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PS9124

Data Sheet
R08DS0049EJ0100
Rev.1.00
Aug 30, 2013

HIGH CMR, 10 Mbps OPEN COLLECTOR OUTPUT TYPE, 5-PIN SOP (SO-5) PHOTOCOUPLER

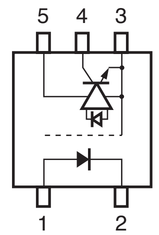
DESCRIPTION

The PS9124 is an optically coupled high-speed, active low type isolator containing a GaAlAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

FEATURES

- Low power consumption (V_{CC} = 3.3/5 V)
- Small package (SO-5)
- <R> High-speed response (t_{PHL} = 100 ns MAX., t_{PLH} = 100 ns MAX.)
- High-speed (10 Mbps)
- High isolation voltage (BV = 3 750 Vr.m.s.)
- Open collector output
- Embossed tape product : PS9124-F3 : 2 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: No. E72422
  - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
  - DIN EN 60747-5-5 (VDE 0884-5) approved (Option)

PIN CONNECTION
(Top View)



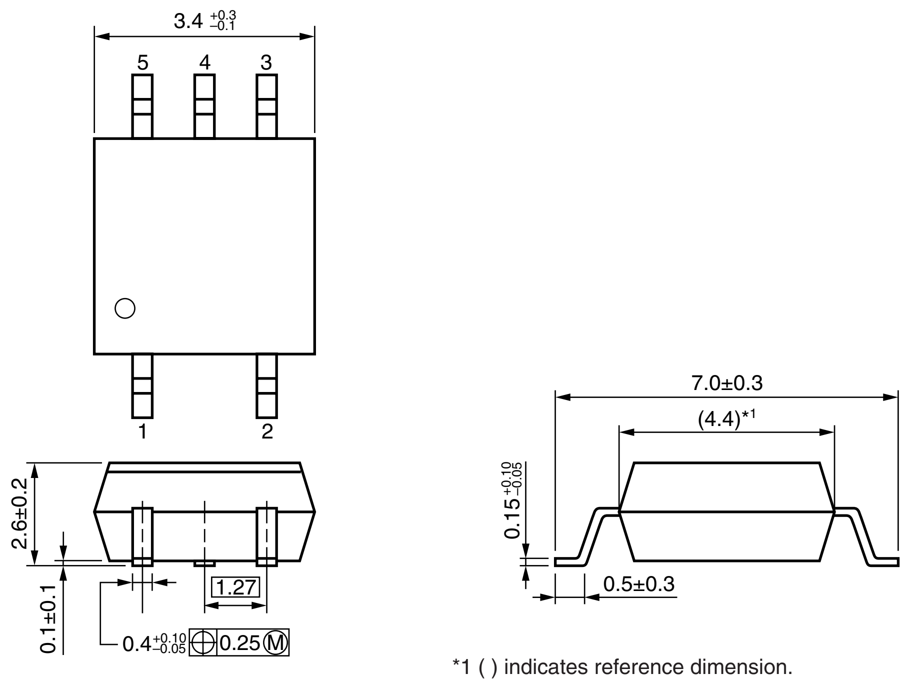
1. Anode
2. Cathode
3. GND
4. V_O
5. V_{CC}

<R> APPLICATIONS

- FA Network

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

PACKAGE DIMENSIONS (UNIT: mm)

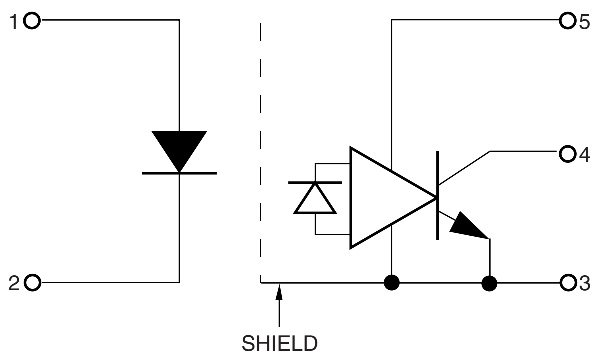


*1 ( ) indicates reference dimension.

