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PHOTOCOUPLER PS9213

1 Mbps, OPEN COLLECTOR OUTPUT HIGH CMR, INTELLIGENT POWER MODULE 5-PIN SOP PHOTOCOUPLER FOR CREEPAGE DISTANCE OF 5.5 mm

-NEPOC Series-

DESCRIPTION

The PS9213 is an optically coupled isolator containing a GaAlAs LED on the input side and a photo diode and a signal processing circuit on the output side on one chip.

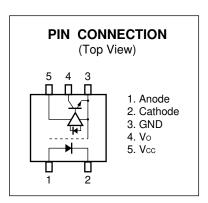
The PS9213 is designed specifically for high common mode transient immunity (CMR) and low pulse width distortion with operating temperature. It is suitable for IPM drive.

FEATURES

- Long creepage distance (5.5 mm MIN.)
- High common mode transient immunity (CMH, CML = $\pm 15 \text{ kV}/\mu \text{s MIN.}$)
- High-speed response (tphl = 500 ns MAX., tplh = 750 ns MAX.)
- Maximum propagation delays (tplh tphl = 270 ns TYP.)
- Pulse width distortion (|tphl tplh | = 270 ns TYP.)
- Ordering number of taping product: PS9213-F3, F4: 2 500 pcs/reel
- Pb-Free product
- Safety standards
 - UL approved: File No. E72422
 - DIN EN60747-5-2 (VDE0884 Part2) approved No.40008347 (Option)

APPLICATIONS

- IPM Driver
- · General purpose inverter

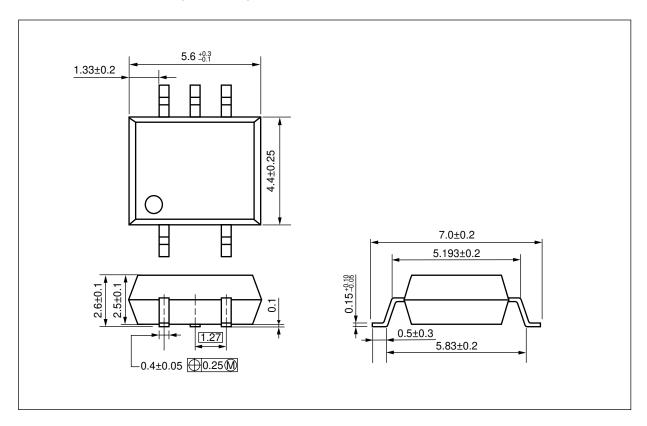


TRUTH TABLE

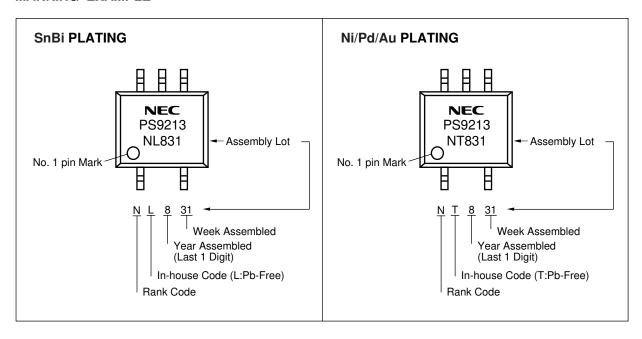
LED	Output
ON	L
OFF	Н

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PACKAGE DIMENSIONS (UNIT: mm)



<R> MARKING EXAMPLE



<R> ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9213	PS9213-A	Pb-Free	20 pcs (Tape 20 pcs cut)	Standard products	PS9213
PS9213-F3	PS9213-F3-A	(SnBi)	Embossed Tape 2 500 pcs/reel	(UL approved)	
PS9213-F4	PS9213-F4-A				
PS9213-V	PS9213-V-A		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2	
PS9213-V-F3	PS9213-V-F3-A		Embossed Tape 2 500 pcs/reel	(VDE0884 Part2)	
PS9213-V-F4	PS9213-V-F4-A			approved (Option)	
PS9213	PS9213-AX	Pb-Free	20 pcs (Tape 20 pcs cut)	Standard products	
PS9213-F3	PS9213-F3-AX	(Ni/Pd/Au)	Embossed Tape 2 500 pcs/reel	(UL approved)	
PS9213-F4	PS9213-F4-AX				
PS9213-V	PS9213-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2	
PS9213-V-F3	PS9213-V-F3-AX		Embossed Tape 2 500 pcs/reel	(VDE0884 Part2)	
PS9213-V-F4	PS9213-V-F4-AX			approved (Option)	

