PS9324L, PS9324L2

R08DS0060EJ0100
Rev.1.00
Apr 26, 2013

HIGH CMR, 10 Mbps OPEN COLLECTOR OUTPUT TYPE, 6-PIN SDIP PHOTOCOUPLER

DESCRIPTION

The PS9324L and PS9324L2 are optical coupled high-speed, active low type isolators containing a GaAlAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

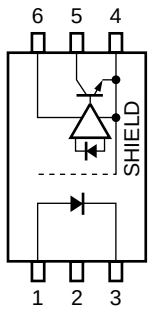
The PS9324L is lead bending type (Gull-wing) for surface mounting.

The PS9324L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

FEATURES

- High common mode transient immunity (CM_H, CM_L = ±15 kV/μs MIN.)
- Half size of 8-pin DIP
- Long creepage distance (8 mm MIN.: PS9324L2)
- High-speed (10 Mbps)
- High-speed response (t_{PHL} = 75 ns MAX., t_{PLH} = 75 ns MAX.)
- Low power consumption (V_{CC} = 3.3/5 V)
- Open collector output
- High isolation voltage (BV = 5 000 Vr.m.s.)
- Embossed tape product : PS9324L-E3 : 2 000 pcs/reel
  : PS9324L2-E3: 2 000 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: No. E72422
  - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
  - SEMKO approved (EN 60065, EN 60950)
  - DIN EN 60747-5-5 (VDE 0884-5) approved (Option)

PIN CONNECTION
(Top View)



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

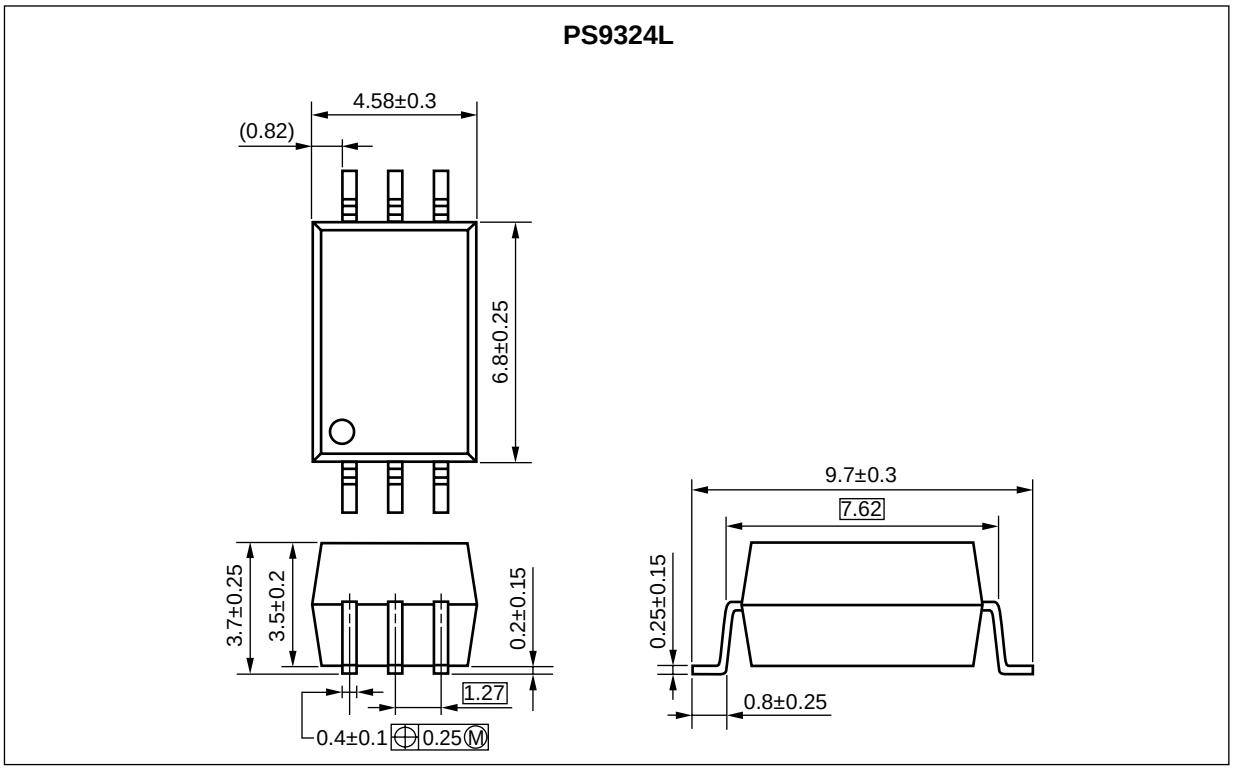
APPLICATIONS

- Measurement equipment
- PDP
- FA Network

PACKAGE DIMENSIONS (UNIT: mm)

