PRELIMINARY DATA SHEET

NEC

PHOTOCOUPLER

PS9553,PS9553L1,PS9553L2,PS9553L3

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.

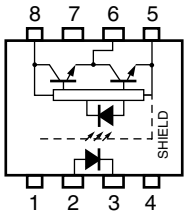
The PS9553L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

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 μs MAX.)
- High common mode transient immunity (CM_H, CM_L = ±15 kV/μs MIN.)
- Ordering number of tape product: PS9553L2-E3: 1 000 pcs/reel
  : PS9553L3-E3: 1 000 pcs/reel
- Pb-Free product

PIN CONNECTION
(Top View)



1. NC
2. Anode
3. Cathode
4. NC
5. V_{EE}
6. V_O
7. NC
8. V_{CC}

APPLICATIONS

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

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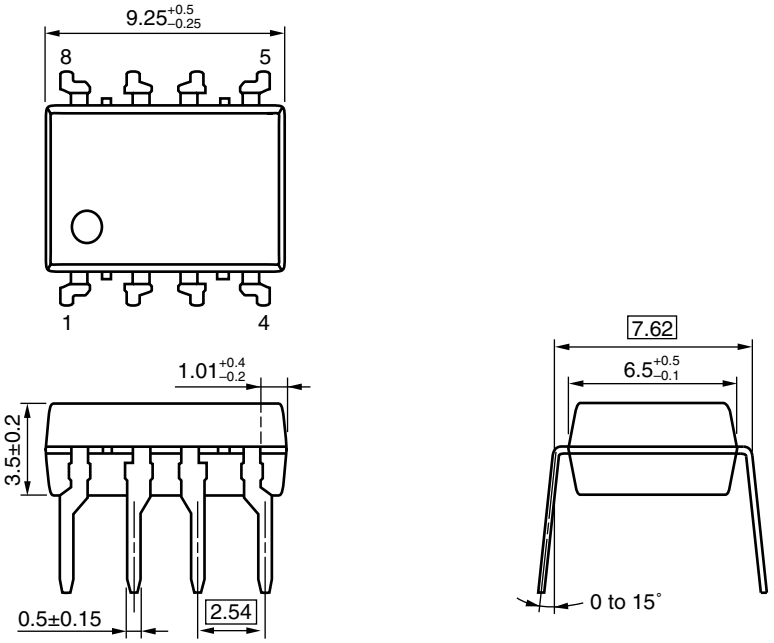
PACKAGE DIMENSIONS (UNIT: mm)

