# PS9305L

R08DS0013EJ0001
Rev.0.01
May 12, 2010

–NEPOC Series–

2.5 A OUTPUT CURRENT, HIGH CMR, IGBT GATE DRIVE, 8-PIN SDIP PHOTOCOUPLER

## DESCRIPTION

The PS9305L is an optically coupled isolator 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 PS9305L is designed specifically for high common mode transient immunity (CMR), high output current and high switching speed.

The PS9305L is suitable for driving IGBTs and MOS FETs.

## FEATURES

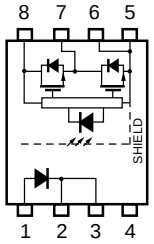
- Long creepage distance (8 mm MIN.)
- Large peak output current (2.5 A MAX., 2.0 A MIN.)
- High speed switching ($t_{PLH}$, $t_{PHL}$ = 0.25 $\mu$s MAX.)
- UVLO (Under Voltage Lock Out) protection with hysteresis
- High common mode transient immunity ($CM_H$, $CM_L$ = ±25 kV/$\mu$s MIN.)

## APPLICATIONS

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

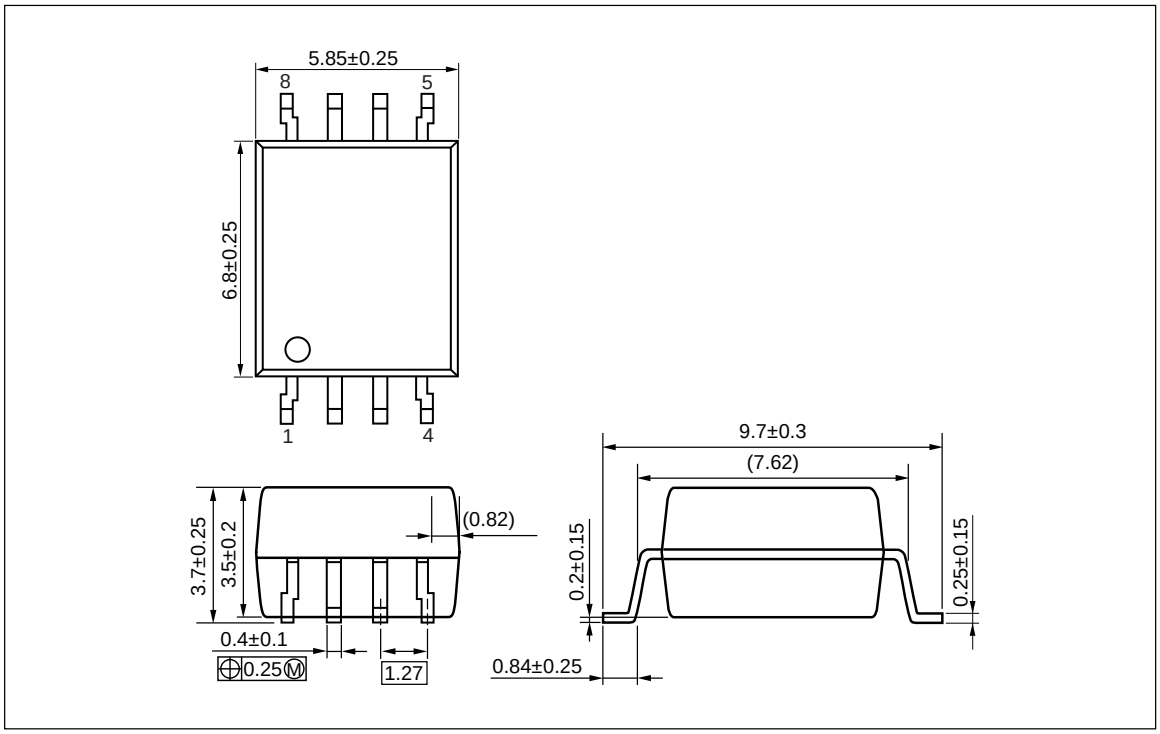
## PIN CONNECTION

(Top View)