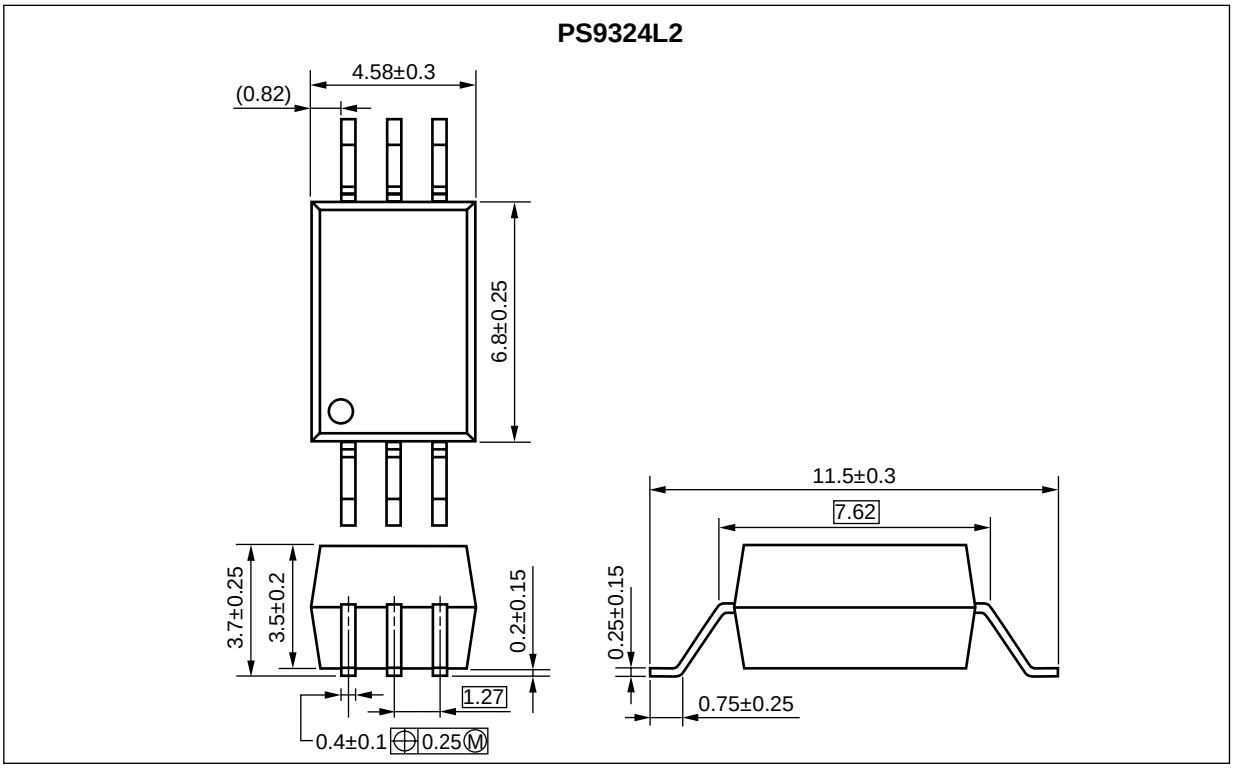
Lead Bending Type (Gull-wing) For Surface Mount

PS9324L

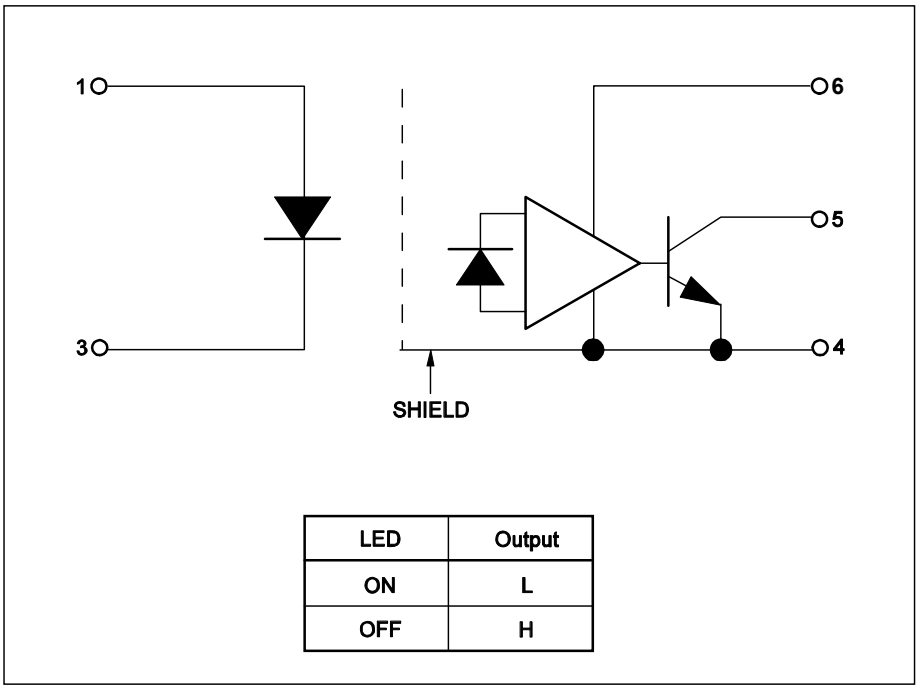


Lead Bending Type (Gull-wing) For Long Creepage Distance (Surface Mount)

PS9324L2

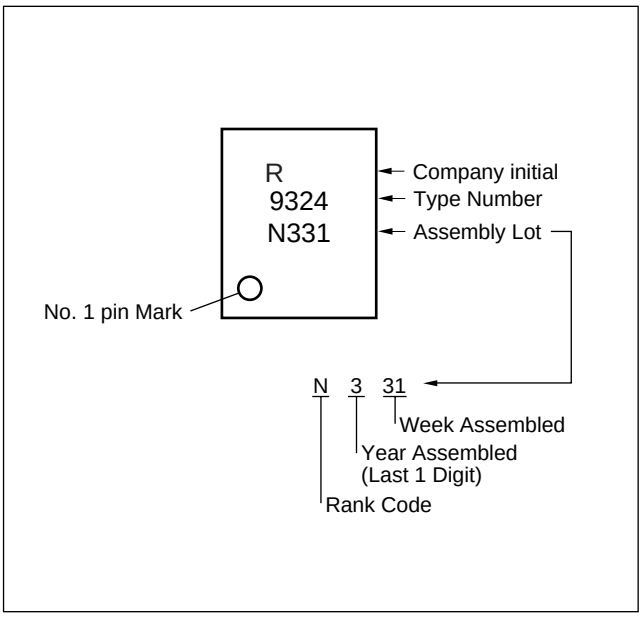


BLOCK DIAGRAM



LED	Output
ON	L
OFF	H

MARKING EXAMPLE



PHOTOCOUPLER CONSTRUCTION

Parameter	PS9324L	PS9324L2
Air Distance (MIN.)	7 mm	8 mm
Outer Creepage Distance (MIN.)	7 mm	8 mm
Isolation Distance (MIN.)	0.4 mm	0.4 mm

ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9324L	PS9324L-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products UL, CSA ,SEMKO approval)	PS9324L
PS9324L-E3	PS9324L-E3-AX		Embossed Tape 2 000 pcs/reel		
PS9324L2	PS9324L2-AX		20 pcs (Tape 20 pcs cut)	Standard products UL, CSA ,SEMKO approval)	PS9324L2
PS9324L2-E3	PS9324L2-E3-AX		Embossed Tape 2 000 pcs/reel		
PS9324L-V	PS9324L-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN 60747-5-5 (VDE 0884-5) Approved (Option)	PS9324L
PS9324L-V-E3	PS9324L-V-E3-AX		Embossed Tape 2 000 pcs/reel		
PS9324L2-V	PS9324L2-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN 60747-5-5 (VDE 0884-5) Approved (Option)	PS9324L2
PS9324L2-V-E3	PS9324L2-V-E3-AX		Embossed Tape 2 000 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	5 000	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 1-3 shorted together, 4-6 shorted together.

RECOMMENDED OPERATING CONDITIONS

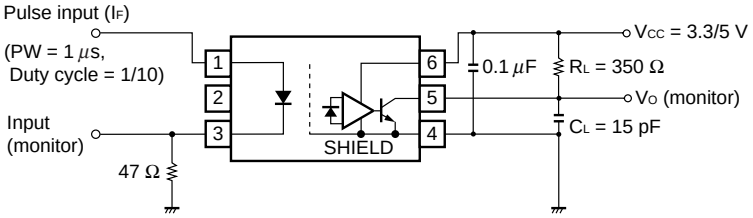
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Low Level Input Current	V_{FL}	0		0.8	V
High Level Input Current	I_{FH}	3.8	6	7.5	mA
Supply Voltage	V_{CC}	2.7		5.5	V
TTL (R_L = 1 kΩ, loads)	N			5	
Pull-up Resistor	R_L	330		4k	Ω

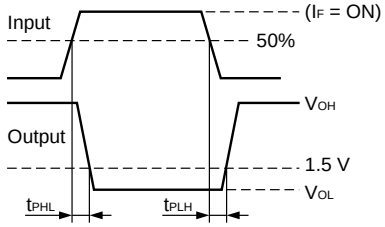
ELECTRICAL CHARACTERISTICS (T_A = –40 to +110°C, unless otherwise specified)

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	3	mA
			V_{CC} = 5.0 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%	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V_{I-O} = 0 V, f = 1 MHz, T_A = 25°C		0.6		pF
	Propagation Delay Time (H → L)[*2]	t_{PHL}	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	
			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}	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	
			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)[*2]	$\lvert t_{PHL}-t_{PLH} \rvert$	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[*2]	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[*3]	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[*3]	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[*4]	$\lvert CM_H \rvert$	V_{CC} = 3.3/5 V, I_F = 0 mA, V_O > 2 V, R_L = 350 Ω, V_{CM} = 1.5 kV, T_A = 25°C	15	20		kV/μs
	Common Mode Transient Immunity at Low Level Output[*4]	$\lvert CM_L \rvert$	V_{CC} = 3.3/5 V, I_F = 4.5 mA, V_O < 0.8 V, R_L = 350 Ω, V_{CM} = 1.5 kV, T_A = 25°C	15	20		kV/μs

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

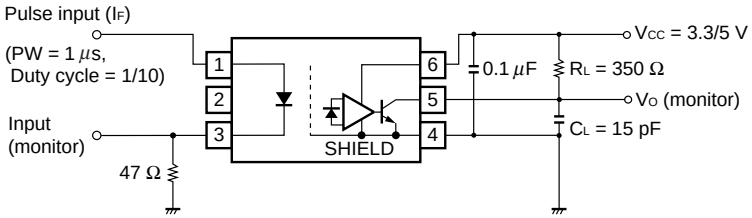
*2. Test circuit for propagation delay time

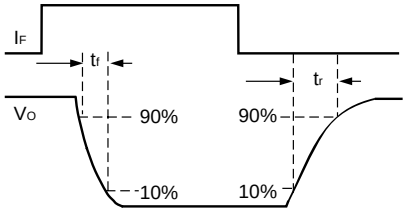




Remark C_L includes probe and stray wiring capacitance.

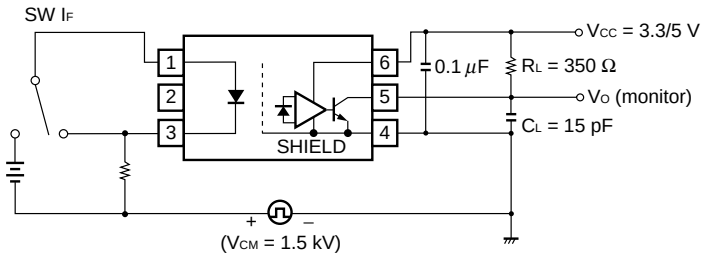
*3. Test circuit for switching time

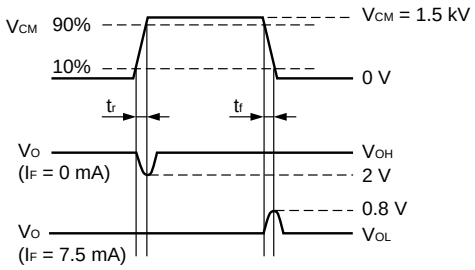




Remark C_L includes probe and stray wiring capacitance.