PHOTOCOUPLER CONSTRUCTION

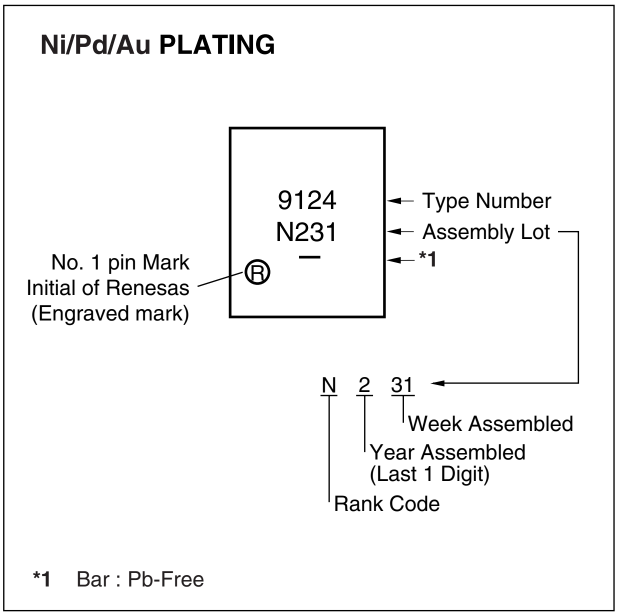
Parameter	MIN.
Air Distance	4.2 mm
Outer Creepage Distance	4.2 mm
Isolation Distance	0.2 mm

BLOCK DIAGRAM (Unit: mm)



LED	Output
ON	L
OFF	H

MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standards Approval	Application Part Number *1
PS9124	PS9124-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products (UL, CSA approved)	PS9124
PS9124-F3	PS9124-F3-AX		Embossed Tape 2 500 pcs/reel		
PS9124-V	PS9124-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-5 (VDE0884-5) approved (Option)	
PS9124-V-F3	PS9124-V-F3-AX		Embossed Tape 2 500 pcs/reel		

Note: *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 *1	I_F	25	mA
	Reverse Voltage	V_R	5	V
Detector	Supply Voltage	V_{CC}	7	V
	Output Voltage	V_O	7	V
	Output Current	I_O	25	mA
	Power Dissipation *2	P_C	200	mW
Isolation Voltage *3		BV	3 750	Vr.m.s.
Operating Ambient Temperature		T_A	–40 to +110	°C
Storage Temperature		T_{stg}	–55 to +125	°C

Notes: *1. Reduced to 0.2 mA/°C at T_A = 25°C or more.
*2. Reduced to 4.0 mW/°C at T_A = 75°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

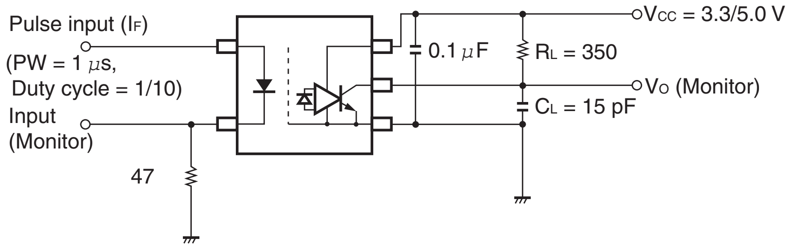
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Low Level Input Voltage	V_{FL}	–2		0.8	V
High Level Input Current	I_{FH}	3.8	6.0	7.5	mA
Supply Voltage	V_{CC}	2.7	3.3	3.6	V
		4.5	5.0	5.5	
TTL (R_L = 1 kΩ, loads)	N			5	
Pull-up Resistor	R_L	330		4 k	Ω

ELECTRICAL CHARACTERISTICS (T_A = –40 to +110°C, unless otherwise specified)

