



# PHOTOCOUPLER PS9401-2

## 0.6 A OUTPUT CURRENT, HIGH CMR, 16-PIN SSOP (SO-16) 2 CHANNEL IGBT GATE DRIVE PHOTOCOUPLER

-NEPOC Series-

### DESCRIPTION

The PS9401-2 is optical coupled isolators containing a GaAlAs LED on the input side and a photo diode and a photo diode, a signal processing circuit and a power output transistor on the output side on one chip.

The PS9401-2 is designed specifically for high common mode transient immunity (CMR) and high switching speed. It is suitable for driving IGBTs and MOS FETs.

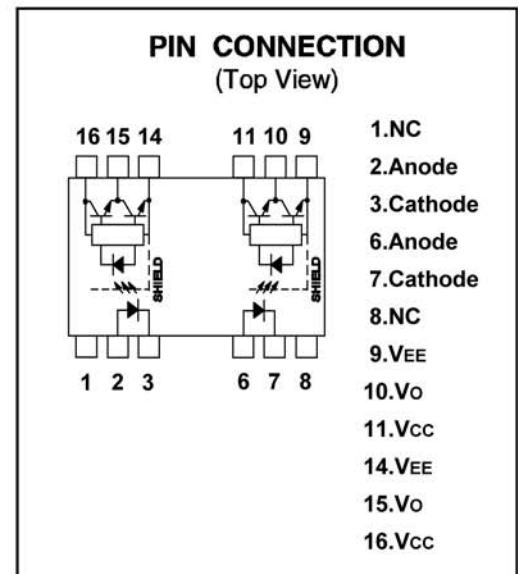
The PS9401-2 integrated dual channel into a 16-pin plastic SSOP (Shrink Small Outline Package). And the PS9401-2 is suitable for high density applications.

### FEATURES

- Integrated dual channel into a 16-pin SSOP
- Peak output current (0.6 A MAX., 0.4 A MIN.)
- High speed switching ( $t_{PLH}/t_{PHL} = 0.7 \mu\text{s}$  MAX.)
- High common mode transient immunity ( $CM_H, CM_L = \pm 15 \text{ kV}/\mu\text{s}$  MIN.)
- Pb-Free product