*4. Test circuit for common mode transient immunity

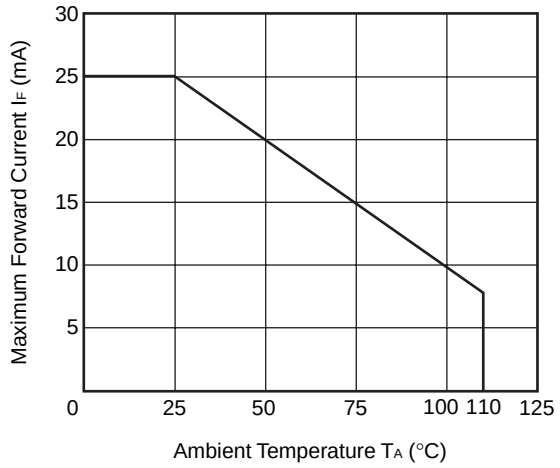




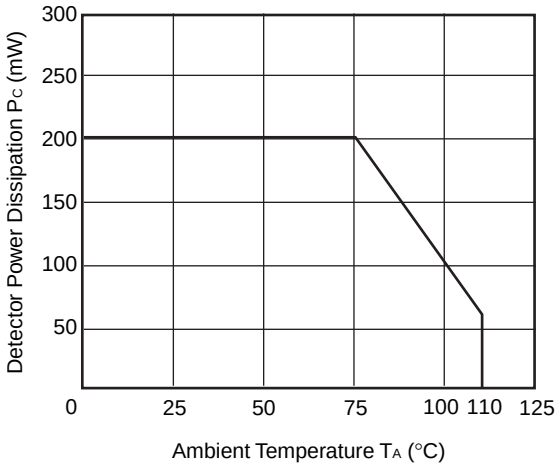
Remark C_L includes probe and stray wiring capacitance.

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

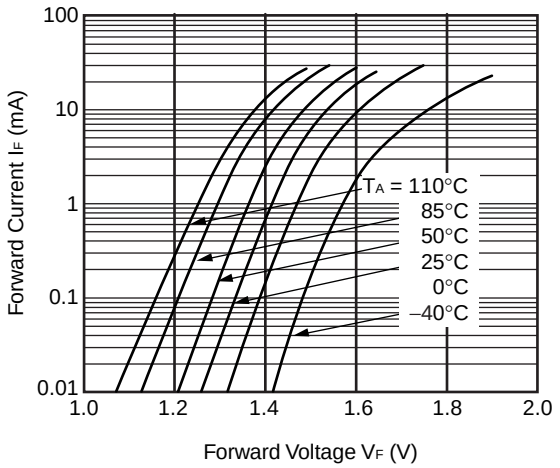
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



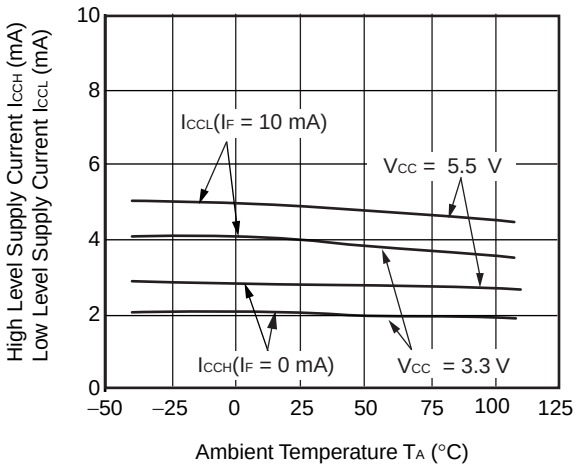
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



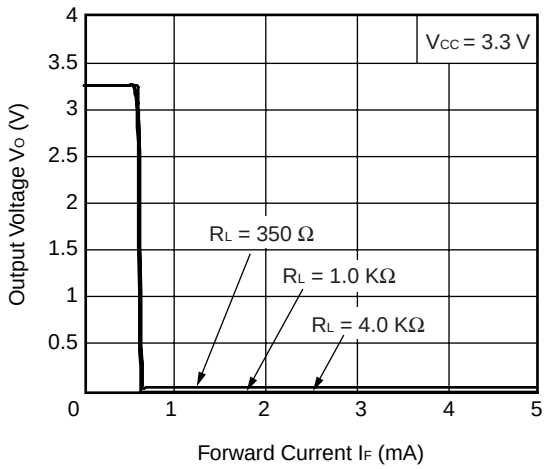
FORWARD CURRENT vs. FORWARD VOLTAGE



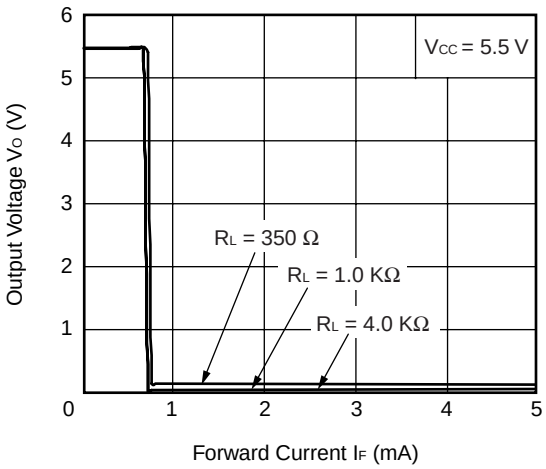
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs. FORWARD CURRENT