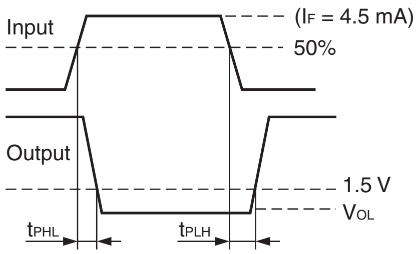
	Parameter	Symbol	Conditions	MIN.	TYP. *1	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C	1.3	1.55	1.8	V
	Reverse Current	I_R	V_R = 3 V, T_A = 25°C			10	μA
	Terminal Capacitance	C_t	f = 1 MHz, V_F = 0 V, T_A = 25°C		30		pF
Detector	High Level Output Current	I_{OH}	V_{CC} = V_O = 3.3 V, V_F = 0.8 V		1	80	μA
			V_{CC} = V_O = 5.5 V, V_F = 0.8 V		1	100	
	Low Level Output Voltage	V_{OL}	V_{CC} = 3.3 V, I_F = 4.5 mA, I_{OL} = 13 mA		0.2	0.6	V
			V_{CC} = 5.5 V, I_F = 4.5 mA, I_{OL} = 13 mA				
	High Level Supply Current	I_{CCH}	V_{CC} = 3.3 V, I_F = 0 mA, V_O = open		4	7	mA
			V_{CC} = 5.5 V, I_F = 0 mA, V_O = open				
	Low Level Supply Current	I_{CCL}	V_{CC} = 3.3 V, I_F = 4.5 mA, V_O = open		6	10	mA
			V_{CC} = 5.5 V, I_F = 4.5 mA, V_O = open		7	10	
Coupled	Threshold Input Voltage (H → L)	I_{FHL}	V_{CC} = 3.3 V, R_L = 350 Ω, V_O = 0.8 V		1.0	3.0	mA
			V_{CC} = 5 V, R_L = 350 Ω, V_O = 0.8 V				
	Isolation Resistance	R_{I-O}	V_{I-O} = 1 kV_{DC}, RH = 40 to 60%, T_A = 25°C	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V = 0 V, f = 1 MHz, T_A = 25°C		0.6		pF
	Propagation Delay Time (H → L) *2	t_{PHL}	V_{CC} = 3.3 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF; T_A = 25°C		40	75	ns
			V_{CC} = 3.3 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF			100	
			V_{CC} = 5 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF; T_A = 25°C		40	75	
			V_{CC} = 5 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF			100	
	Propagation Delay Time (L → H) *2	t_{PLH}	V_{CC} = 3.3 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF; T_A = 25°C		50	75	ns
			V_{CC} = 3.3 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF			100	
			V_{CC} = 5 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF; T_A = 25°C		45	75	
			V_{CC} = 5 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF			100	
	Pulse Width Distortion (PWD)	$\lvert t_{PHL}-t_{PLH} \rvert$	V_{CC} = 3.3/5 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF		5	35	ns
	Propagation Delay Skew	t_{psk}	V_{CC} = 3.3/5 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF			40	ns
	Rise Time	t_r	V_{CC} = 3.3/5 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF		20		ns
	Fall Time	t_f	V_{CC} = 3.3/5 V, I_F = 4.5 mA, R_L = 350 Ω, C_L = 15 pF		5		ns
	Common Mode Transient Immunity at High Level Output *3	CM_H	V_{CC} = 3.3/5 V, T_A = 25°C, I_F = 0 mA, V_O > 2 V, R_L = 350 Ω, V_{CM} = 1 kV	10	15		kV/μs
	Common Mode Transient Immunity at Low Level Output *3	CM_L	V_{CC} = 3.3/5 V, T_A = 25°C, I_F = 4.5 mA, V_O < 0.8 V, R_L = 350 Ω, V_{CM} = 1 kV	10	15		kV/μs

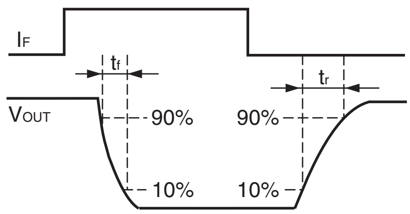
Notes: *1. Typical values at T_A = 25°C

<R> *2. Test circuit for propagation delay time

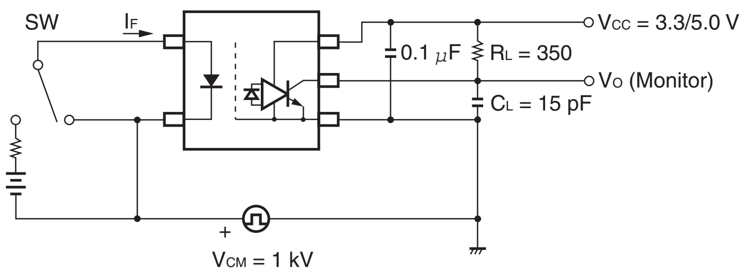


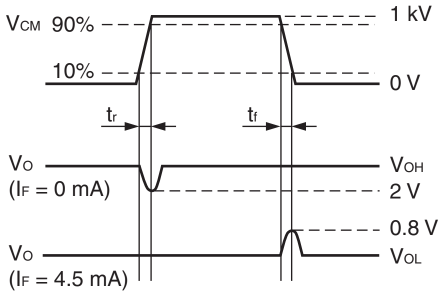
Remark C_L includes probe and stray wiring capacitance.





