 to V <sub>CC</sub>	V
	Power Dissipation <sup>*3</sup>	P <sub>C</sub>	250	mW
Isolation Voltage <sup>*4</sup>		BV	5 000	Vr.m.s.
Operating Frequency <sup>*5</sup>		f	25	kHz
Operating Ambient Temperature		T <sub>A</sub>	-40 to +100	°C
Storage Temperature		T <sub>stg</sub>	-55 to +125	°C

\*1 Reduced to 1.6 mW/°C at T<sub>A</sub> = 85°C or more.

\*2 Maximum pulse width = 10 μs, Maximum duty cycle = 0.2%

\*3 Reduced to 5.5 mW/°C at T<sub>A</sub> = 75°C or more.

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

Pins 1-4 shorted together, 5-8 shorted together.

\*5 I<sub>OH (PEAK)</sub> ≤ 0.4 A (≤ 2.0 μs), I<sub>OL (PEAK)</sub> ≤ 0.4 A (≤ 2.0 μs)

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	(V <sub>CC</sub> - V <sub>EE</sub> )	10		30	V
Forward Current (ON)	I <sub>F (ON)</sub>	8		12	mA
Forward Voltage (OFF)	V <sub>F (OFF)</sub>	-2		0.8	V
Operating Ambient Temperature	T <sub>A</sub>	-40		100	°C

**ELECTRICAL CHARACTERISTICS** ( $T_A = -40$  to  $+100^\circ\text{C}$ ,  $V_{CC} = 10$  to  $30$  V,  $I_F(\text{ON}) = 8$  to  $12$  mA,  $V_F(\text{OFF}) = -2$  to  $0.8$  V,  $V_{EE} = \text{GND}$ , unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	$V_F$	$I_F = 10$ mA, $T_A = 25^\circ\text{C}$	1.2	1.56	1.9	V
	Reverse Current	$I_R$	$V_R = 3$ V, $T_A = 25^\circ\text{C}$			10	$\mu\text{A}$
Detector	High Level Output Current	$I_{OH}$	$V_O = (V_{CC} - 4 \text{ V})^{*2}$	0.2			A
			$V_O = (V_{CC} - 10 \text{ V})^{*3}$	0.4	0.5		
	Low Level Output Current	$I_{OL}$	$V_O = (V_{EE} + 2.5 \text{ V})^{*2}$	0.2	0.4		A
			$V_O = (V_{EE} + 10 \text{ V})^{*3}$	0.4	0.5		
	High Level Output Voltage	$V_{OH}$	$I_O = -100$ mA <sup>*4</sup>	$V_{CC} - 4.0$	$V_{CC} - 1.8$		V
	Low Level Output Voltage	$V_{OL}$	$I_O = 100$ mA		0.4	1.0	V
	High Level Supply Current	$I_{CCH}$	$V_O = \text{open}$ , $I_F = 8$ to $12$ mA		0.7	3.0	mA
	Low Level Supply Current	$I_{CCL}$	$V_O = \text{open}$ , $V_F = -2$ to $+0.8$ V		1.2	3.0	mA
Coupled	Threshold Input Current (L → H)	$I_{FLH}$	$I_O = 0$ mA, $V_O > 5$ V			5.0	mA
	Threshold Input Voltage (H → L)	$V_{FHL}$	$I_O = 0$ mA, $V_O < 5$ V	0.8			V
	Isolation Capacitance	$C_{I-O}$	$f = 1$ MHz, $V_F = 0$ V, $T_A = 25^\circ\text{C}$		60		pF

\*1 Typical values at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} - V_{EE} = 30$  V.

\*2 Maximum pulse width = 50  $\mu\text{s}$ , Maximum duty cycle = 0.5%.

\*3 Maximum pulse width = 10  $\mu\text{s}$ , Maximum duty cycle = 0.2%

\*4  $V_{OH}$  is measured with the DC load current in this testing.