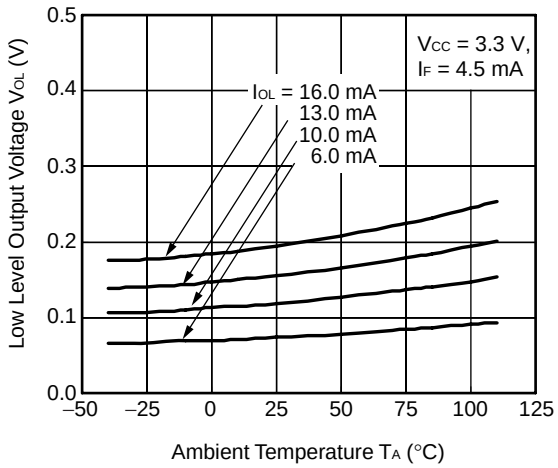


OUTPUT VOLTAGE vs. FORWARD CURRENT

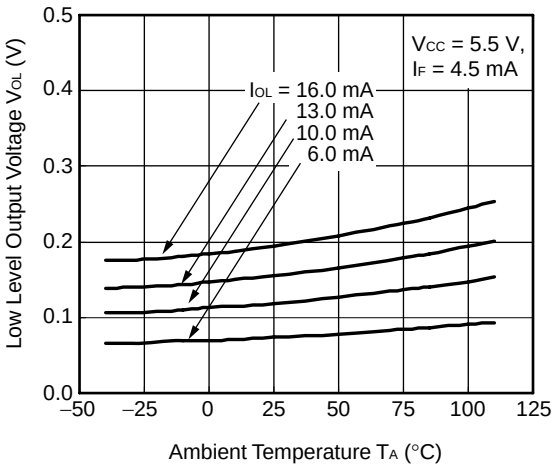


Remark The graphs indicate nominal characteristics.

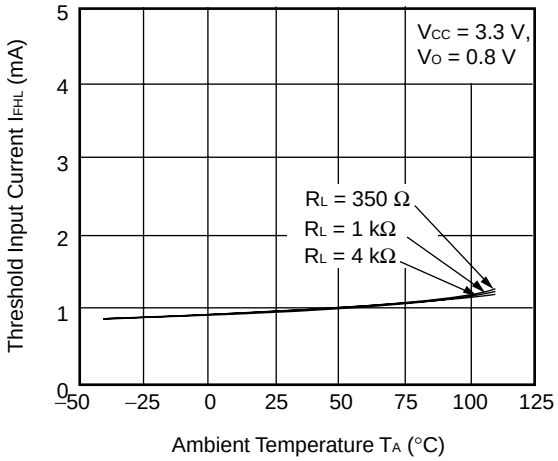
LOW LEVEL OUTPUT VOLTAGE vs.
AMBIENT TEMPERATURE



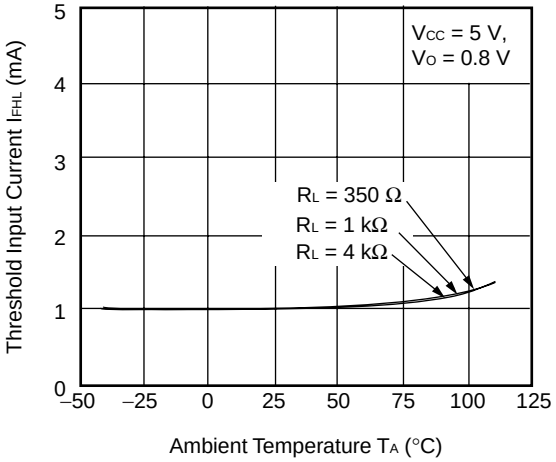
LOW LEVEL OUTPUT VOLTAGE vs.
AMBIENT TEMPERATURE



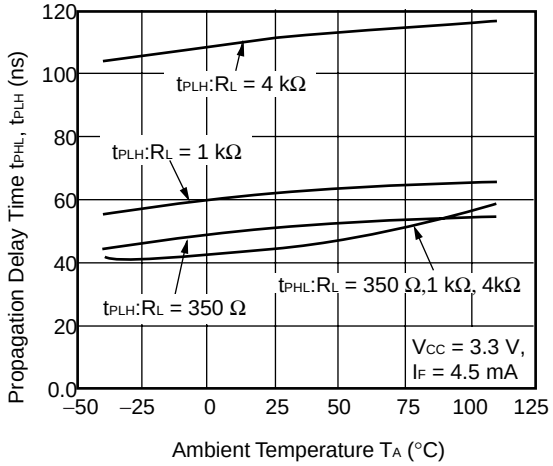
THRESHOLD INPUT CURRENT vs.
AMBIENT TEMPERATURE



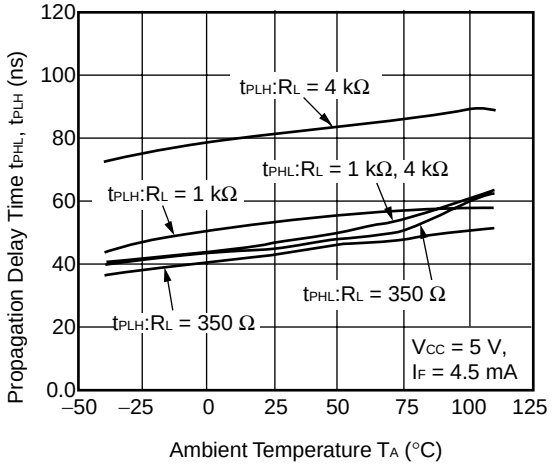
THRESHOLD INPUT CURRENT vs.
AMBIENT TEMPERATURE