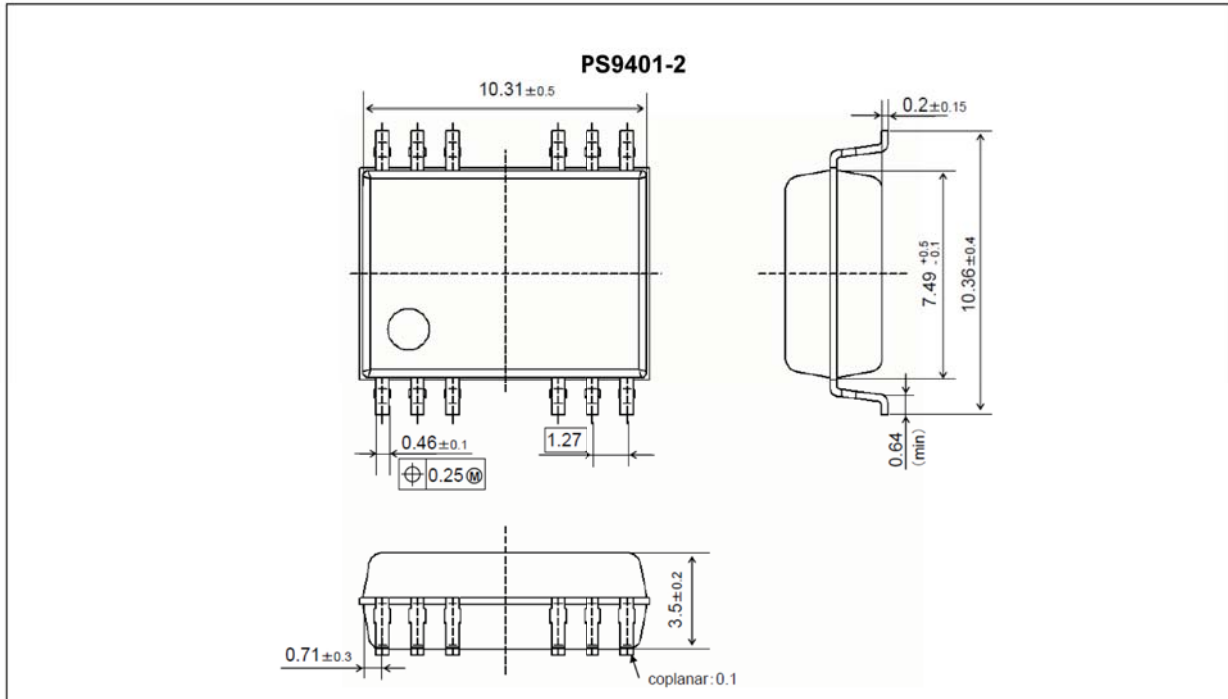
### APPLICATIONS

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

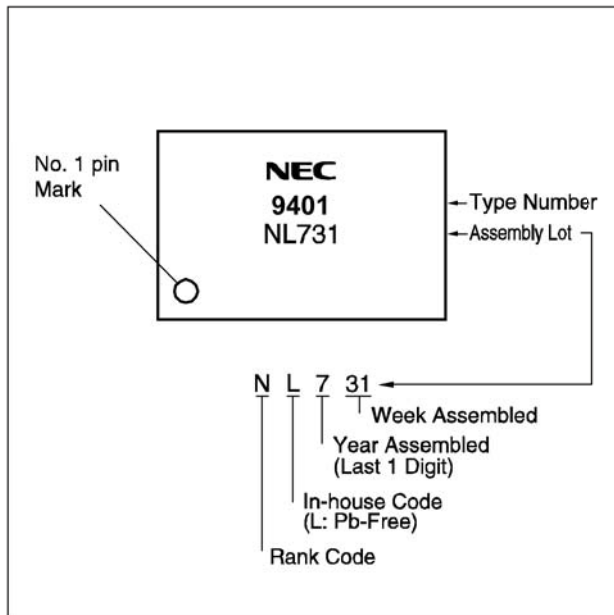


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PACKAGE DIMENSIONS (UNIT: mm)



MARKING EXAMPLE



PHOTOCOUPLER CONSTRUCTION

Parameter	PS9401-2
Air Distance (MIN.)	8 mm
Outer Creepage Distance (MIN.)	8 mm
Isolation Distance (MIN.)	0.4 mm

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

Parameter		Symbol	Ratings	Unit
Diode	Forward Current *1	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
Detector	High Level Peak Output Current *1	I <sub>OH (PEAK)</sub>	0.6	A
	Low Level Peak Output Current *1	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	P <sub>C</sub>	250	mW
Isolation Voltage *2		BV	5 000	Vr.m.s.
Insulation Viltage (Output - Output) *3		V <sub>O-O</sub>	1 500	Vr.m.s.
Total Power Dissipation		P <sub>T</sub>	360	mW
Operating Frequency *4		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 Maximum pulse width = 10 μs, Maximum duty cycle = 0.2%

\*2 AC voltage for 1 minute at T<sub>A</sub> = 25°C, RH = 60% between input and output.

Pins 1-8 shorted together, 9-16 shorted together.

\*3 V<sub>O-O</sub> is measured with Pins 9-11 shorted together, 14-16 shorted together.

\*4 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  $30\text{ V}$ ,  $V_{EE} = \text{GND}$ ,  
 $I_F(\text{ON}) = 8$  to  $12\text{ mA}$ ,  $V_F(\text{OFF}) = -2$  to  $0.8\text{ V}$ , unless otherwise specified)**

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

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

\*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.

\*5 The  $I_{CCH}$  and  $I_{CCL}$  increases when operating frequency and  $Q_B$  of the driven IGBT increases.

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

Parameter	Symbol	Conditions	MIN.	TYP.**1	MAX.	Unit
Propagation Delay Time (L → H)	$t_{PLH}$	$I_F = 10$ mA, $V_{CC} = 30$ V	0.1	0.2	0.7	$\mu\text{s}$
Propagation Delay Time (H → L)	$t_{PHL}$	$R_G = 47 \Omega$ , $C_G = 3$ nF, $f = 10$ kHz,	0.1	0.2	0.7	$\mu\text{s}$
Pulse Width Distortion (PWD)	$ t_{PHL} - t_{PLH} $	Duty Cycle = 50%**2			0.5	$\mu\text{s}$
Propagation Delay Time (Difference Between Any Two Products)	$t_{PHL} - t_{PLH}$		-0.5		0.5	$\mu\text{s}$
Rise Time	$t_r$			50		ns
Fall Time	$t_f$			50		ns
Common Mode Transient Immunity at High Level Output*3	$CM_H$	$T_A = 25^\circ\text{C}$ , $I_F = 10$ mA, $V_{CC} = 30$ V, $V_{O(\text{MIN})} = 26$ V, $V_{CM} = 1.5$ k V	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, $V_{CM} = 1.5$ k V	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 8 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  $\mu\text{F}$  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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This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

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		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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