*3. Test circuit for common mode transient immunity

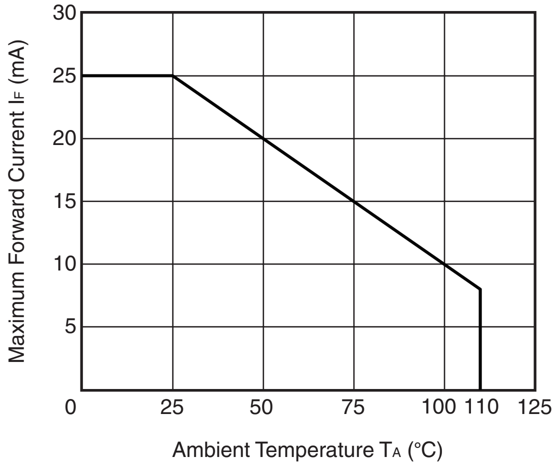




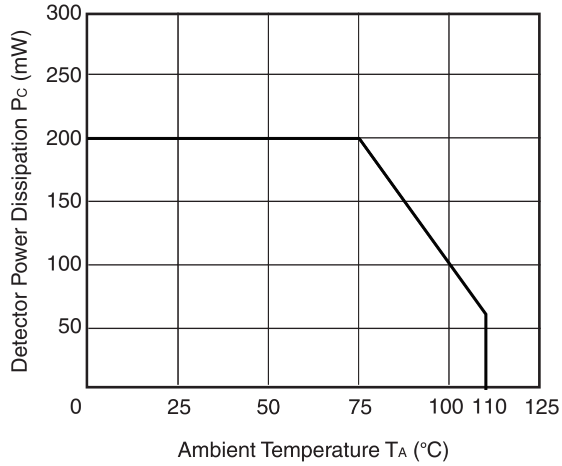
Remark C_L includes probe and stray wiring capacitance.

<R> **TYPICAL CHARACTERISTICS (T_A = 25°C, unless otherwise specified)**

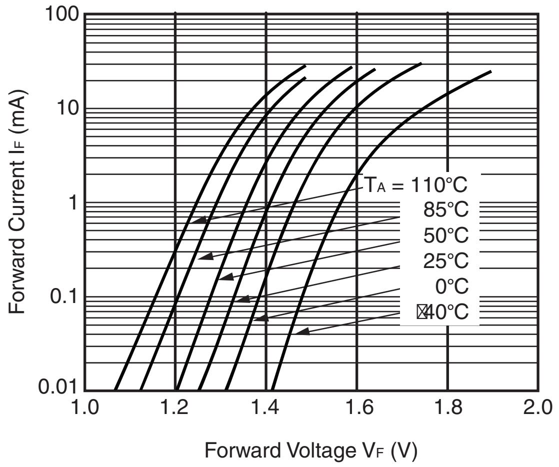
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



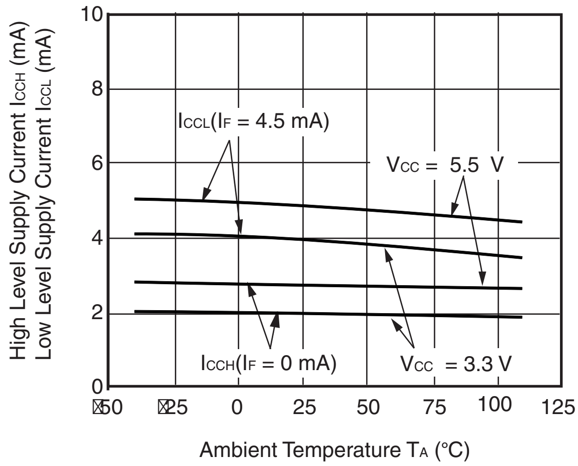
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



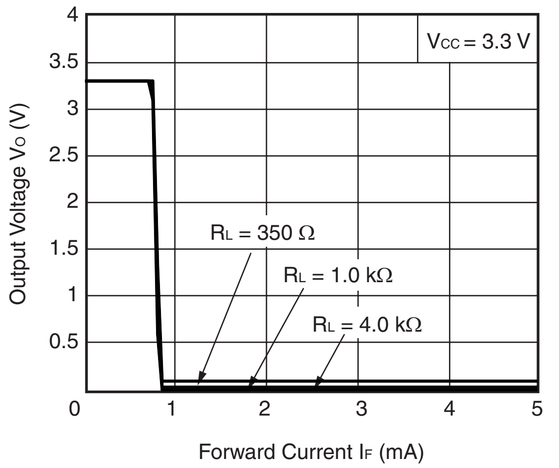
FORWARD CURRENT vs. FORWARD VOLTAGE



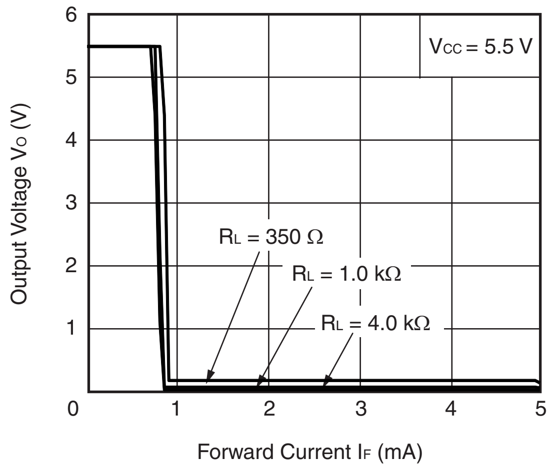
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs. FORWARD CURRENT