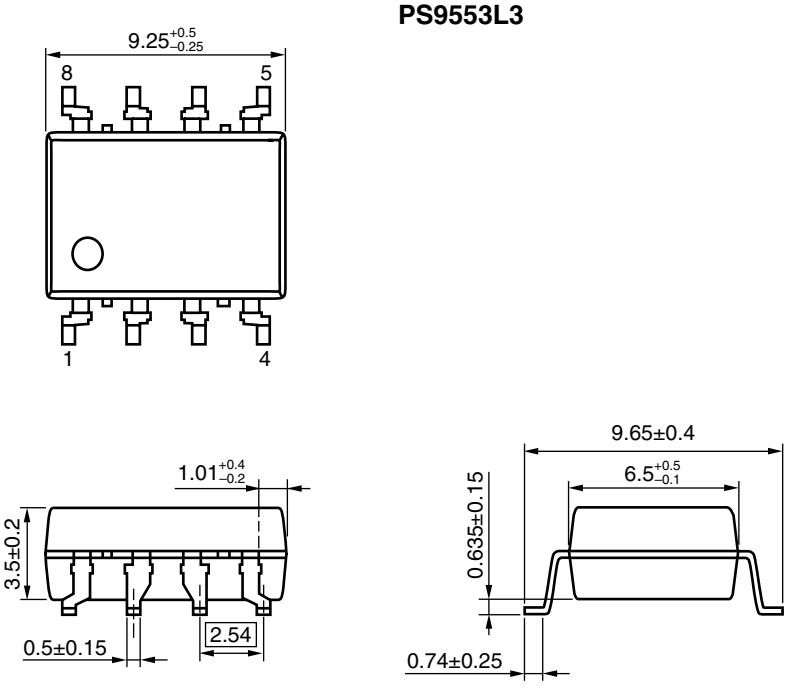
DIP Type

PS9553



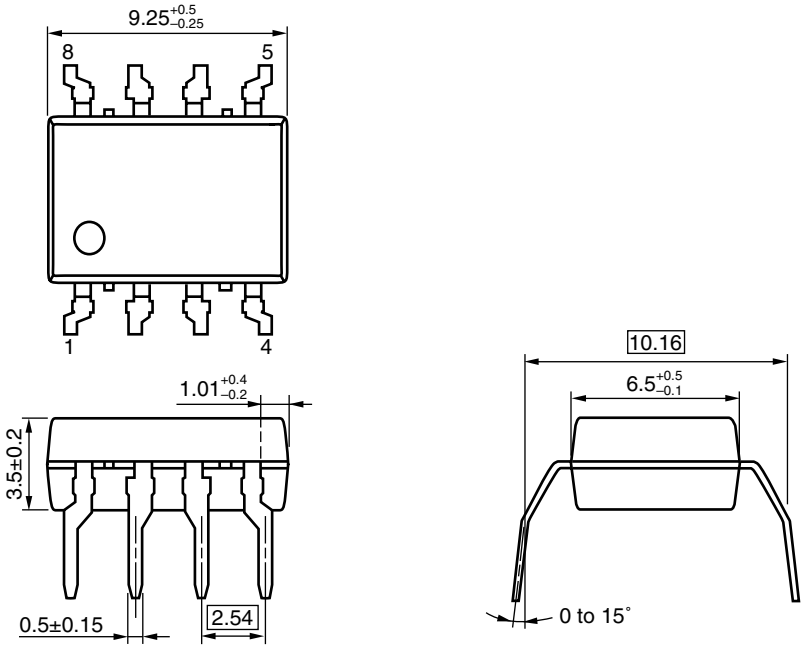
Lead Bending Type (Gull-wing) For Surface Mount

PS9553L3



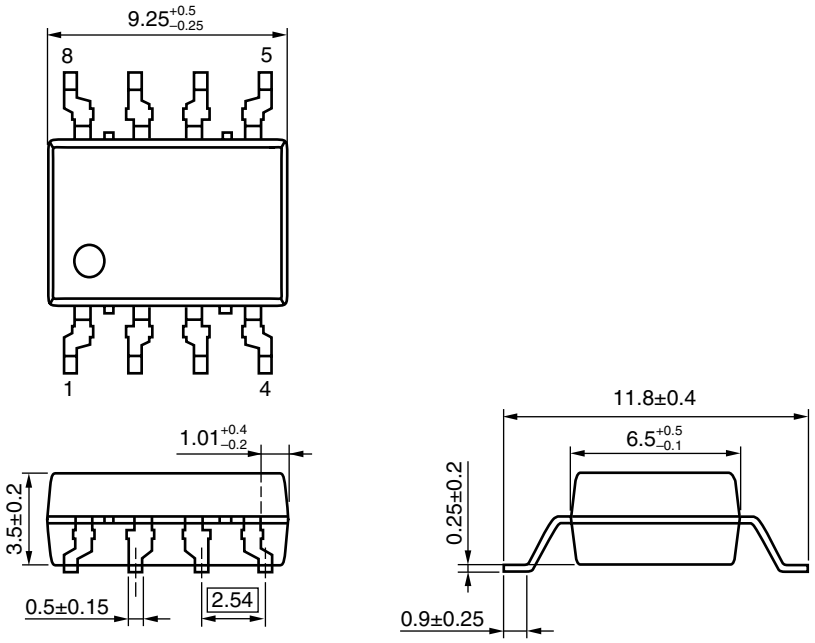
Lead Bending Type For Long Creepage Distance

