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April 1st, 2010 Renesas Electronics Corporation

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RENESAS

PHOTOCOUPLER

PS9587, PS9587L1, PS9587L2, PS9587L3

HIGH CMR, 10 Mbps OPEN COLLECTOR OUTPUT TYPE 8-PIN DIP HIGH-SPEED PHOTOCOUPLER FOR CREEPAGE DISTANCE OF 8 mm -NEPOC Series-

DESCRIPTION

The PS9587, PS9587L1, PS9587L2 and PS9587L3 are optically coupled isolators 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 PS9587L1 and PS9587L2 are designed specifically for long creepage-distance as well as high common mode transient immunity (CMR) and high speed digital output type. Consequently, they are suitable for high speed logic interface that needs long creepage-distance (8 mm) on mounting.

The PS9587L1 is lead bending type for long creepage distance.

The PS9587L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

The PS9587L3 is lead bending type (Gull-wing) for surface mounting.

FEATURES

- Long creepage distance (8 mm MIN.: PS9587L1, PS9587L2)
- High common mode transient immunity (CM_H, CM_L = $\pm 15 \text{ kV}/\mu \text{s MIN.}$)
- High isolation voltage (BV = 5 000 Vr.m.s.)
- High-speed response (10 Mbps)
- Pulse width distortion ($|t_{PHL} t_{PLH}| = 10 \text{ ns TYP.}$)
- Open collector output
- Ordering number of tape product: PS9587L2-E3: 1 000 pcs/reel

: PS9587L3-E3: 1 000 pcs/reel

- Pb-Free product
- Safety standards

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- UL approved: No. E72422
- CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
- BSI approved: No. 8937, 8938
- SEMKO approved: No. 615433
- NEMKO approved: No. P06207243
- DEMKO approved: No. 314091
- FIMKO approved: No. FI 22827

DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40019182 (Option)

APPLICATIONS

- FA Network
- Measurement equipment
- PDP

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The mark <R> shows major revised points.

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The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.



<R> PACKAGE DIMENSIONS (UNIT: mm)

DIP Type



Lead Bending Type (Gull-wing) For Surface Mount





Lead Bending Type For Long Creepage Distance

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



PHOTOCOUPLER CONSTRUCTION

Parameter	PS9587, PS9587L3	PS9587L1, PS9587L2	
Air Distance (MIN.)	7 mm	8 mm	
Outer Creepage Distance (MIN.)	7 mm	8 mm	
Isolation Distance (MIN.)	0.4 mm	0.4 mm	

FUNCTIONAL DIAGRAM



<R> MARKING EXAMPLE



Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number* ¹
PS9587	PS9587-AX	Pb-Free	Magazine case 50 pcs	Standard products	PS9587
PS9587L1	PS9587L1-AX	(Ni/Pd/Au)		(UL, CSA, BSI,	PS9587L1
PS9587L2	PS9587L2-AX			SEMKO, NEMKO,	PS9587L2
PS9587L3	PS9587L3-AX			DEMKO, FIMKO	PS9587L3
PS9587L2-E3	PS9587L2-E3-AX		Embossed Tape 1 000 pcs/reel	approved)	PS9587L2
PS9587L3-E3	PS9587L3-E3-AX				PS9587L3
PS9587-V	PS9587-V-AX		Magazine case 50 pcs	DIN EN60747-5-2	PS9587
PS9587L1-V	PS9587L1-V-AX			(VDE0884 Part2)	PS9587L1
PS9587L2-V	PS9587L2-V-AX			Approved (Option)	PS9587L2
PS9587L3-V	PS9587L3-V-AX				PS9587L3
PS9587L2-V-E3	PS9587L2-V-E3-AX		Embossed Tape 1 000 pcs/reel		PS9587L2
PS9587L3-V-E3	PS9587L3-V-E3-AX				PS9587L3

ORDERING INFORMATION

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

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

	Parameter	Symbol	Ratings	Unit
Diode	Forward Current ¹¹	lf	30	mA
	Reverse Voltage	VR	5	V
Detector	Supply Voltage	Vcc	7	V
	Output Voltage	Vo	7	V
	Output Current	lo	25	mA
	Power Dissipation ²	Pc	40	mW
Isolation	Voltage ^{*3}	BV	5 000	Vr.m.s.
Operating	g Ambient Temperature	TA	-40 to +85	°C
Storage -	Temperature	Tstg	-55 to +125	°C

*1 Reduced to 0.3 mA/°C at $T_A = 25^{\circ}C$ or more.

- *2 Applies to output pin Vo (Collector pin). Reduced to 1.5 mW/°C at $T_A = 65^{\circ}C$ or more.
- *3 AC voltage for 1 minute at $T_A = 25^{\circ}C$, RH = 60% between input and output. Pins 1-4 shorted together, 5-8 shorted together.