^{*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*1	lF	25	mA
	Reverse Voltage	VR	5	٧
Detector	tor Supply Voltage Vcc		−0.5 to +35	٧
	Output Voltage	Vo	−0.5 to +35	٧
	Output Current	lo	15	mA
	Power Dissipation*2	Pc	100	mW
Isolation Voltage*3		BV	2 500	Vr.m.s.
Operating Ambient Temperature		TA	-40 to +100	°C
Storage Temperature		T _{stg}	-55 to +125	°C

- *1 Reduced to 0.33 mA/ $^{\circ}$ C at T_A = 70 $^{\circ}$ C or more.
- *2 Reduced to 1.9 mW/ $^{\circ}$ C at T_A = 70 $^{\circ}$ C or more.
- *3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output. Pins 1-2 shorted together, 3-5 shorted together.

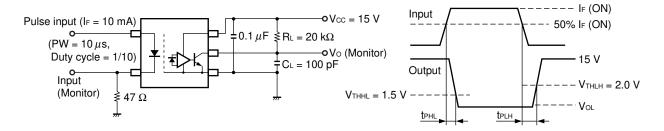
RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
High Level Input Current	lғн	10		20	mA
Output Voltage	Vo	0		30	V
Supply Voltage	Vcc	4.5	15	30	٧
LED Off Voltage	VF	0		0.8	V

ELECTRICAL CHARACTERISTICS (TA = -40 to +100°C, Vcc = 15 V, unless otherwise specified)

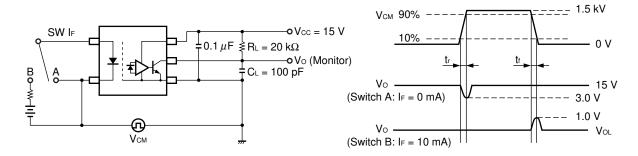
	Parameter	Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	VF	I _F = 10 mA	1.3	1.65	2.1	V
	Reverse Current	lR	V _R = 3 V			200	μА
	Terminal Capacitance	Ct	V = 0 V, f = 1 MHz, T _A = 25°C		30		pF
Detector	Low Level Output Voltage	Vol	IF = 10 mA, IoL = 2.4 mA		0.13	0.6	V
	High Level Output Current	Іон	Vcc = Vo = 30 V, VF = 0.8 V		0.01	50	μА
	High Level Supply Current	Іссн	Vcc = 30 V, V _F = 0.8 V, V _O = open		0.6	1.3	mA
	Low Level Supply Current	Iccl	Vcc = 30 V, IF = 10 mA, Vo = open		0.6	1.3	mA
Coupled	Threshold Input Current $(H \rightarrow L)$	IFHL	Vo = 0.8 V, Io = 0.75 mA		1.5	5.0	mA
	Current Transfer Ratio (Ic/IF)	CTR	IF = 10 mA, Vo = 0.6 V	44	110		%
	Isolation Resistance	R⊦o	V _{I-O} = 1 kV _{DC} , RH = 40 to 60%, T _A = 25°C	10 ¹¹			Ω
	Isolation Capacitance	C _{I-O}	Vi-o = 0 V, f = 1 MHz, Ta = 25°C		0.6		pF
	Propagation Delay Time $(H \rightarrow L)^{*2}$	tрнL	$I_F=10mA,~R_L=20~k\Omega,~C_L=100~pF,$ $V_{THHL}=1.5~V,~V_{THLH}=2.0~V$		250	500	ns
	Propagation Delay Time $(L \rightarrow H)^{*2}$	tрLН			520	750	
	Maximum Propagation Delays	tрін—tрні		-200	270	650	
	Pulse Width Distortion (PWD)*2	трнс-трсн			270	650	
	Common Mode Transient Immunity at High Level Output ^{*3}	СМн	$T_{\text{A}} = 25^{\circ}\text{C}, \text{ If } = 0 \text{ mA, Vo} > 3.0 \text{ V},$ $V_{\text{CM}} = 1.5 \text{ kV}, \text{ RL} = 20 \text{ k}\Omega,$ $C_{\text{L}} = 100 \text{ pF}$	15			kV/μs
	Common Mode Transient Immunity at Low Level Output ^{*3}	CM∟	$T_{A} = 25^{\circ}C, \ \text{IF} = 10 \ \text{mA}, \ \text{Vo} < 1.0 \ \text{V},$ $V_{CM} = 1.5 \ \text{kV}, \ R_{L} = 20 \ \text{k}\Omega,$ $C_{L} = 100 \ \text{pF}$	15			kV/μs