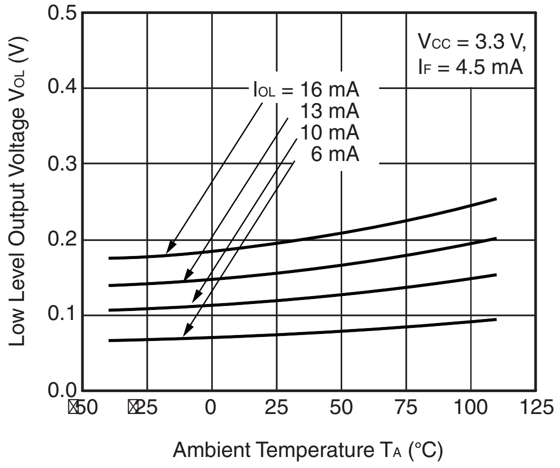


OUTPUT VOLTAGE vs. FORWARD CURRENT

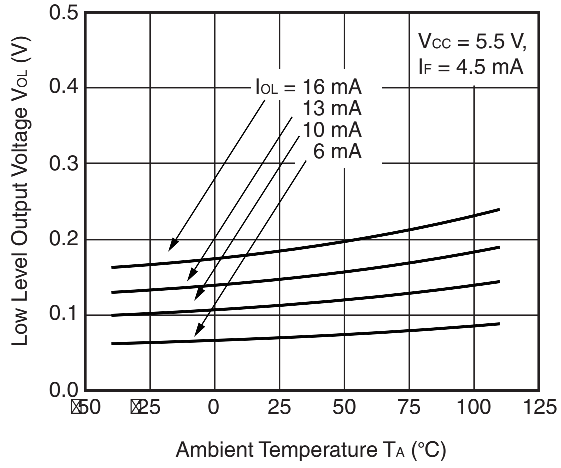


Remark The graphs indicate nominal characteristics.

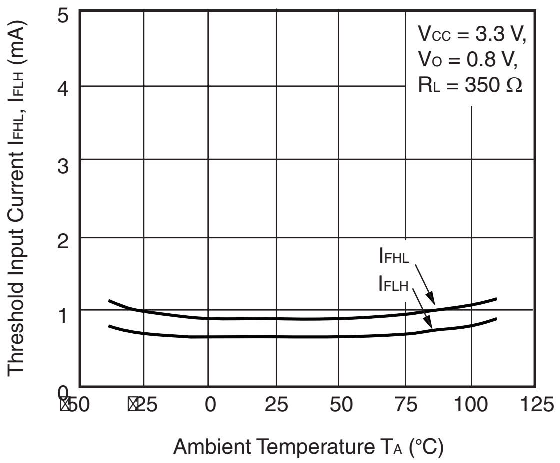
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



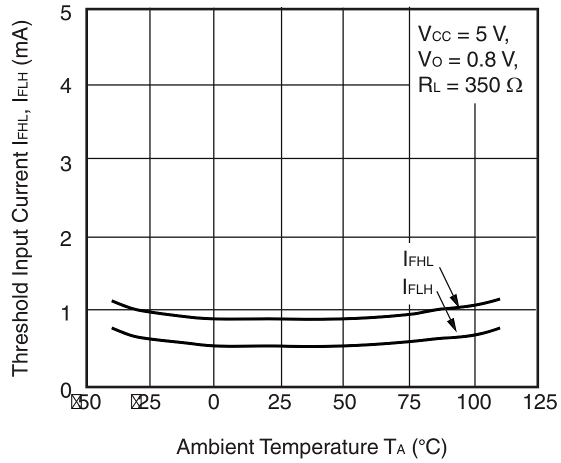
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



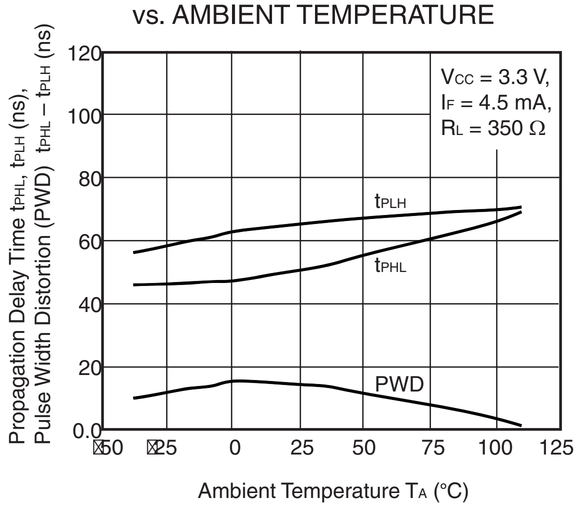
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