PROPAGATION DELAY TIME vs.
AMBIENT TEMPERATURE

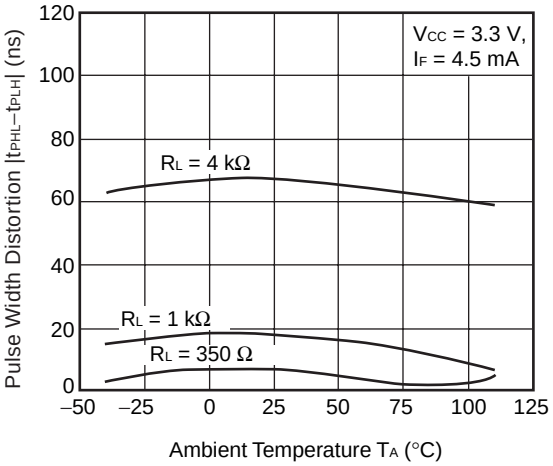


PROPAGATION DELAY TIME vs.
AMBIENT TEMPERATURE

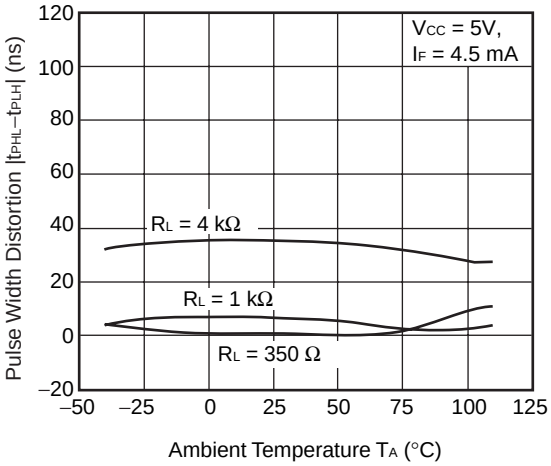


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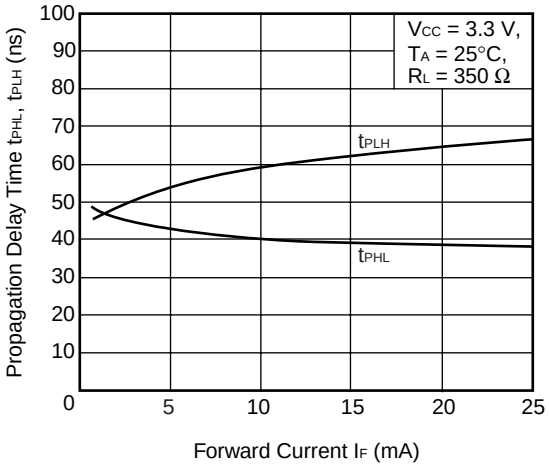
PULSE WIDTH DISTORTION vs.
AMBIENT TEMPERATURE



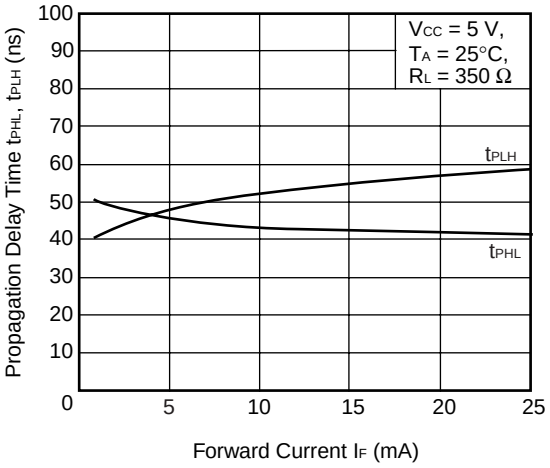
PULSE WIDTH DISTORTION vs.
AMBIENT TEMPERATURE



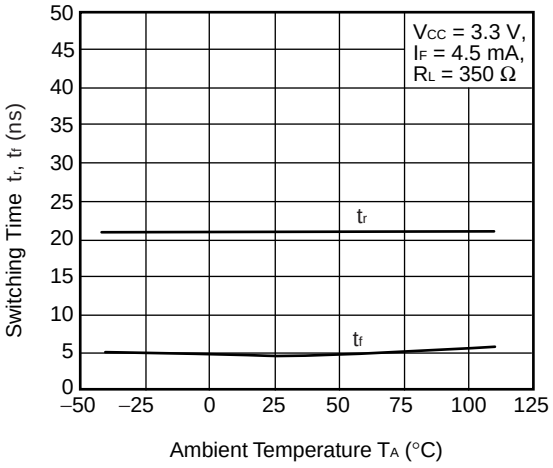
PROPAGATION DELAY TIME vs.
FORWARD CURRENT



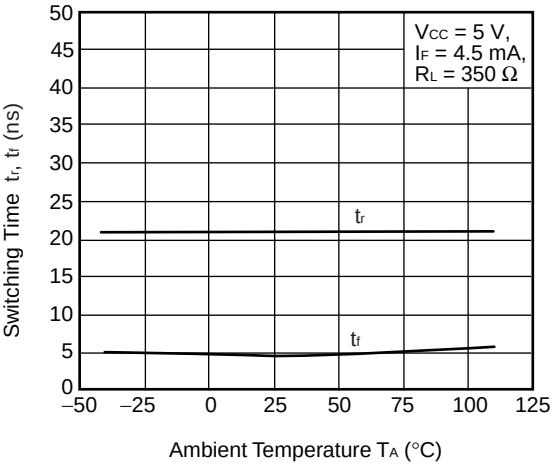
PROPAGATION DELAY TIME vs.
FORWARD CURRENT