- *1 Typical values at $T_A = 25^{\circ}C$.
- *2 Test circuit for propagation delay time



Remark CL includes probe and stray wiring capacitance.

*3 Test circuit for common mode transient immunity

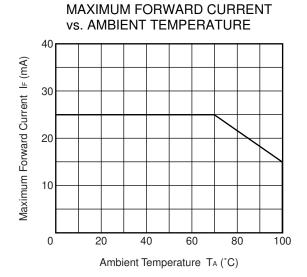


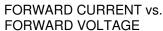
Remark C_L includes probe and stray wiring capacitance.

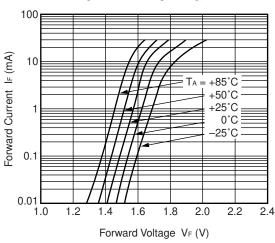
USAGE CAUTIONS

- 1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
- 2. By-pass capacitor of 0.1 μ 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.
- 3. Avoid storage at a high temperature and high humidity.

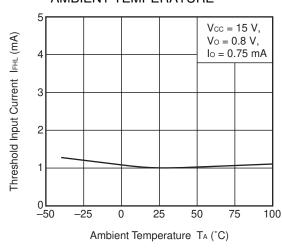
TYPICAL CHARACTERISTICS (TA = 25°C unless otherwise specified)



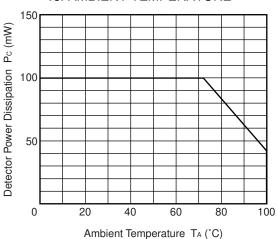




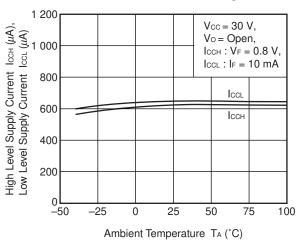
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



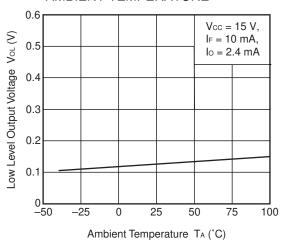
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



SUPPLY CURRENT vs. AMBIENT TEMPERATURE

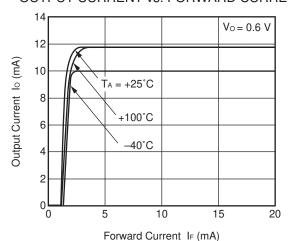


LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

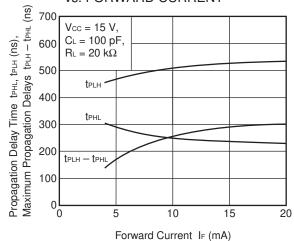


Remark The graphs indicate nominal characteristics.