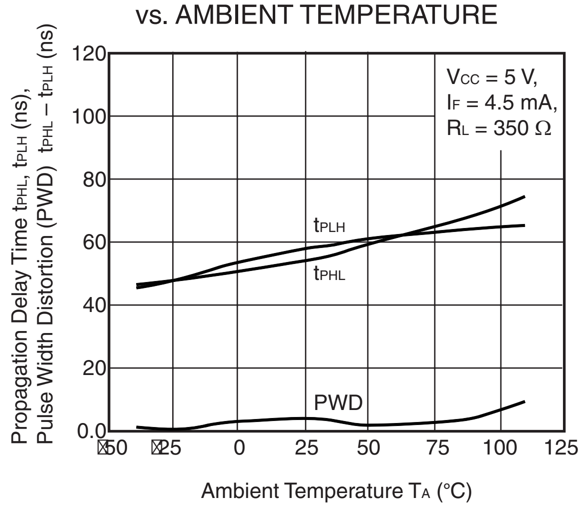
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE

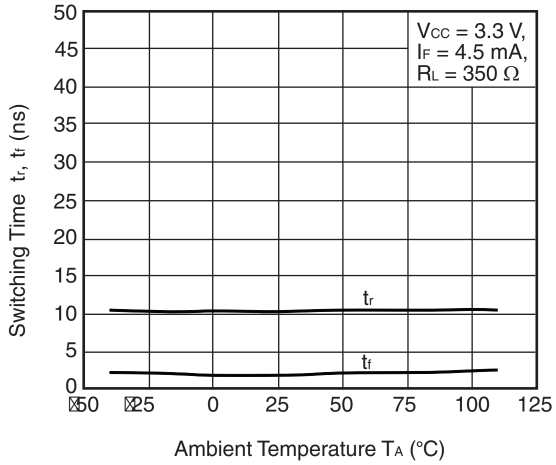


PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE

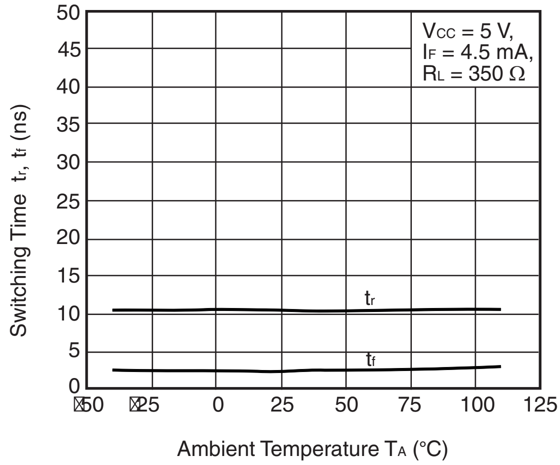


Remark The graphs indicate nominal characteristics.