PS9553L1

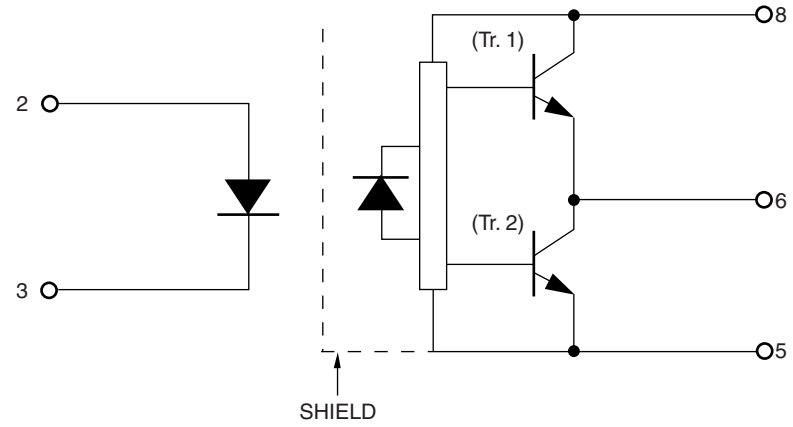


Lead Bending Type (Gull-wing) For Long Creepage Distance (Surface Mount)

PS9553L2

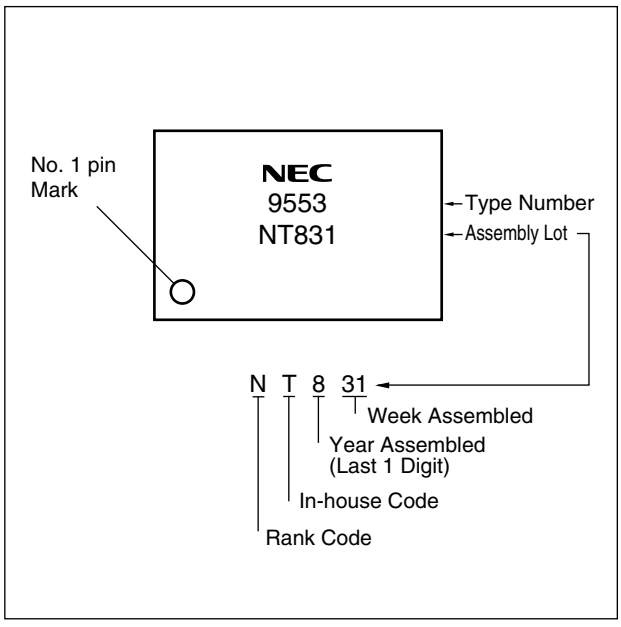


FUNCTIONAL DIAGRAM



Input	LED	Tr. 1	Tr. 2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

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_A = 25°C, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Forward Current	I_F	25	mA
	Peak Transient Forward Current (Pulse Width < 1 μs)	$I_{F\ (TRAN)}$	1.0	A
	Reverse Voltage	V_R	5	V
	Power Dissipation*1	P_D	45	mW
Detector	High Level Peak Output Current*2	$I_{OH\ (PEAK)}$	0.6	A
	Low Level Peak Output Current*2	$I_{OL\ (PEAK)}$	0.6	A
	Supply Voltage	$(V_{CC} - V_{EE})$	0 to 35	V
	Output Voltage	V_O	0 to V_{CC}	V
	Power Dissipation*3	P_C	250	mW
Isolation Voltage*4		BV	5 000	Vr.m.s.
Operating Frequency*5		f	25	kHz
Operating Ambient Temperature		T_A	–40 to +100	°C
Storage Temperature		T_{stg}	–55 to +125	°C

