## PRELIMINARY DATA SHEET

# PHOTOCOUPLER PS9306L,PS9306L2

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

-NEPOC Series-

#### DESCRIPTION

NEC

The PS9306L and PS9306L2 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 PS9306L and PS9306L2 are in 6-pin plastic SDIP (Shrink Dual In-line Package). The PS9306L2 has 8 mm creepage distance. The mount area of 6-pin plastic SDIP is half size of 8-pin DIP.

The PS9306L and PS9306L2 are designed specifically for high common mode transient immunity (CMR) and high switching speed. It is suitable for driving IGBTs and MOS FETs.

The PS9306L is lead bending type (Gull-wing) for surface mounting.

The PS9306L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

#### FEATURES

- Long creepage distance (8 mm MIN. : PS9306L2)
- Half size of 8-pin DIP
- Peak output current (0.6 A MAX., 0.4 A MIN.)
- High speed switching (tPLH, tPHL = 0.3 µs MAX.)
- High common mode transient immunity (CMH, CML =  $\pm 25 \text{ kV}/\mu \text{s}$  MIN.)
- Pb-Free product



#### **APPLICATIONS**

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

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## PACKAGE DIMENSIONS (UNIT: mm)

## Lead Bending Type (Gull-wing) For Surface Mount



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



#### MARKING EXAMPLE



## PHOTOCOUPLER CONSTRUCTION

Parameter	PS9306L PS9300	
Air Distance (MIN.)	7 mm	8 mm
Outer Creepage Distance (MIN.)	7 mm	8 mm
Isolation Distance (MIN.)	0.4 mm	0.4 mm

## ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>
PS9306L	PS9306L-AX	Pb-Free	20 pcs (Tape 20 pcs cut)	Standard products	PS9306L
PS9306L-E3	PS9306L-E3-AX	(Ni/Pd/Au)	Embossed Tape 2 000 pcs/reel	(UL, CSA approved)	
PS9306L2	PS9306L2-AX		20 pcs (Tape 20 pcs cut)		PS9306L2
PS9306L2-E3	PS9306L2-E3-AX		Embossed Tape 2 000 pcs/reel		
PS9306L-V	PS9306L-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2	PS9306L
PS9306L-V-E3	PS9306L-V-E3-AX		Embossed Tape 2 000 pcs/reel	(VDE0884 Part2)	
PS9306L2-V	PS9306L2-V-AX		20 pcs (Tape 20 pcs cut)	Approved (Option)	PS9306L2
PS9306L2-V-E3	PS9306L2-V-E3-AX		Embossed Tape 2 000 pcs/reel		

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

## ABSOLUTE MAXIMUM RATINGS (TA = 25°C, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Forward Current	lf	25	mA
	Peak Transient Forward Current (Pulse Width < 1 $\mu$ s)	IF (TRAN)	1.0	A
	Reverse Voltage	Vr	5	V
	Power Dissipation *1	Po	45	mW
Detector	High Level Peak Output Current <sup>*2</sup>	Іон (реак)	0.6	A
	Low Level Peak Output Current <sup>*2</sup>	OL (PEAK)	0.6	A
	Supply Voltage	(Vcc - Vee)	0 to 35	V
	Output Voltage	Vo	0 to Vcc	V
	Power Dissipation *3	Pc	250	mW
Isolation	Voltage <sup>*4</sup>	BV	5 000	Vr.m.s.
Operating Frequency *5		f	50	kHz
Operating Ambient Temperature		TA	-40 to +110	°C
Storage Temperature		Tstg	-55 to +125	°C

\*1 Reduced to 1.6 mW/°C at  $T_A = 85^{\circ}C$  or more.

- \*2 Maximum pulse width = 10  $\mu$ s, Maximum duty cycle = 0.2%
- \*3 Reduced to 4.5 mW/°C at  $T_A = 65^{\circ}C$  or more.
- \*4 AC voltage for 1 minute at  $T_A = 25^{\circ}$ C, RH = 60% between input and output. Pins 1-3 shorted together, 4-6 shorted together.
- \*5 IOH (PEAK)  $\leq 0.4$  A ( $\leq 2.0$   $\mu$ s), IOL (PEAK)  $\leq 0.4$  A ( $\leq 2.0$   $\mu$ s)

### **RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	(Vcc - Vee)	10		30	V
Forward Current (ON)	IF (ON)	8		12	mA
Forward Voltage (OFF)	VF (OFF)	-2		0.8	V
Operating Ambient Temperature	TA	-40		110	°C

