PRELIMINARY DATA SHEET

NEC

PHOTOCOUPLER

PS9301L,PS9301L2

0.6 A OUTPUT CURRENT, HIGH CMR, IGBT GATE DRIVE 6-PIN SDIP PHOTOCOUPLER

–NEPOC Series–

DESCRIPTION

The PS9301L and PS9301L2 are optical 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 PS9301L and PS9301L2 are in 6-pin plastic SDIP (Shrink Dual In-line Package). The PS9301L2 has 8 mm creepage distance. The mount area of 6-pin plastic SDIP is half size of 8-pin DIP.

The PS9301L and PS9301L2 are designed specifically for high common mode transient immunity (CMR) and high switching speed. It is suitable for driving IGBTs and MOS FETs.

The PS9301L is lead bending type (Gull-wing) for surface mounting.

The PS9301L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

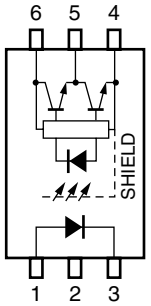
FEATURES

- Long creepage distance (8 mm MIN. : PS9301L2)
- Half size of 8-pin DIP
- Peak output current (0.6 A MAX., 0.4 A MIN.)
- High speed switching (t_{PLH}/t_{PHL} = 0.7 μs MAX.)
- High common mode transient immunity (CM_H, CM_L = ±15 kV/μs MIN.)
- Pb-Free product

APPLICATIONS

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

PIN CONNECTION
(Top View)



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

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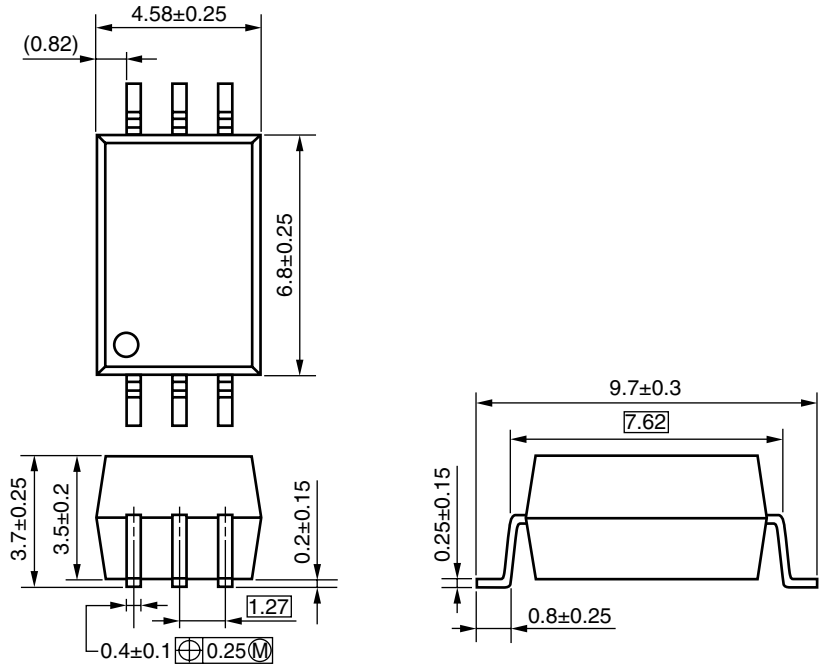
PACKAGE DIMENSIONS (UNIT: mm)

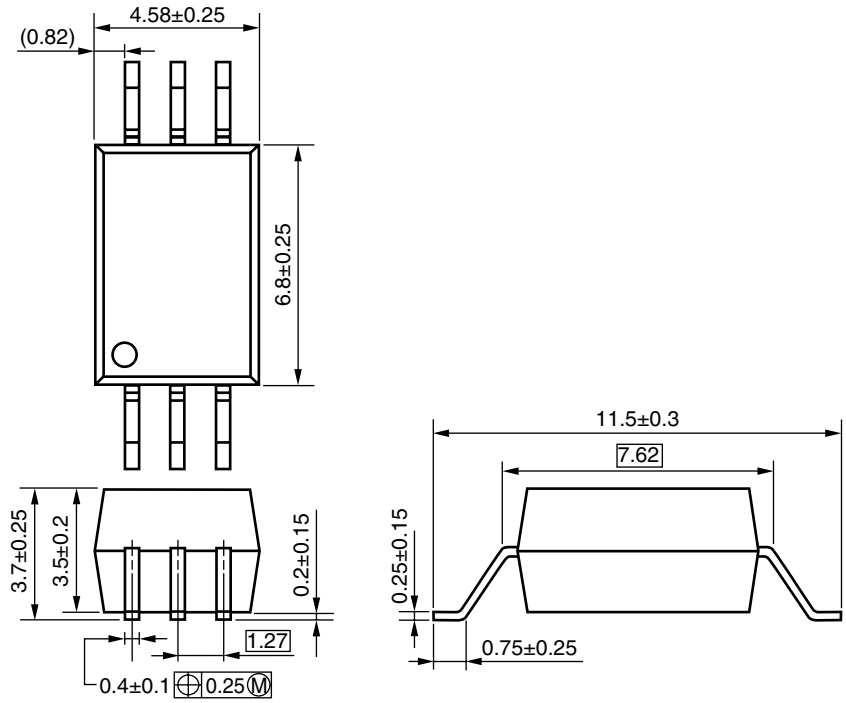
Lead Bending Type (Gull-wing) For Surface Mount