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

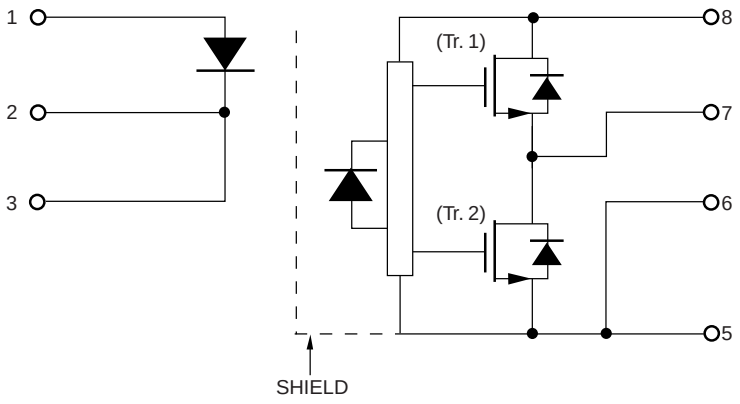
## PACKAGE DIMENSIONS (UNIT: mm)




## PHOTOCOUPLER CONSTRUCTION

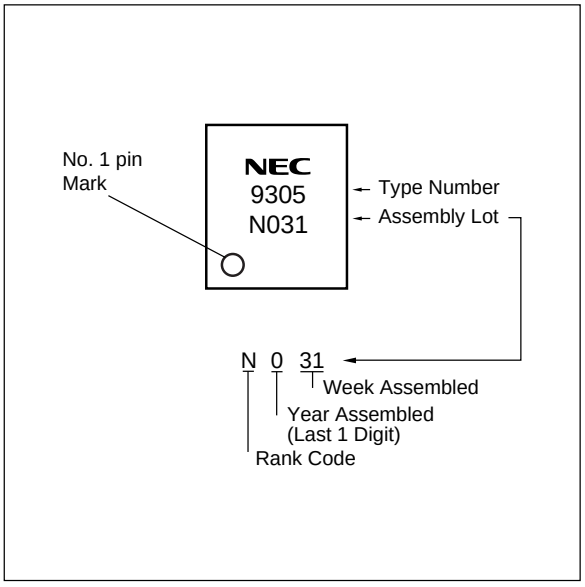
| Parameter | Unit (MIN.) |
|---|---|
| Air Distance | 7 mm |
| Outer Creepage Distance | 8 mm |
| Isolation Distance | 0.4 mm |

## FUNCTIONAL DIAGRAM




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

## MARKING EXAMPLE



## 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 | $I_{OH\ (PEAK)}$ | 2.5 | A |
| | Low Level Peak Output Current *2 | $I_{OL\ (PEAK)}$ | 2.5 | 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 | 50 | kHz |
| Operating Ambient Temperature | | $T_A$ | –40 to +110 | °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 4.5 mW/°C at $T_A$ = 80°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** $I_{OH\ (PEAK)} \leq$ 2.0 A (≤ 0.3 μs), $I_{OL\ (PEAK)} \leq$ 2.0 A (≤ 0.3 μs)

## RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Supply Voltage | $(V_{CC} - V_{EE})$ | 15 | | 30 | V |
| Forward Current (ON) | $I_{F\ (ON)}$ | 7 | 10 | 16 | mA |
| Forward Voltage (OFF) | $V_{F\ (OFF)}$ | –2 | | 0.8 | V |
| Operating Ambient Temperature | $T_A$ | –40 | | 110 | °C |