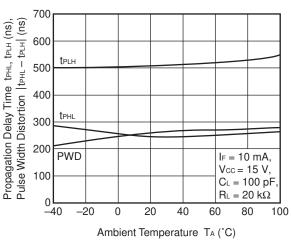
OUTPUT CURRENT vs. FORWARD CURRENT



PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. FORWARD CURRENT

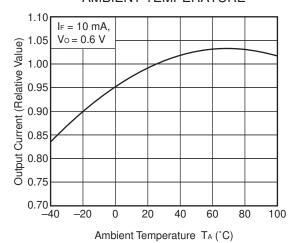


PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE

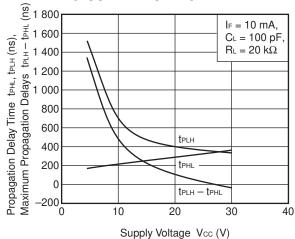


Remark The graphs indicate nominal characteristics.

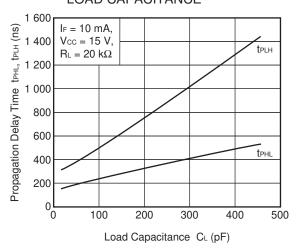
OUTPUT CURRENT vs. AMBIENT TEMPERATURE



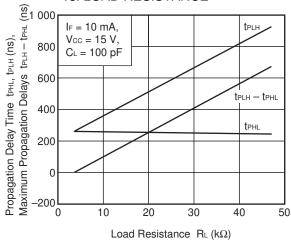
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE



PROPAGATION DELAY TIME vs. LOAD CAPACITANCE

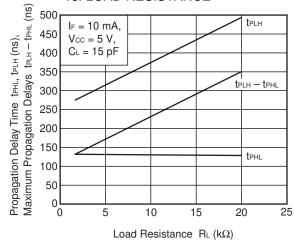


PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. LOAD RESISTANCE

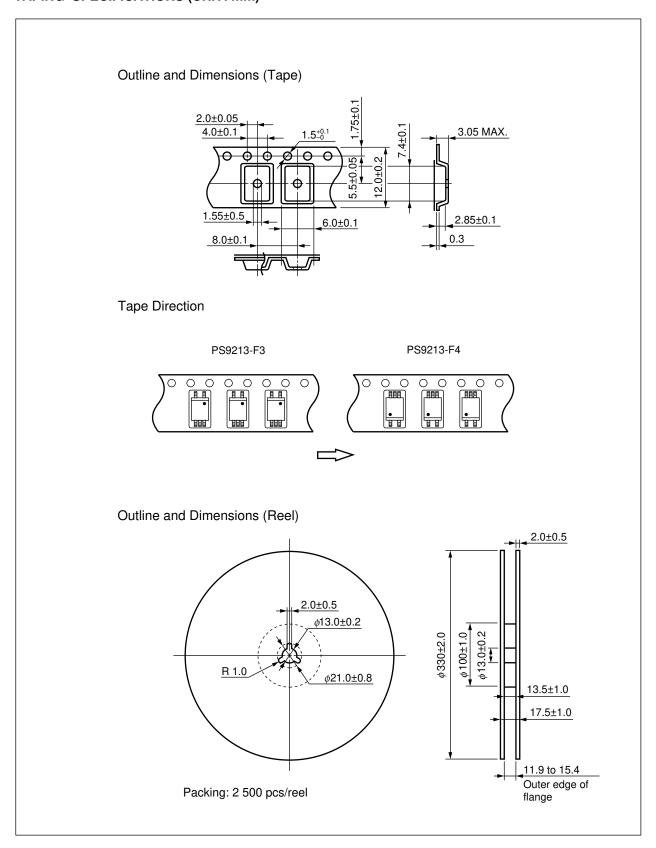


Remark The graphs indicate nominal characteristics.