**SWITCHING CHARACTERISTICS** ( $T_A = -40$  to  $+100^\circ\text{C}$ ,  $V_{CC} = 10$  to  $30$  V,  $I_F(\text{ON}) = 8$  to  $12$  mA,  $V_F(\text{OFF}) = -2$  to  $0.8$  V,  $V_{EE} = \text{GND}$ , unless otherwise specified)

Parameter	Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Propagation Delay Time (L → H)	$t_{PLH}$	$I_F = 10$ mA, $R_g = 47 \Omega$ , $C_g = 3$ nF, $f = 10$ kHz, Duty Cycle = 50%*2	0.05	0.2	0.65	$\mu\text{s}$
Propagation Delay Time (H → L)	$t_{PHL}$		0.05	0.2	0.65	$\mu\text{s}$
Pulse Width Distortion (PWD)	$ t_{PHL} - t_{PLH} $		-0.5		0.5	$\mu\text{s}$
Propagation Delay Time (Difference Between Any Two Products)	$t_{PHL} - t_{PLH}$			50		ns
Rise Time	$t_r$			50		ns
Fall Time	$t_f$					
Common Mode Transient Immunity at High Level Output*3	$ CM_H $	$T_A = 25^\circ\text{C}$ , $I_F = 10$ mA, $V_{CC} = 30$ V, $V_{O(\text{MIN.})} = 26$ V, $V_{CM} = 1.5$ kV	15			kV/ $\mu\text{s}$
Common Mode Transient Immunity at Low Level Output*3	$ CM_L $	$T_A = 25^\circ\text{C}$ , $I_F = 0$ mA, $V_{CC} = 30$ V, $V_{O(\text{MAX.})} = 1$ V, $V_{CM} = 1.5$ kV	15			kV/ $\mu\text{s}$

\*1 Typical values at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} - V_{EE} = 30$  V.

\*2 This load condition is equivalent to the IGBT load at 1 200 V/25 A.

\*3 Connect pin 1 and pin 4 to the LED common.



TEST CIRCUIT

Fig. 1 I<sub>OH</sub> Test Circuit

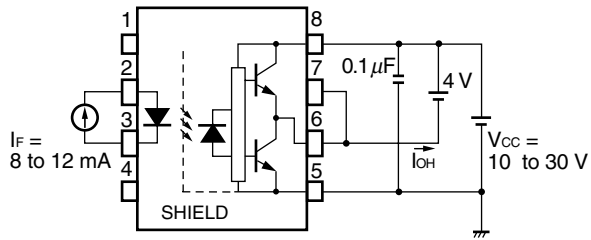


Fig. 2 I<sub>oL</sub> Test Circuit

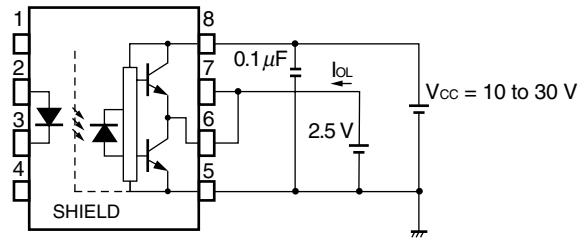


Fig. 3 V<sub>oH</sub> Test Circuit

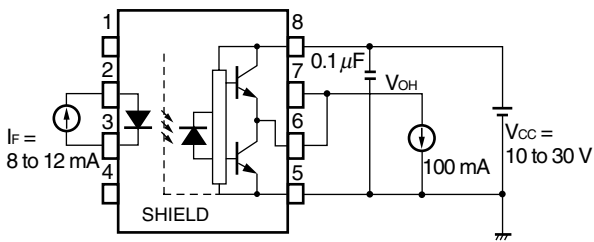


Fig. 4 V<sub>oL</sub> Test Circuit

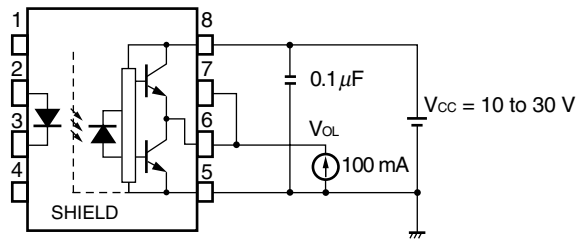


Fig. 5 I<sub>FLH</sub> Test Circuit

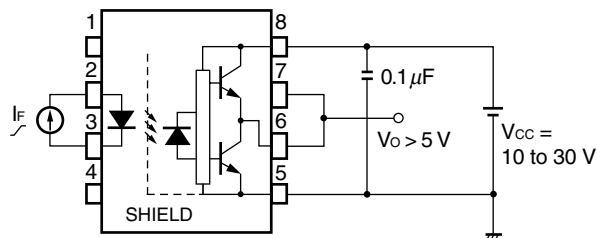


Fig. 6  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_r$ ,  $t_f$  Test Circuit and Wave Forms