RECOMMENDED OPERATING CONDITIONS (TA = 25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
High Level Input Current	IFH	6.3	10	12.0	mA
Low Level Input Voltage	VFL	0		0.8	V
Supply Voltage	Vcc	4.5	5.0	5.5	V
TTL (R∟ = 1 kΩ, loads)	N			5	
Pull-up Resistance	R∟	330		4 k	Ω

ELECTRICAL CHARACTERISTICS (TA = -40 to +85°C, unless otherwise specified)

	Parameter	Symbol		Conditions	MIN.	TYP. ^{*1}	MAX.	Unit
Diode	Forward Voltage	VF	I⊧ = 10 mA, T₄ = 25°C		1.4	1.65	1.8	V
	Reverse Current	IR	$V_R = 3 V, T_A =$	Vr = 3 V, T _A = 25°C			10	μA
	Terminal Capacitance	Ct	$V_F = 0 V, f = 1$	MHz, T _A = 25°C		30	150	pF
Detector	High Level Output Current	Іон	Vcc = Vo = 5.5	V, V _F = 0.8 V		1	100	μA
	Low Level Output Voltage ²	Vol	Vcc = 5.5 V, IF	= 5 mA, lo∟ = 13 mA		0.2	0.6	V
	High Level Supply Current	Іссн	Vcc = 5.5 V, IF	= 0 mA, Vo = Open		5	8	mA
	Low Level Supply Current	lcc∟	Vcc = 5.5 V, IF	= 10 mA, Vo = Open		9	11	mA
Coupled	Threshold Input Current (H \rightarrow L)	IFHL		T _A = 25°C			3.3	mA
			Vcc = 5 V, Vo =	= 0.8 V, RL = 350 Ω		1.5	5	
	Isolation Resistance	R I-0	VI-0 = 1 kVDC, F	RH = 40 to 60%, T _A = 25°C	10 ¹¹			Ω
	Isolation Capacitance	CI-O	V = 0 V, f = 1 N	MHz, TA = 25°C		0.9	5	pF
	Propagation Delay Time	tрнL	Vcc = 5 V,	T _A = 25°C		35	75	ns
	$(H \rightarrow L)^{^{*3}}$		VTHHL = VTHLH =	1.5 V,			100	
	Propagation Delay Time	tрін	R∟ = 350 Ω,	T₄ = 25°C		45	75	ns
	$(L \rightarrow H)^{^{*3}}$		l⊧ = 7.5 mA, C∟	_ = 15 pF			100	
	Rise Time	tr				20		ns
	Fall Time	tr				10		ns
	Pulse Width Distortion (PWD) ^{*3}	tрнг-tргн				10	50	ns
	Propagation Delay Skew	tрsк					60	ns
	Common Mode Transient Immunity at High Level Output ^{*4}	СМн	Vcc = 5 V, TA = Vo (min.) = 2 V, V	= 25°C, I⊧ = 0 mA, Vcм = 1.5 kV, R∟ = 350 Ω	15			kV/µs
	Common Mode Transient Immunity at Low Level Output ^{:4}	CM∟	Vcc = 5 V, Ta = Vo (max.) = 0.8 V	25°C, I⊧ = 7.5 mA, , Vcм = 1.5 kV, R∟ = 350 Ω	15			kV/µs

*1 Typical values at $T_A = 25^{\circ}C$

NEC

- *2 Because VoL of 2 V or more may be output when LED current is input and when output power supply is on and off, confirm the characteristics (operation with the power supply on and off) during design, before using this device.
- *3 Test circuit for propagation delay time





*4 Test circuit for common mode transient immunity



Remark CL 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 more than 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.
- Pins 1, 4 (which is an NC¹ pin) can either be connected directly to the GND pin on the LED side or left open.
 Also, Pin 7 (which is an NC¹ pin) can either be connected directly to the GND pin on the detector 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 (No Connection)
- 4. Avoid storage at a high temperature and high humidity.

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



Remark The graphs indicate nominal characteristics.



Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)





RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



NOTES ON HANDLING

1. Recommended soldering conditions

(1) Infrared reflow soldering

- Peak reflow temperature
- Time of peak reflow temperature
- Time of temperature higher than 220°C
- Time to preheat temperature from 120 to 180°C
- Number of reflows
- Flux

260°C or below (package surface temperature) 10 seconds or less 60 seconds or less 120±30 s Three 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 $100^{\circ}C$

(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 Vcc-GND at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Speck	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/85/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.5 \times U_{IORM}, P_d < 5 \text{ pC}$	Uiorm Upr	1 130 1 695	V _{peak} V _{peak}
Test voltage (partial discharge test, procedure b for all devices) U_{pr} = 1.875 \times U_{IORM}, P_{d} < 5 pC	Upr	2 119	V _{peak}
Highest permissible overvoltage	Utr	8 000	Vpeak
Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))	CTI	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 +85	°C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25^{\circ}\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^{\circ}\text{C}$	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 (autout or total power dissipation)	Tsi Isi Psi	175 400 700	°C mA
Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = Tsi$	Ris MIN.	10°	Ω

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	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.

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.З, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж: moschip.ru moschip.ru_4

moschip.ru_6 moschip.ru_9