SWITCHING TIME vs.
AMBIENT TEMPERATURE



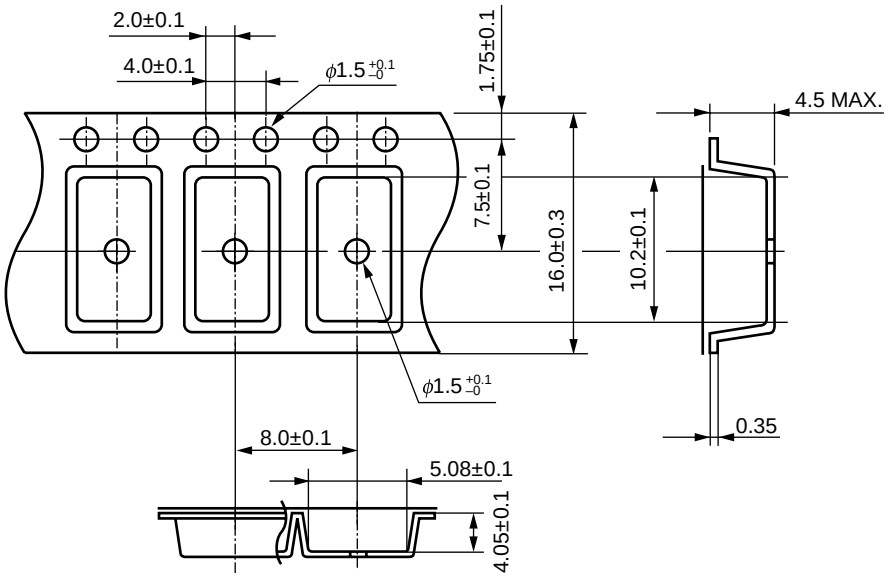
SWITCHING TIME vs.
AMBIENT TEMPERATURE



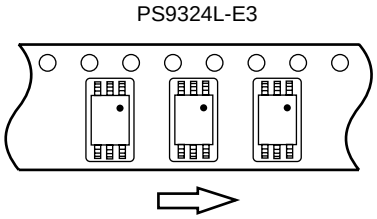
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

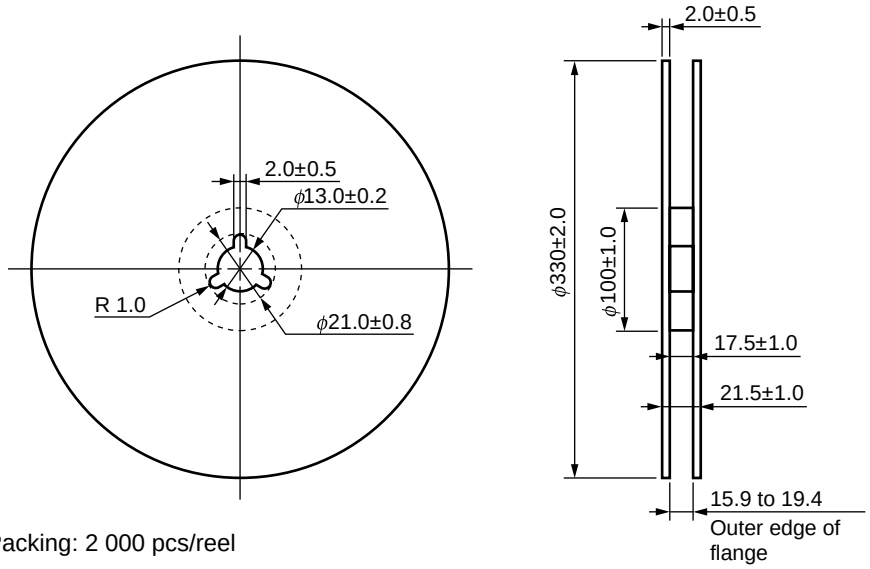
Outline and Dimensions (Tape)



Tape Direction

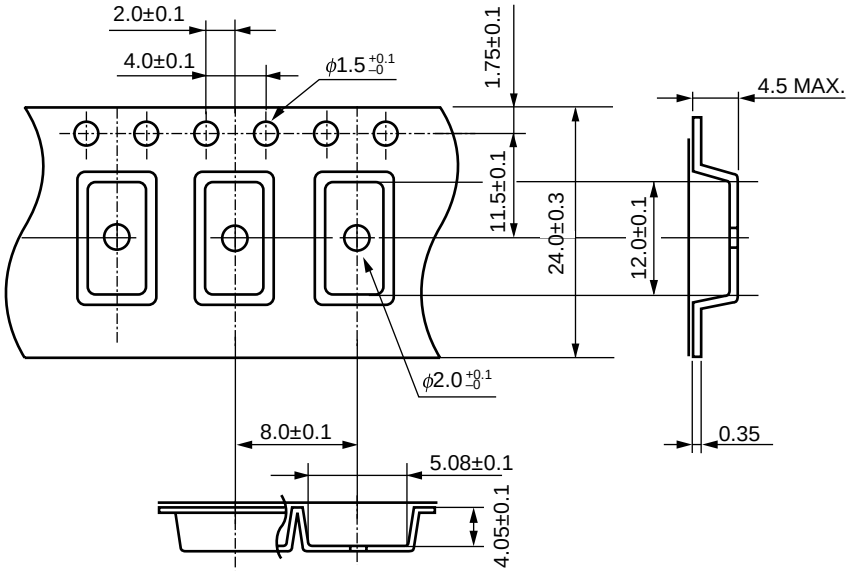


Outline and Dimensions (Reel)

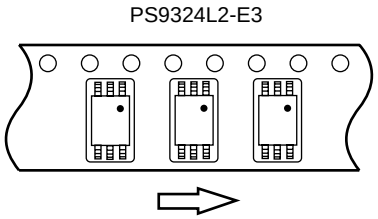


Packing: 2 000 pcs/reel

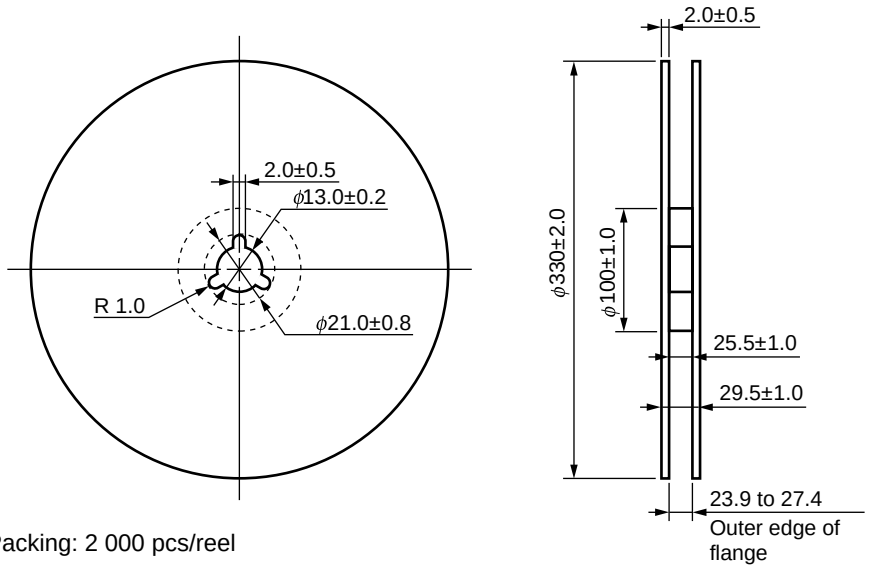
Outline and Dimensions (Tape)