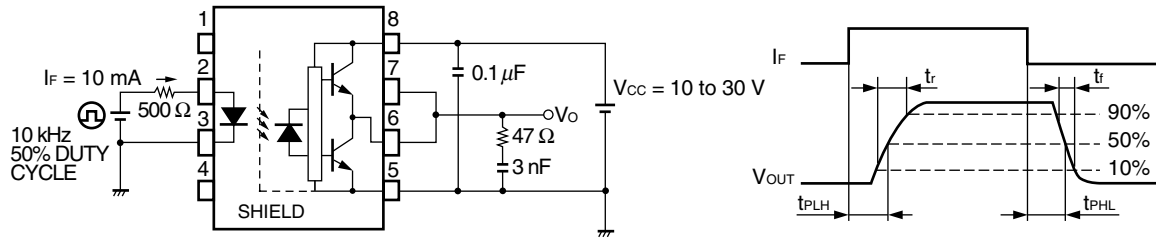
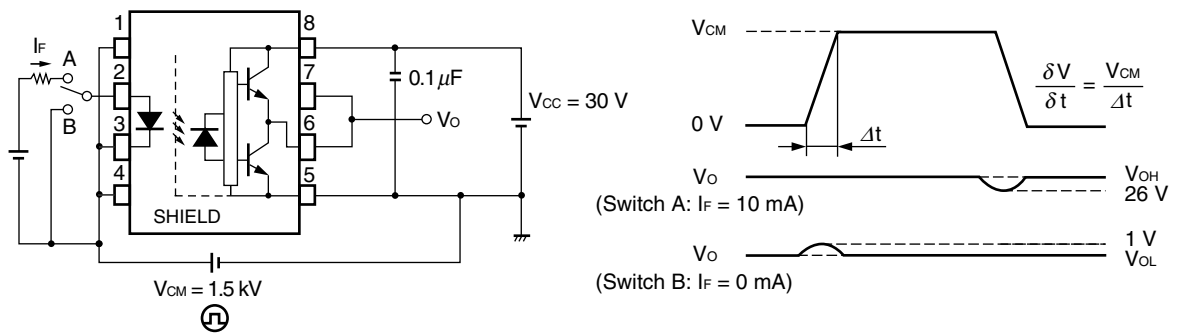


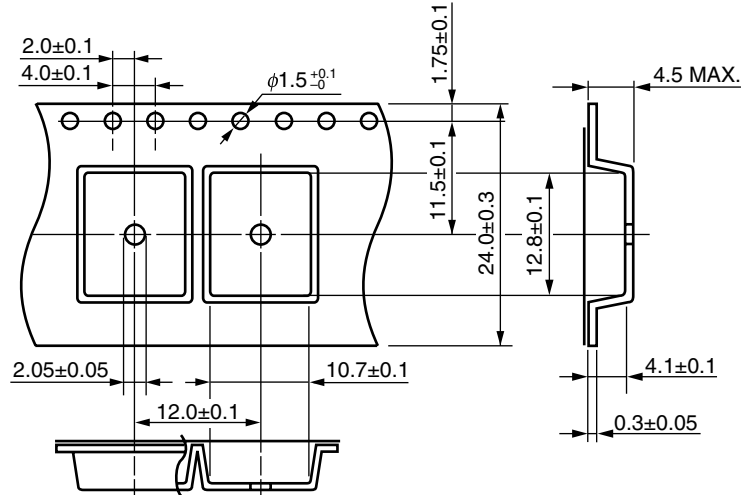
Fig. 7 CMR Test Circuit and Wave Forms



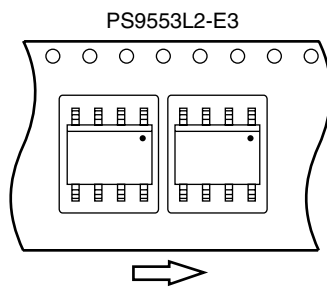
**Remark** CMR Test : Connect pin 1 and pin 4 to the LED common.