***1** Reduced to 1.6 mW/°C at T_A = 85°C or more.

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

***3** Reduced to 5.5 mW/°C at T_A = 75°C or more.

***4** 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.

***5** $I_{OH\ (PEAK)} \leq 0.4$ A (≤ 2.0 μs), $I_{OL\ (PEAK)} \leq 0.4$ A (≤ 2.0 μs)

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	$(V_{CC} - V_{EE})$	10		30	V
Forward Current (ON)	$I_{F\ (ON)}$	8		12	mA
Forward Voltage (OFF)	$V_{F\ (OFF)}$	–2		0.8	V
Operating Ambient Temperature	T_A	–40		100	°C

ELECTRICAL CHARACTERISTICS (T_A = –40 to +100°C, V_{CC} = 10 to 30 V, $I_{F(ON)}$ = 8 to 12 mA, $V_{F(OFF)}$ = –2 to 0.8 V, V_{EE} = GND, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C	1.2	1.56	1.9	V
	Reverse Current	I_R	V_R = 3 V, T_A = 25°C			10	μA
Detector	High Level Output Current	I_{OH}	V_O = (V_{CC} – 4 V) *2	0.2			A
			V_O = (V_{CC} – 10 V) *3	0.4	0.5		
	Low Level Output Current	I_{OL}	V_O = (V_{EE} + 2.5 V) *2	0.2	0.4		A
			V_O = (V_{EE} + 10 V) *3	0.4	0.5		
	High Level Output Voltage	V_{OH}	I_O = –100 mA *4	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 = open, I_F = 8 to 12 mA		0.7	3.0	mA
	Low Level Supply Current	I_{CCL}	V_O = 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°C		60		pF

***1** Typical values at T_A = 25°C, V_{CC} – V_{EE} = 30 V.

***2** Maximum pulse width = 50 μs, Maximum duty cycle = 0.5%.

***3** Maximum pulse width = 10 μs, 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°C, V_{CC} = 10 to 30 V, $I_{F\,(ON)}$ = 8 to 12 mA, $V_{F\,(OFF)}$ = –2 to 0.8 V, V_{EE} = GND, unless otherwise specified)