## ELECTRICAL CHARACTERISTICS ($T_A$ = –40 to +110°C, $V_{CC}$ = 15 to 30 V, $I_{F\ (ON)}$ = 7 to 16 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 | 1.8 | V |
| | Reverse Current | $I_R$ | $V_R$ = 3 V, $T_A$ = 25°C | | | 10 | μA |
| | Terminal Capacitance | $C_t$ | f = 1 MHz, $V_F$ = 0 V, $T_A$ = 25°C | | 30 | | pF |
| Detector | High Level Output Current | $I_{OH}$ | $V_O$ = ($V_{CC}$ – 4 V) *2 | 0.5 | 2.0 | | A |
| | | | $V_O$ = ($V_{CC}$ – 15 V) *3 | 2.0 | | | |
| | Low Level Output Current | $I_{OL}$ | $V_O$ = ($V_{EE}$ + 2.5 V) *2 | 0.5 | 2.0 | | A |
| | | | $V_O$ = ($V_{EE}$ + 15 V) *3 | 2.0 | | | |
| | High Level Output Voltage | $V_{OH}$ | $I_O$ = –100 mA *4 | $V_{CC}$ – 3.0 | $V_{CC}$ – 1.5 | | V |
| | Low Level Output Voltage | $V_{OL}$ | $I_O$ = 100 mA | | 0.1 | 0.5 | V |
| | High Level Supply Current | $I_{CCH}$ | $V_O$ = open, $I_F$ = 10 mA | | 2.0 | 3.0 | mA |
| | Low Level Supply Current | $I_{CCL}$ | $V_O$ = open, $V_F$ = 0 to +0.8 V | | 2.0 | 3.0 | mA |
| | UVLO Threshold | $V_{UVLO+}$ | $V_O$ > 5 V, $I_F$ = 10 mA | 10.8 | 12.3 | 13.4 | V |
| | | $V_{UVLO–}$ | | 9.5 | 11.0 | 12.5 | |
| | UVLO Hysteresis | $UVLO_{HYS}$ | $V_O$ > 5 V, $I_F$ = 10 mA | 0.4 | 1.3 | | V |
| Coupled | Threshold Input Current (L → H) | $I_{FLH}$ | $I_O$ = 0 mA, $V_O$ > 5 V | | 2.0 | 5.0 | mA |
| | Threshold Input Voltage (H → L) | $V_{FHL}$ | $I_O$ = 0 mA, $V_O$ < 5 V | 0.8 | | | V |

***1** Typical values at $T_A$ = 25°C.

***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 (Maximum pulse width = 2 ms, Maximum duty cycle = 20%).

## SWITCHING CHARACTERISTICS ($T_A$ = –40 to +110°C, $V_{CC}$ = 15 to 30 V, $I_{F\,(ON)}$ = 7 to 16 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) | $t_{PLH}$ | $R_g$ = 10 Ω, $C_g$ = 10 nF, f = 10 kHz, Duty Cycle = 50%*2, $I_F$ = 10 mA | | 0.18 | 0.25 | μs |
| Propagation Delay Time (H → L) | $t_{PHL}$ | | | 0.18 | 0.25 | μs |
| Pulse Width Distortion (PWD) | $\lvert t_{PHL}-t_{PLH}\rvert$ | | –0.1 | 0.02 | 0.1 | μs |
| Propagation Delay Time (Difference Between Any Two Products) | $t_{PHL}-t_{PLH}$ | | –0.1 | | 0.1 | μs |
| Rise Time | $t_r$ | | | 50 | | ns |
| Fall Time | $t_f$ | | | 50 | | ns |
| UVLO (Turn On Delay) | $t_{UVLO\,ON}$ | $V_O$ > 5 V, $I_F$ = 10 mA | | 0.8 | | μs |
| UVLO (Turn Off Delay) | $t_{UVLO\,OFF}$ | $V_O$ < 5 V, $I_F$ = 10 mA | | 0.6 | | μs |
| Common Mode Transient Immunity at High Level Output*3 | $\lvert CM_H\rvert$ | $T_A$ = 25°C, $I_F$ = 10 mA, $V_{CC}$ = 30 V, $V_{O\,(MIN.)}$ = 26 V, $V_{CM}$ = 1.5 kV | 25 | | | kV/μs |
| Common Mode Transient Immunity at Low Level Output*3 | $\lvert CM_L\rvert$ | $T_A$ = 25°C, $I_F$ = 0 mA, $V_{CC}$ = 30 V, $V_{O\,(MAX.)}$ = 1 V, $V_{CM}$ = 1.5 kV | 25 | | | kV/μs |

***1** Typical values at $T_A$ = 25°C.

***2** This load condition is equivalent to the IGBT load at 1 200 V/75 A.

***3** Connect pin 4 to the LED common.

| | |
|---|---|
| **Caution** GaAs Products | This product uses gallium arsenide (GaAs).<br>GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.<br>• 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.<br>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.<br>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.<br>• Do not burn, destroy, cut, crush, or chemically dissolve the product.<br>• Do not lick the product or in any way allow it to enter the mouth. |

| Revision History | PS9305L Preliminary Data Sheet |
|---|---|

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 0.01 | May 12, 2010 | – | First Edition issued |
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