TAPING SPECIFICATIONS (UNIT: mm)

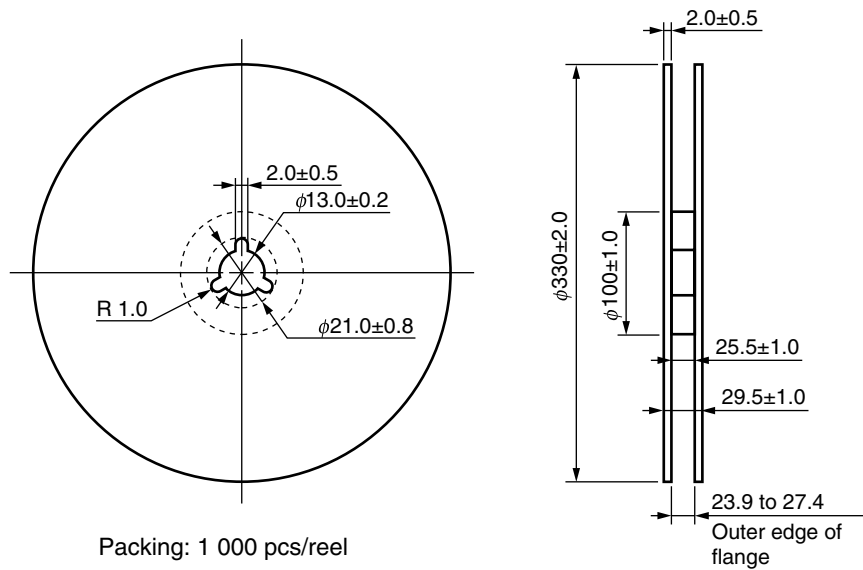
Outline and Dimensions (Tape)



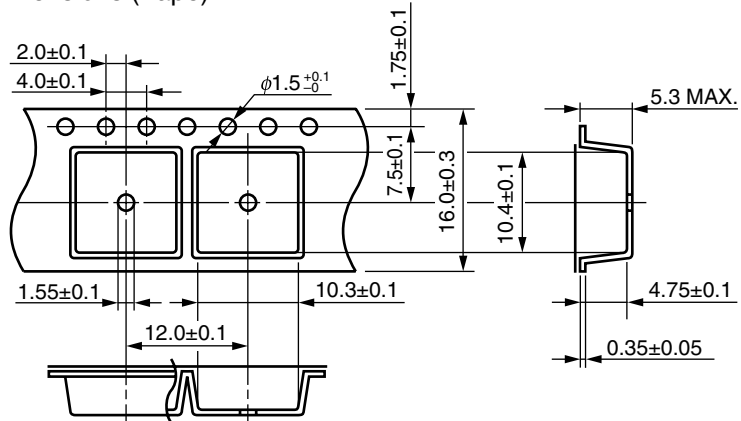
Tape Direction



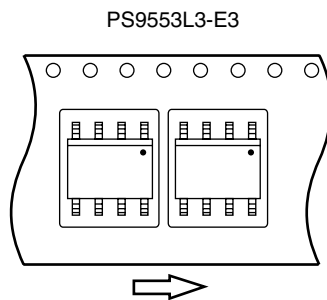
Outline and Dimensions (Reel)



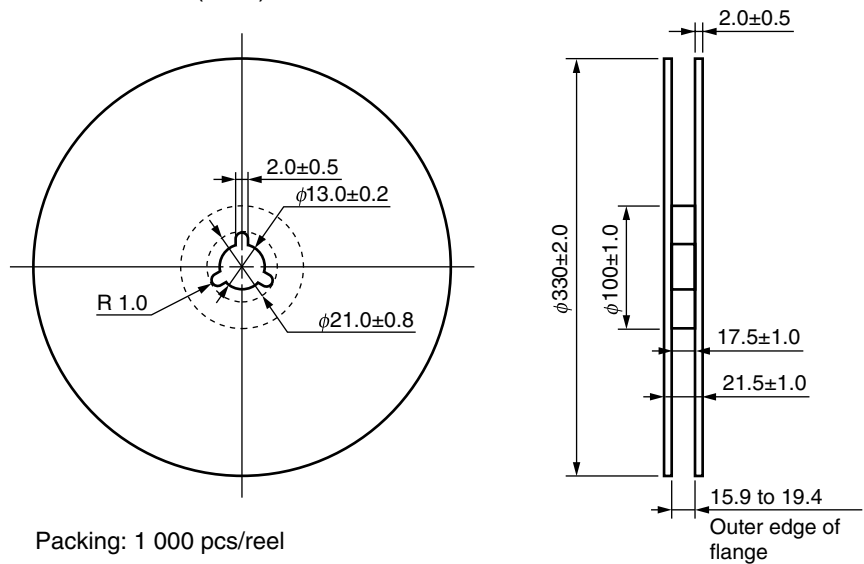
Outline and Dimensions (Tape)