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

***1** Typical values at T_A = 25°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_{OH} Test Circuit

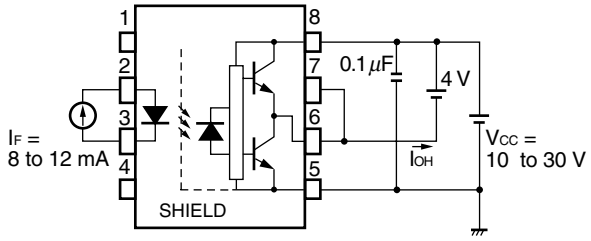


Fig. 2 I_{OL} Test Circuit

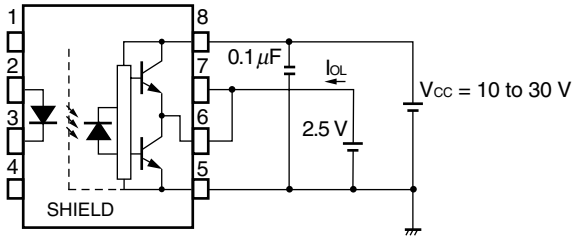


Fig. 3 V_{OH} Test Circuit

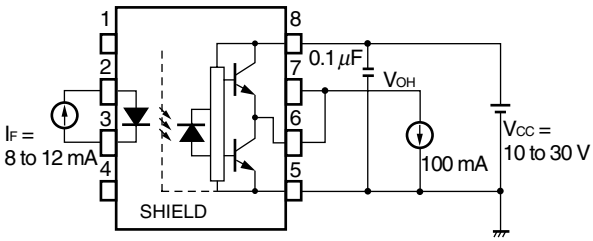


Fig. 4 V_{OL} Test Circuit

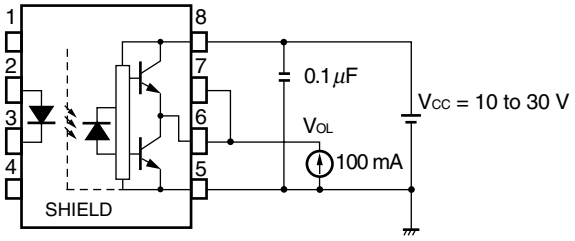


Fig. 5 I_{FLH} Test Circuit

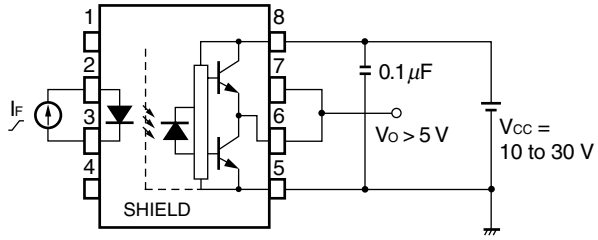


Fig. 6 t_{PLH}, t_{PHL}, t_r, t_f Test Circuit and Wave Forms

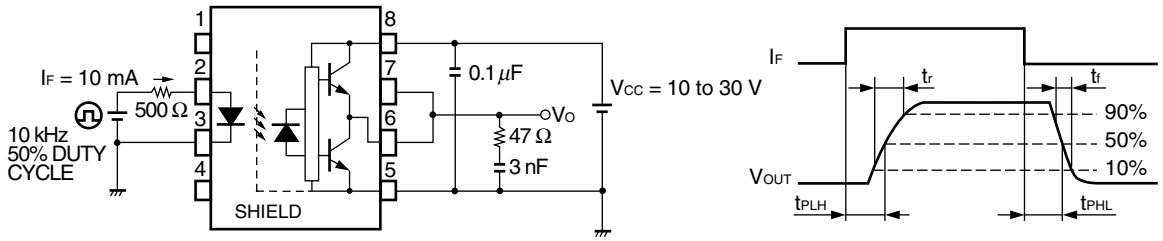
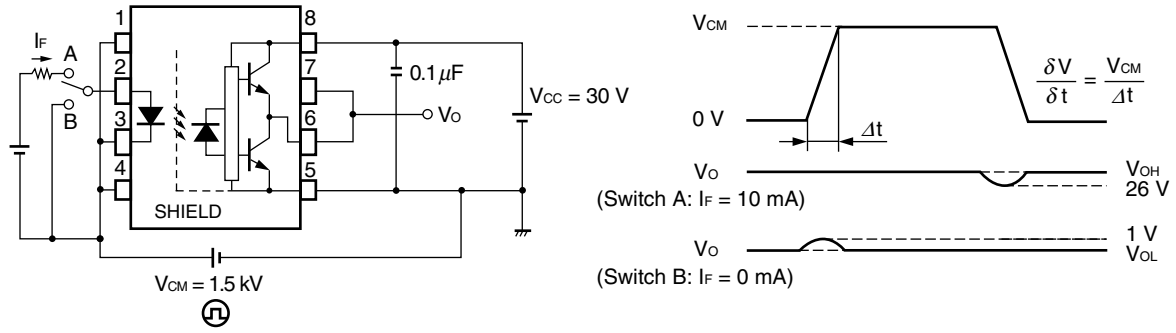