Tape Direction

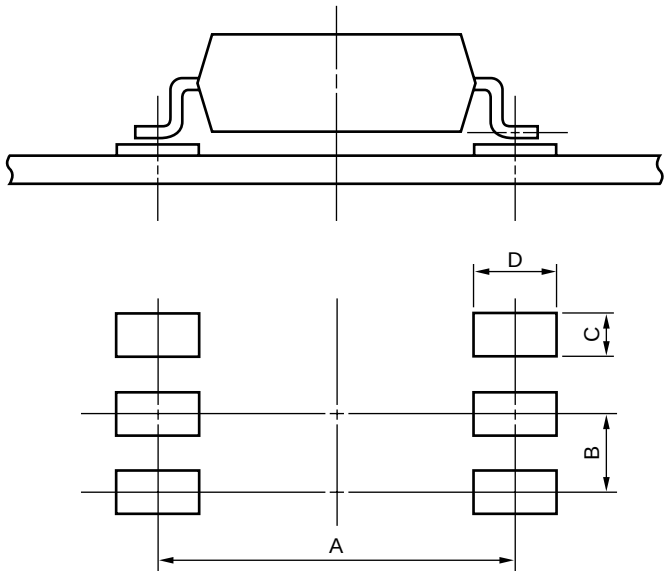


Outline and Dimensions (Reel)



Packing: 2 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



Part Number	Lead Bending	A	B	C	D
PS9324L	lead bending type (Gull-wing) for surface mount	9.2	1.27	0.8	2.2
PS9324L2	lead bending type (Gull-wing) for long creepage distance (surface mount)	10.2	1.27	0.8	2.2

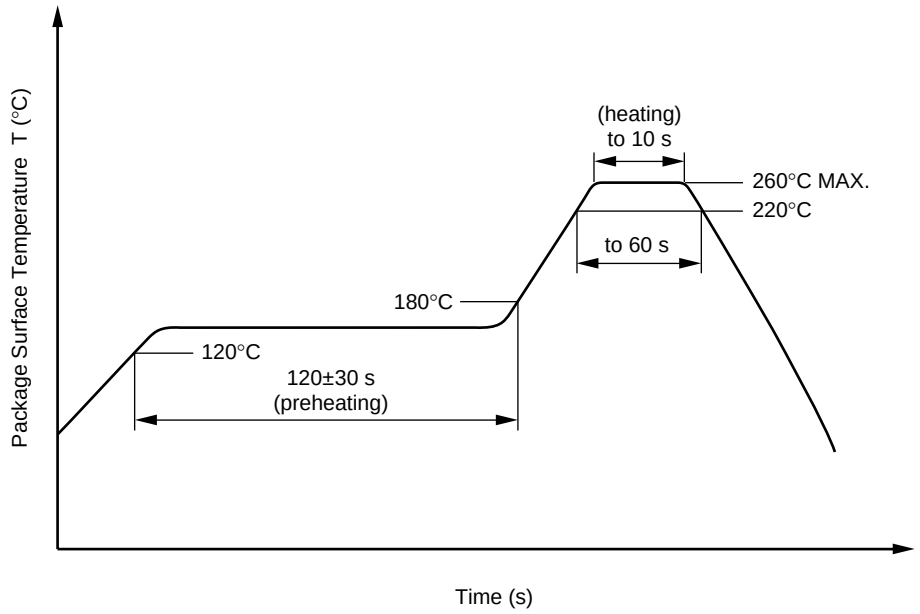
NOTES ON HANDLING

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 pin) — 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 or between collector-emitters at startup, the output side 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. When V_{DD} is lower than around 2 V, the output(V_O) of this product is unstable, and this might produce undesirable operation. Be sure to check the operation of an IC or a discrete component that is connected to this product during Power-up and Power-down process. And we recommend to use a disable function (shutdown function) of the connected IC or a reset IC to avoid this undesirable operation.
4. Pin 2 (which is an NC[*1] pin) can either be connected directly to the GND pin on the LED 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.
   Note: *1. NC: Non-Connection (No Connection).
5. Avoid storage at a high temperature and high humidity.

SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Spec.	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/110/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.6 \times U_{IORM}$, $P_d < 5$ pC	 U_{IORM} U_{pr}	 1 130 1 808	 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	U_{pr}	2 119	V_{peak}
Highest permissible overvoltage	U_{TR}	8 000	V_{peak}
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	T_{stg}	–55 to +125	°C
Operating temperature range	T_A	–40 to +110	°C
Isolation resistance, minimum value V_{IO} = 500 V dc at T_A = 25°C V_{IO} = 500 V dc at T_A 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 I_F, Psi = 0) Power (output or total power dissipation) Isolation resistance V_{IO} = 500 V dc at T_A = Tsi	 Tsi Isi Psi Ris MIN.	 175 400 700 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	PS9324L, PS9324L2 Data Sheet

Rev.	Date	Description	
		Page	Summary
1.00	Apr 26, 2013	–	First Edition Issued

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