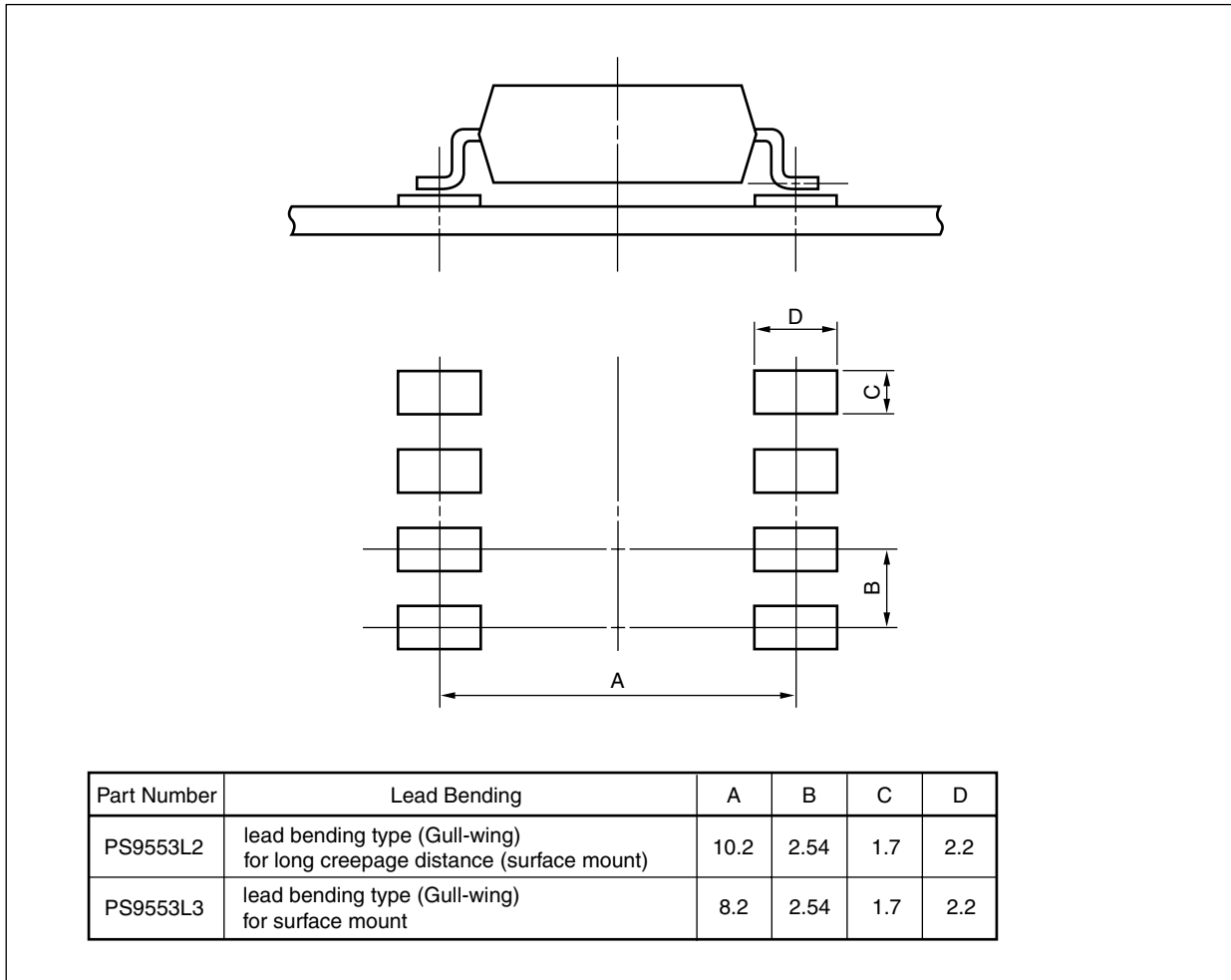
Tape Direction



Outline and Dimensions (Reel)



RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



## NOTES ON HANDLING

### Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

## 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. Board designing
  - (1) By-pass capacitor of more than 0.1  $\mu\text{F}$  is used between  $V_{\text{CC}}$  and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
  - (2) In order to avoid malfunctions and characteristics degradation, IGBT collector or emitter traces should not be closed to the LED input.
3. Make sure the rise/fall time of the forward current is 0.5  $\mu\text{s}$  or less.
4. In order to avoid malfunctions, make sure the rise/fall slope of the supply voltage is 3 V/ $\mu\text{s}$  or less.
5. Avoid storage at a high temperature and high humidity.

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M8E 02.11-1

<b>Caution</b>	GaAs Products	<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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