PS9301L

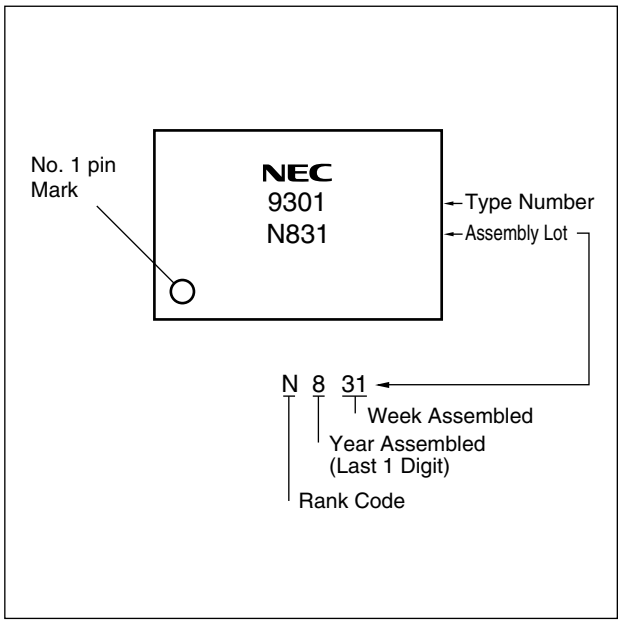


Lead Bending Type For Long Creepage Distance (Gull-wing) For Surface Mount

PS9301L2



MARKING EXAMPLE



PHOTOCOUPLER CONSTRUCTION

Parameter	PS9301L	PS9301L2
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 *1	I_F	25	mA
	Peak Transient Forward Current (Pulse Width < 1 μs)	$I_{F\ (TRAN)}$	1.0	A
	Reverse Voltage	V_R	5	V
Detector	High Level Peak Output Current *1	$I_{OH\ (PEAK)}$	0.6	A
	Low Level Peak Output Current *1	$I_{OL\ (PEAK)}$	0.6	A
	Supply Voltage	(V_{CC} - V_{EE})	0 to 35	V
	Output Voltage	V_O	0 to V_{CC}	V
	Power Dissipation	P_C	260	mW
Isolation Voltage *2		BV	5 000	Vr.m.s.
Total Power Dissipation		P_T	360	mW
Operating Frequency *3		f	25	kHz
Operating Ambient Temperature		T_A	–40 to +100	°C
Storage Temperature		T_{stg}	–55 to +125	°C

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

***2** AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output. Pins 1-3 shorted together, 4-6 shorted together.

***3** $I_{OH\ (PEAK)} \leq 0.4$ 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}	I_O = 0 mA *5		0.7	3.0	mA
	Low Level Supply Current	I_{CCL}	I_O = 0 mA *5		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.

***5** The I_{CCH} and I_{CCL} increase when operating frequency and Q_g of the driven IGBT increases.

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,	0.1	0.2	0.7	μs
Propagation Delay Time (H → L)	t_{PHL}	R_g = 47 Ω, C_g = 3 nF, f = 10 kHz,	0.1	0.2	0.7	μs
Pulse Width Distortion (PWD)	$\lvert t_{PHL}-t_{PLH}\rvert$	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 2 to the LED common.