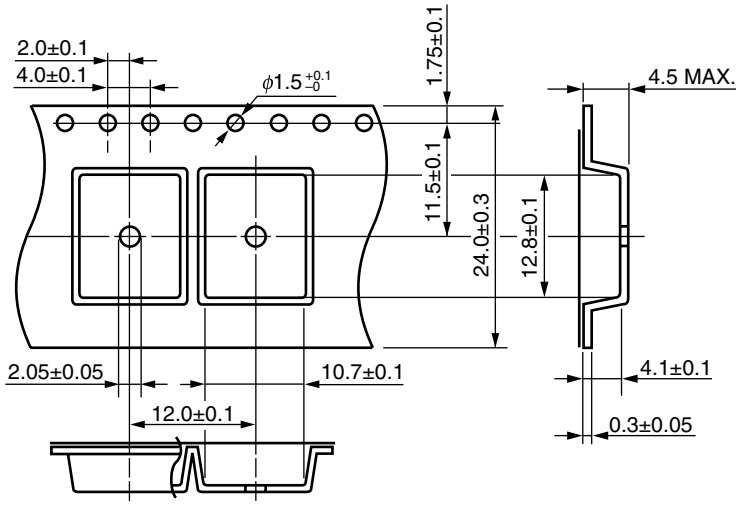
Fig. 7 CMR Test Circuit and Wave Forms



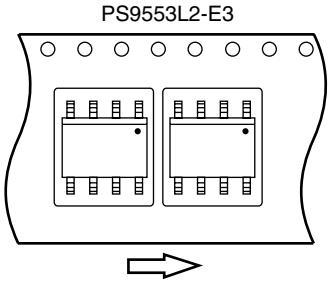
Remark CMR Test : Connect pin 1 and pin 4 to the LED common.

TAPING SPECIFICATIONS (UNIT: mm)

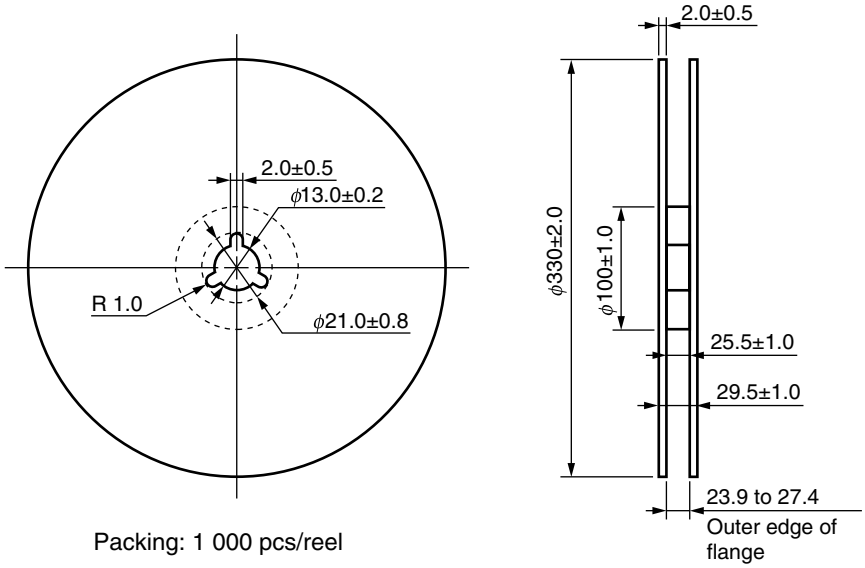
Outline and Dimensions (Tape)



Tape Direction

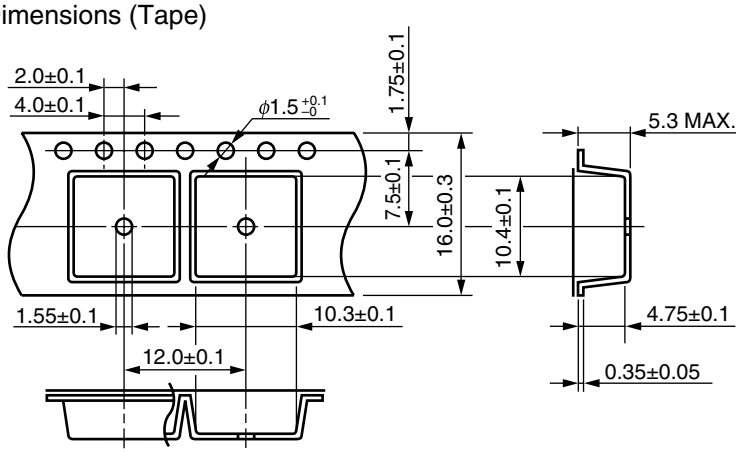


Outline and Dimensions (Reel)