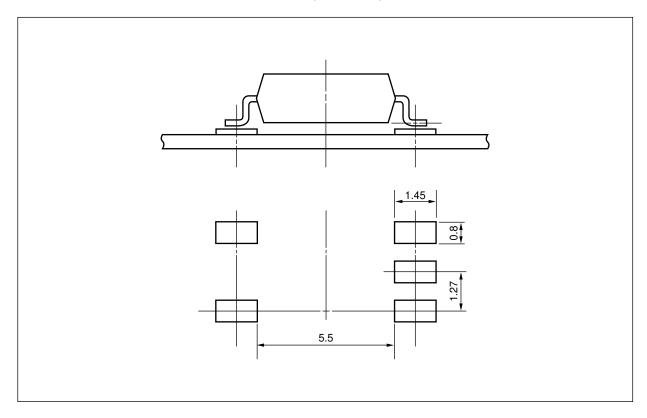
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. LOAD RESISTANCE



TAPING SPECIFICATIONS (UNIT: mm)



RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



NOTES ON HANDLING

1. Recommended soldering conditions

(1) Infrared reflow soldering

· Peak reflow temperature 260°C or below (package surface temperature)

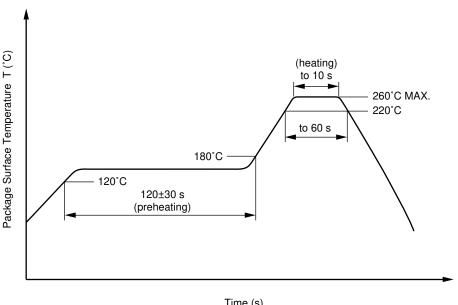
• Time of peak reflow temperature 10 seconds or less • Time of temperature higher than 220°C 60 seconds or less

• Time to preheat temperature from 120 to 180°C 120±30 s · Number of reflows Three

• Flux Rosin flux containing small amount of chlorine (The flux with a

maximum chlorine content of 0.2 Wt% is recommended.)

Recommended Temperature Profile of Infrared Reflow



Time (s)

(2) Wave soldering

 Temperature 260°C or below (molten solder temperature)

• Time 10 seconds or less

· Preheating conditions 120°C or below (package surface temperature)

· Number of times One (Allowed to be dipped in solder including plastic mold portion.)

• Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine

content of 0.2 Wt% is recommended.)

(3) Soldering by Soldering Iron

• Peak Temperature (lead part temperature) 350°C or below • Time (each pins) 3 seconds or less

• Flux Rosin flux containing small amount of chlorine (The flux with a

maximum chlorine content of 0.2 Wt% is recommended.)

(a) Soldering of leads should be made at the point 1.5 to 2.0 mm from the root of the lead

(b) Please be sure that the temperature of the package would not be heated over 100°C

(4) Cautions

Fluxes

Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.

2. Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output or between collector-emitters at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

USAGE CAUTIONS

- 1. Protect against static electricity when handling.
- 2. Avoid storage at a high temperature and high humidity.

<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Speck	Unit
Application classification (DIN EN 60664-1 VDE0110 Part 1) for rated line voltages \leq 300 Vr.m.s. for rated line voltages \leq 600 Vr.m.s.		IV III	
Climatic test class (DIN EN 60664-1 VDE0110)		40/100/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.5 \times U_{\text{IORM}}, P_{\text{d}} < 5 \text{pC}$	UIORM Upr	707 1 061	V _{peak} V _{peak}
Test voltage (partial discharge test, procedure b for all devices) $U_{pr}=1.875\times U_{\text{IORM}},P_{\text{d}}<5\;\text{pC}$	U _{pr}	1 326	V_{peak}
Highest permissible overvoltage	Utr	6 000	V _{peak}
Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)		2	
Clearance distance		>4.0	mm
Creepage distance		>4.0	mm
Comparative tracking index (DIN IEC 112/VDE 0303 Part 1)	СТІ	175	
Material group (DIN EN 60664-1 VDE0110 Part 1)		III a	
Storage temperature range	Tstg	-55 to +125	°C
Operating temperature range	TA	-40 to +100	°C
Isolation resistance, minimum value VIO = 500 V dc at TA = 25°C VIO = 500 V dc at TA MAX. at least 100°C	Ris MIN. Ris MIN.	10 ¹² 10 ¹¹	Ω Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) Package temperature Current (input current IF, Psi = 0) Power (output or total power dissipation) Isolation resistance	Tsi Isi Psi	150 150 600	°C mA mW
Vio = 500 V dc at TA = Tsi	Ris MIN.	10 ⁹	Ω

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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.
 - 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 in any way allow it to enter the mouth.