CEL

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.

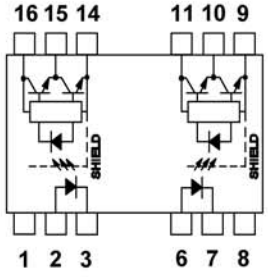
FEATURES

- 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 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)
- PDP

PIN CONNECTION
(Top View)



1.NC
2.Anode
3.Cathode
6.Anode
7.Cathode
8.NC
9.V_{EE}
10.V_O
11.V_{CC}
14.V_{EE}
15.V_O
16.V_{CC}

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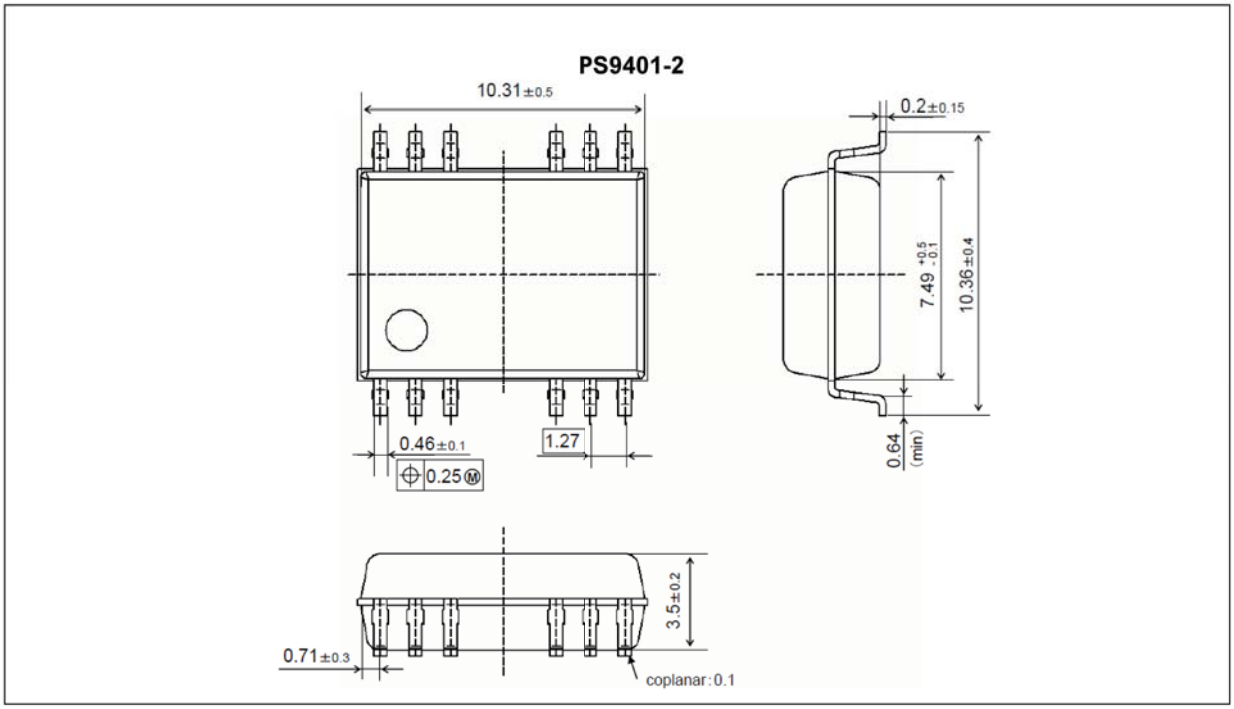
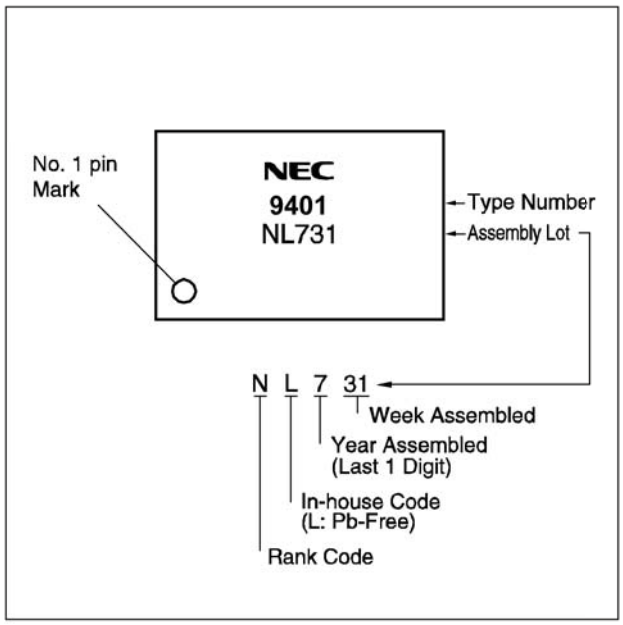
PACKAGE DIMENSIONS (UNIT: mm)



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_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	250	mW
Isolation Voltage*2		BV	5 000	Vr.m.s.
Insulation Viltage (Output - Output)*3		V_{O-O}	1 500	Vr.m.s.
Total Power Dissipation		P_T	360	mW
Operating Frequency*4		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 1-8 shorted together, 9-16 shorted together.

***3** V_{O-O} is measured with Pins 9-11 shorted together, 14-16 shorted together.

***4** $I_{OH\ (PEAK)} \leq 0.4$ 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, V_{EE} = GND, $I_{F(ON)}$ = 8 to 12 mA, $V_{F(OFF)}$ = –2 to 0.8 V, 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 Capaitance	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} = 30V.

***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} increases 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, V_{EE} = GND, $I_{F(ON)}$ = 8 to 12 mA, $V_{F(OFF)}$ = –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	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} = 1.5k V	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} = 1.5k V	15			kV/μs

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

***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 μF 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. 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

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. 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. 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. • Do not burn, destroy, cut, crush, or chemically dissolve the product. • Do not lick the product or i any way allow it to enter the mouth.

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Subject: Compliance with EU Directives

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CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

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.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
Lead (Pb)	< 1000 PPM	-A	-AZ
		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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