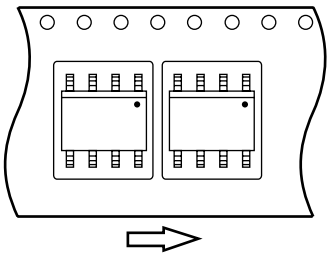
Packing: 1 000 pcs/reel

Outline and Dimensions (Tape)

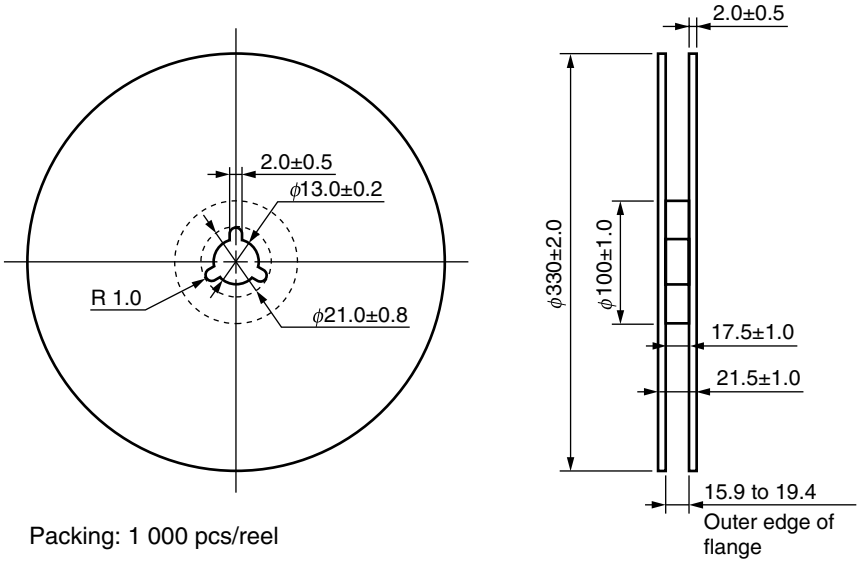


Tape Direction

PS9553L3-E3

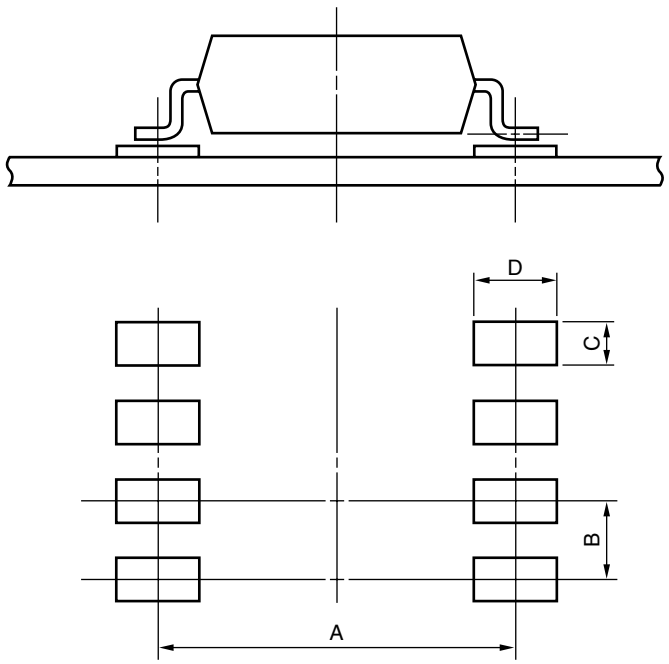


Outline and Dimensions (Reel)



Packing: 1 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



Part Number	Lead Bending	A	B	C	D
PS9553L2	lead bending type (Gull-wing) for long creepage distance (surface mount)	10.2	2.54	1.7	2.2
PS9553L3	lead bending type (Gull-wing) for surface mount	8.2	2.54	1.7	2.2

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 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.
   (2) In older 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 μs or less.
4. In order to avoid malfunctions, make sure the rise/fall slope of the supply voltage is 3 V/μs or less.
5. Avoid storage at a high temperature and high humidity.

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M8E 02. 11-1

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