TEST CIRCUIT

Fig. 1 I_{OH} Test Circuit

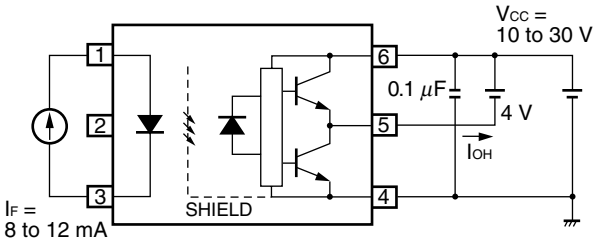


Fig. 2 I_{OL} Test Circuit

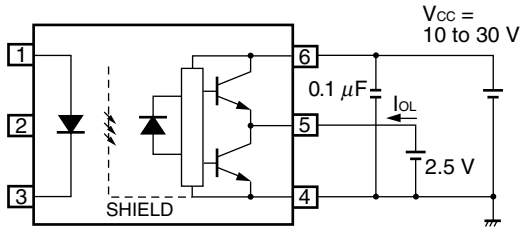


Fig. 3 V_{OH} Test Circuit

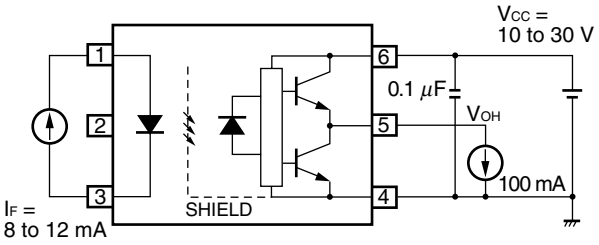


Fig. 4 V_{OL} Test Circuit

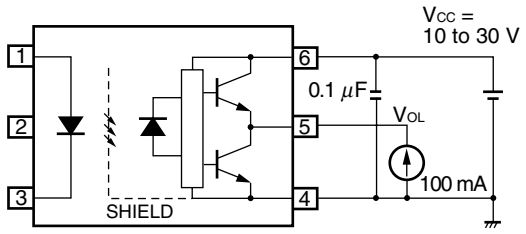


Fig. 5 I_{FLH} Test Circuit

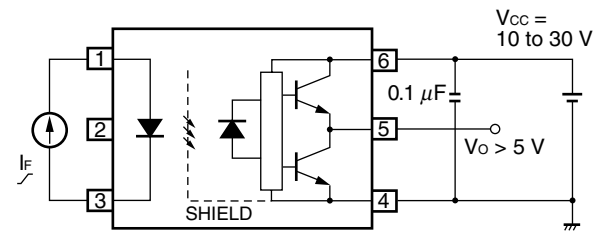


Fig. 6 t_{PLH}, t_{PHL}, t_r, t_f Test Circuit and Wave Forms

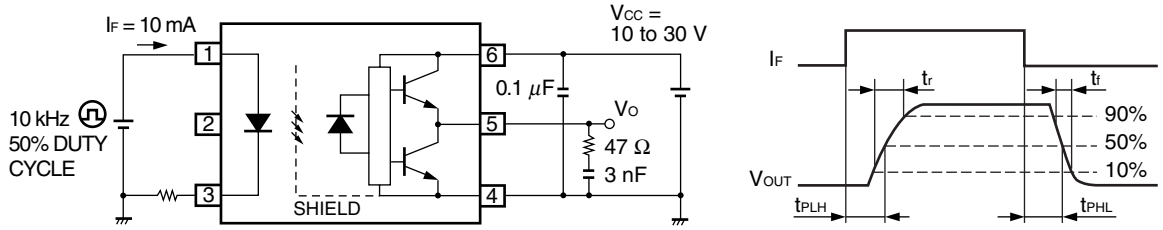
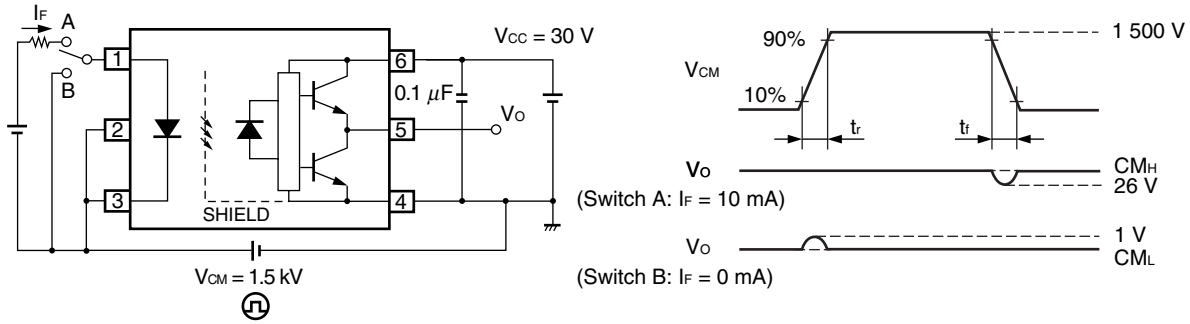


Fig. 7 CMR Test Circuit and Wave Forms



Remarks 1. Common Mode Transient Immunity at High Level Output is the maximum value of dVCM/dt at which the output remains High Level (e.g. V_O > 26 V).

2. Common Mode Transient Immunity at Low Level Output is the maximum value of dVCM/dt at which the output remains Low Level (e.g. V_O < 1.0 V).

3. Connect pin 2 to the LED common.

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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