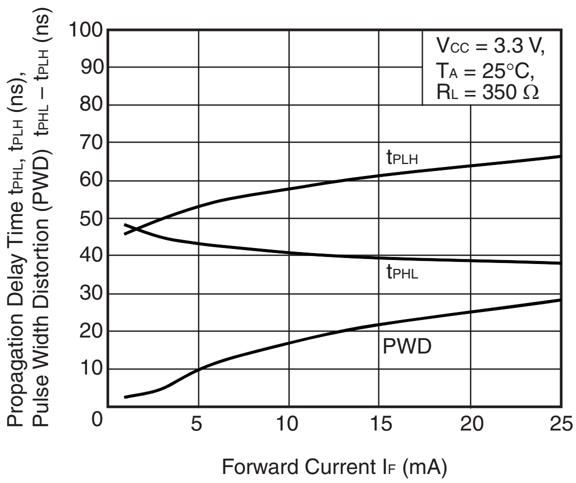
SWITCHING TIME vs.
AMBIENT TEMPERATURE



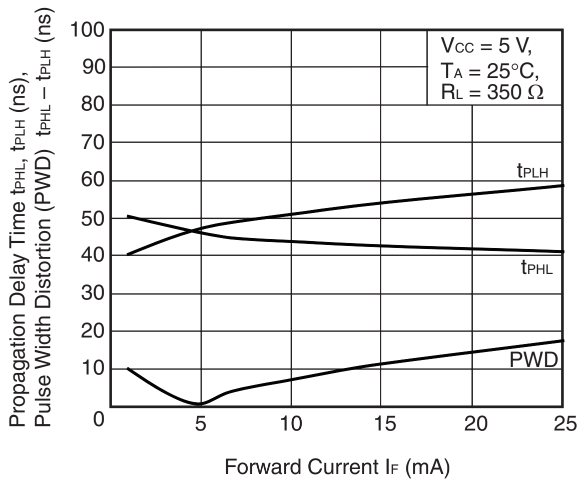
SWITCHING TIME vs.
AMBIENT TEMPERATURE



PROPAGATION DELAY TIME,
PULSE WIDTH DISTORTION
vs. FORWARD CURRENT



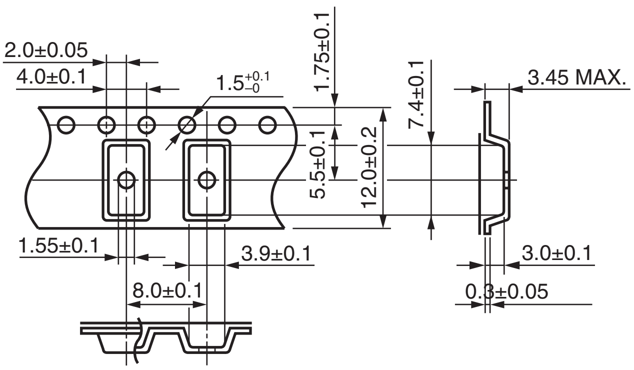
PROPAGATION DELAY TIME,
PULSE WIDTH DISTORTION
vs. FORWARD CURRENT



Remark The graphs indicate nominal characteristics.

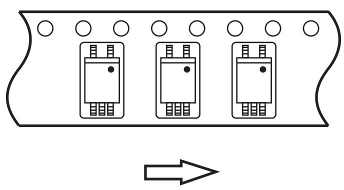
<R> TAPING SPECIFICATIONS (UNIT: mm)

Outline and Dimensions (Tape)

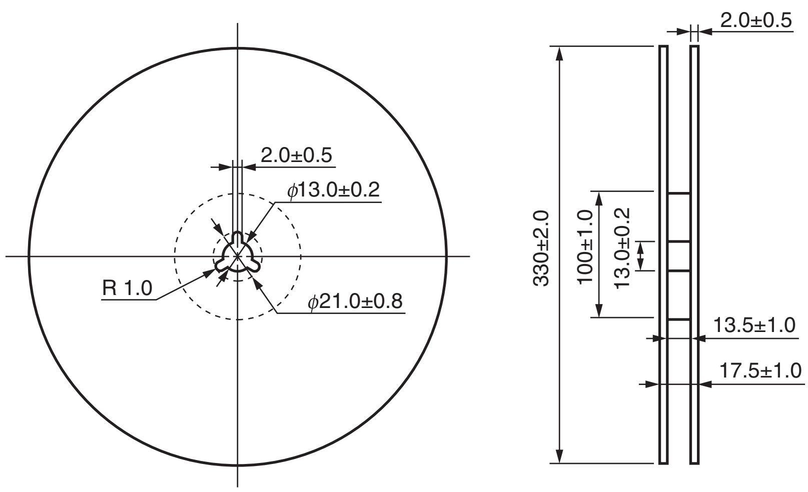


Tape Direction

PS9124-F3

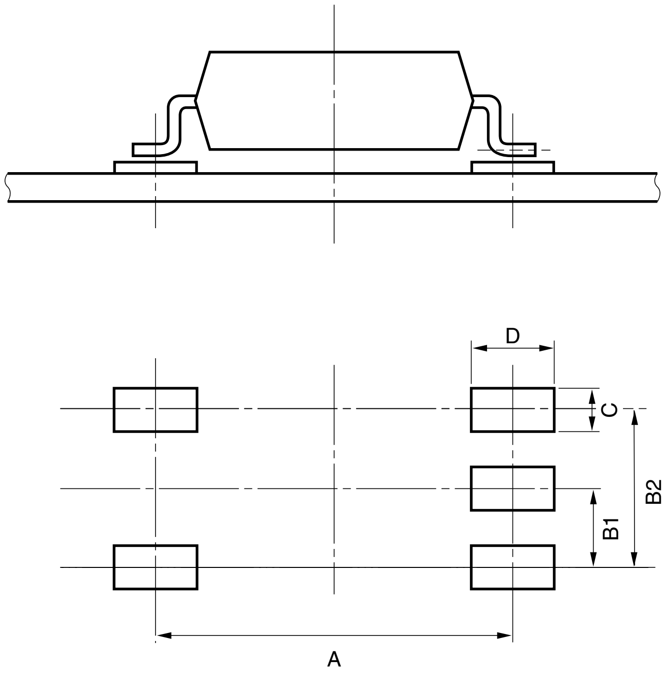


Outline and Dimensions (Reel)