## ELECTRICAL CHARACTERISTICS (TA = -40 to +110°C, Vcc = 10 to 30 V, IF (ON) = 8 to 12 mA, VF (OFF) = -2 to 0.8 V, VEE = GND, unless otherwise specified)

	Parameter	Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	VF	I⊧ = 10 mA, T₄ = 25°C	1.2	1.56	1.8	V
	Reverse Current	Ir	Vr = 3 V, Ta = 25°C			10	μA
	Terminal Capacitance	Ct	V = 0 V, f = 1 MHz, T <sub>A</sub> = 25°C		30		pF
Detector	High Level Output Current	Іон	$V_0 = (V_{CC} - 4 V)^{*2}$	0.2			А
			$V_0 = (V_{CC} - 10 V)^{*3}$	0.4	0.5		
	Low Level Output Current	Iol	Vo = (VEE + 2.5 V) <sup>*2</sup>	0.2	0.4		А
			Vo = (Vee + 10 V) *3	0.4	0.5		
	High Level Output Voltage	Vон	$I_{0} = -100 \text{ mA}^{*4}$	Vcc-4.0	Vcc - 1.8		V
	Low Level Output Voltage	Vol	lo = 100 mA		0.4	1.0	V
	High Level Supply Current	Іссн	lo = 0 mA		0.7	3.0	mA
	Low Level Supply Current	lcc∟	lo = 0 mA		1.2	3.0	mA
Coupled	Threshold Input Current $(L \rightarrow H)$	IFLH	lo = 0 mA, Vo > 5 V			7.0	mA
	Threshold Input Voltage $(H \rightarrow L)$	VFHL	lo = 0 mA, Vo < 5 V	0.8			V
	Isolation Capacitance	CI-O	f = 1 MHz, VF = 0 V, TA = 25°C		0.7		pF

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

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

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

\*4 VOH is measured with the DC load current in this testing.

## SWITCHING CHARACTERISTICS (TA = -40 to +110°C, Vcc = 10 to 30 V, IF (ON) = 8 to 12 mA, VF (OFF) = -2 to 0.8 V, VEE = GND, unless otherwise specified)

Parameter	Symbol	Conditions	MIN.	TYP. <sup>*1</sup>	MAX.	Unit
Propagation Delay Time (L $\rightarrow$ H)	tрын	I⊧ = 10 mA, Vcc= 30 V,	0.05	0.18	0.3	μs
Propagation Delay Time (H $\rightarrow$ L)	tрн∟	$R_g$ = 47 Ω, $C_g$ = 3 nF, f = 10 kHz,	0.05	0.18	0.3	μs
Pulse Width Distortion (PWD)	tphl-tplh	Duty Cycle = 50% <sup>*2</sup>			0.15	μs
Propagation Delay Time (Difference Between Any Two Products)	tрн∟—tр∟н		-0.2		0.2	μS
Rise Time	tr			50		ns
Fall Time	tr			50		ns
Common Mode Transient Immunity at High Level Output <sup>*3</sup>	СМн	$T_{A} = 25^{\circ}C, I_{F} = 10 \text{ mA}, V_{CC} = 30 \text{ V},$ $V_{O (MIN.)} = 26 \text{ V}, V_{CM} = 1.5 \text{ kV}$	25			kV/ <i>µ</i> s
Common Mode Transient Immunity at Low Level Output <sup>*3</sup>	CM∟	$T_{A} = 25^{\circ}C, I_{F} = 0 \text{ mA}, V_{CC} = 30 \text{ V},$ Vo (max.) = 1 V, V_{CM} = 1.5 kV	25			kV/ <i>µ</i> s

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





- **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. Vo > 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. Vo < 1.0 V).
  - 3. Connect pin 2 to the LED common.





### **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  $\mu$ F is used between Vcc 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) Pin 2 (which is an NC\*<sup>1</sup> pin) can either be connected directly to the GND pin on the LED side or left open. Unconnected pins should not be used as a bypass for signals or for any other similar purpose because this may degrade the internal noise environment of the device.

\*1 NC : Non-Connection or No Connection

- 3. Make sure the rise/fall time of the forward current is 0.5  $\mu \rm s$  or less.
- 4. In order to avoid malfunctions, make sure the rise/fall slope of the supply voltage is 3 V/ $\mu$ s or less.
- 5. Avoid storage at a high temperature and high humidity.

#### 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.

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Caution GaAs Products	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.
	• 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> <li>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> </ol>
	<ol><li>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>
	• Do not burn, destroy, cut, crush, or chemically dissolve the product.
	• Do not lick the product or in any way allow it to enter the mouth.