Packing: 2 500 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



Part Number	A	B1	B2	C	D
PS9124	6.25	1.27	2.54	0.8	1.45

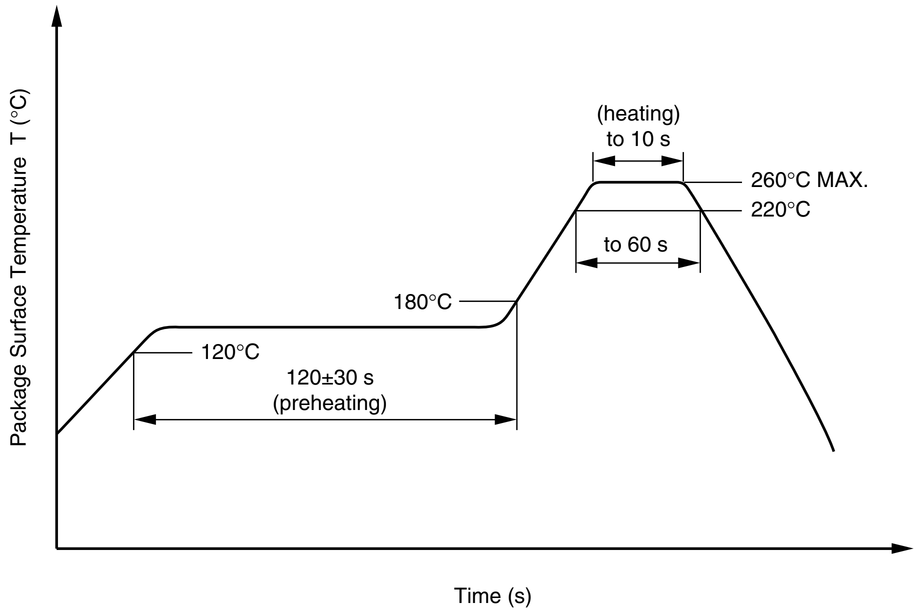
<R> ## NOTES ON HANDLING

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



(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

(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 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. By-pass capacitor of more than 0.1 μF is used between V_{CC} 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.

<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Spec.	Unit
Maximum repetitive peak operating isolation voltage	U_{IORM}	707	V_{peak}
Partial discharge test voltage at 100% production test $U_{pr} = 1.875 \times U_{IORM}$, Method b, t_m=1sec, $p_d < 5$ pC	U_{pr}	1 326	V_{peak}
Partial discharge test voltage at Type test and Sample test $U_{pr} = 1.6 \times U_{IORM}$, Method a, t_m=10sec, $p_d < 5$ pC	U_{pr}	1 131	V_{peak}
Maximum transient isolation voltage (Transient overvoltage t_{ini}=60sec)	U_{IOTM}	6 000	V_{peak}
Installation classification (IEC 60664/ DIN EN 60664-1/ VDE0110 Part 1) for rated mains voltage $\leq$ 300 Vr.m.s. for rated mains voltage $\leq$ 600 Vr.m.s.		 I - IV I - III	
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	
Pollution degree (DIN EN 60664-1/ VDE0110 Part 1)		2	
Climatic category (IEC 60068-1/ DIN EN 60068-1)		40/110/21	
Operating temperature range	T_A	–40 to +110	°C
Storage temperature range	T_{stg}	–55 to +125	°C
Isolation resistance, minimum value V_{IO} = 500 Vdc at T_A=25°C V_{IO} = 500 Vdc at T_A MAX. at least 100°C	 Ris MIN. Ris MIN.	 10^{12} 10^{11}	 Ω Ω
Safety limiting values ratings (maximum allowable in the event of a fault or a failure, see thermal derating curve) Maximum ambient safety temperature Maximum input current Maximum output power Isolation resistance at V_{IO}= 500 Vdc, T_A=Ts	 Ts Isi Pso Ris MIN.	 150 200 300 10^9	 °C mA mW Ω

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 in any way allow it to enter the mouth.

Revision History	PS9124 Data Sheet

Rev.	Date	Description	
		Page	**Summary**
0.01	Jul 03, 2012	–	First edition issued
1.00	Aug 30, 2013	Throughout	“Preliminary Data Sheet” is changed to “Data Sheet.”
		p.1	Modification of FEATURES
			Modification of APPLICATIONS
		p.6	Modification of Test circuit for propagation delay time
		p.7 to 9	Addition of TYPICAL CHARACTERISTICS
		p.10	Modification of TAPING SPECIFICATIONS
		p.12	Addition of NOTES ON HANDLING
		p.14	Addition of SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

NOTICE

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