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PS9924

Data Sheet

HIGH CMR, 10 Mbps OPEN COLLECTOR OUTPUT TYPE, 8-PIN LSDIP PHOTOCOUPLER FOR CREEPAGE DISTANCE OF 14.5 mm

R08DS0059EJ0100
Rev.1.00
Jun 28, 2013

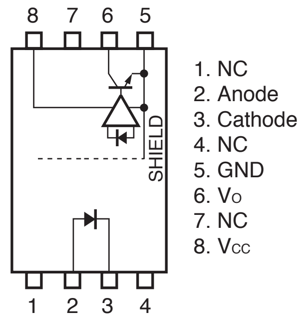
DESCRIPTION

The PS9924 is an optical 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

- Long creepage distance (14.5 mm MIN.)
- High common mode transient immunity (CM_H, CM_L = ±15 kV/μs MIN.)
- High-speed response (t_{PHL} = 100 ns MAX., t_{PLH} = 100 ns MAX.)
- Low power consumption (V_{CC} = 3.3/5V)
- 8-pin LSDIP (Long Creepage SDIP) type
- Embossed tape product: PS9924-F3: 1 000 pcs/reel
- Pb-Free and Halogen 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)



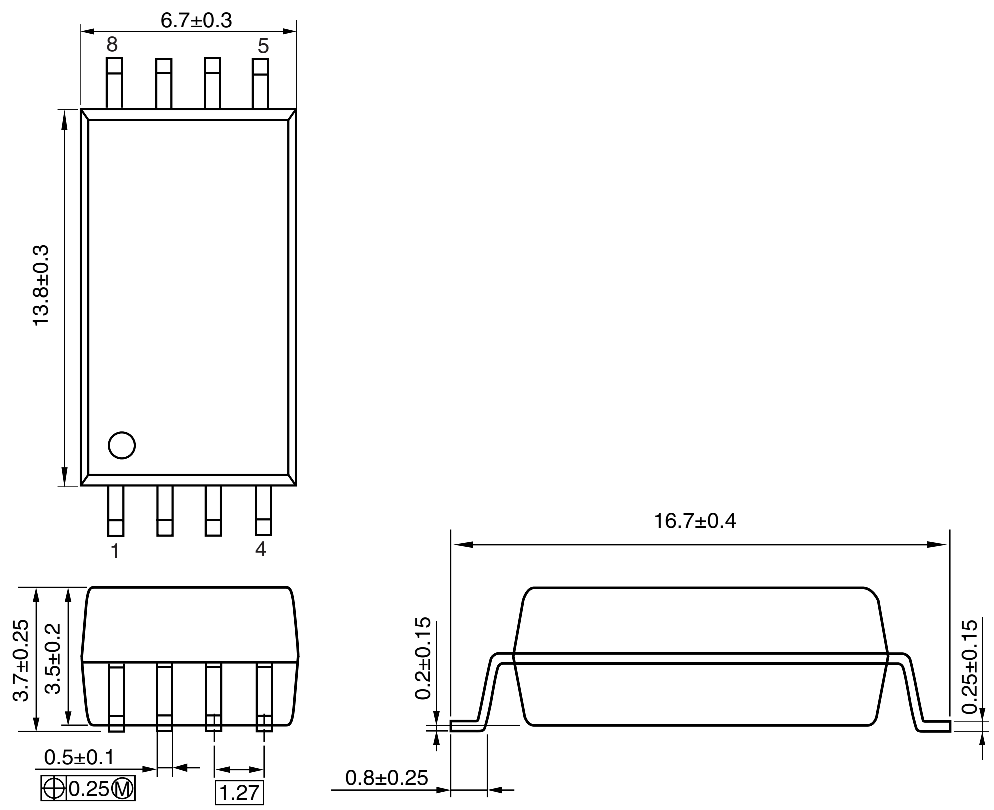
APPLICATIONS

- Industrial inverter
- Solar inverter

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.

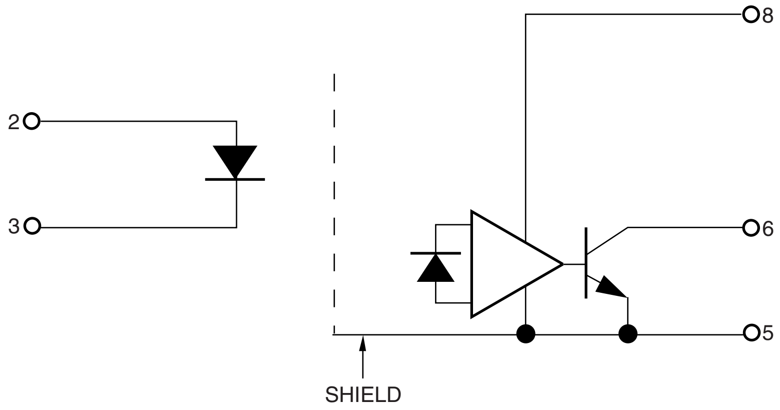
PACKAGE DIMENSIONS (UNIT: mm)



PHOTOCOUPLER CONSTRUCTION

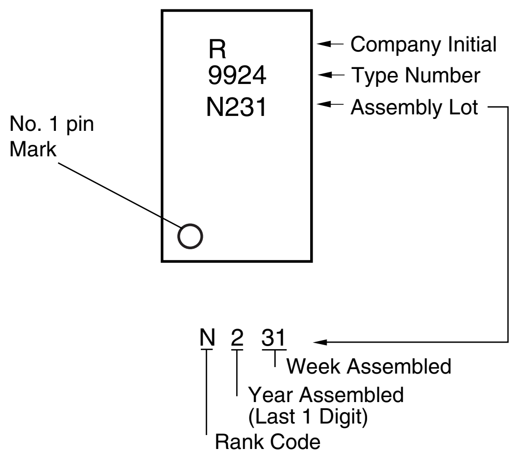
Parameter	MIN.
Air Distance	14.5 mm
Creepage Distance	14.5 mm
Isolation Distance	0.4 mm

BLOCK DIAGRAM



LED	Output
ON	L
OFF	H

MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9924	PS9924-Y-AX	Pb-Free and Halogen Free (Ni/Pd/Au)	10 pcs (Tape 10 pcs cut)	Standard products (UL, CSA, SEMKO approved)	PS9924
PS9924-F3	PS9924-Y-F3-AX		Embossed Tape 1 000 pcs/reel		
PS9924-V	PS9924-Y-V-AX		10 pcs (Tape 10 pcs cut)	DIN EN 60747-5-5 (VDE 0884-5) approved (Option)	
PS9924-V-F3	PS9924-Y-V-F3-AX		Embossed Tape 1 000 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	I_F	25	mA
	Reverse Voltage	V_R	5	V
	Power Dissipation*1	P_D	45	mW
Detector	Supply Voltage	V_{CC}	7	V
	Output Voltage	V_O	7	V
	Output Current	I_O	25	mA
	Power Dissipation*2	P_C	250	mW
Isolation Voltage*3		BV	7 500	Vr.m.s.
Operating Ambient Temperature		T_A	–40 to +110	°C
Storage Temperature		T_{stg}	–55 to +125	°C

Notes: *1. Reduced to 0.8 mW/°C at T_A = 85°C or more.
*2. Reduced to 5.2 mW/°C at T_A = 85°C or more.
*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output.
Pins 1-4 shorted together, 5-8 shorted together.

RECOMMENDED OPERATING CONDITIONS

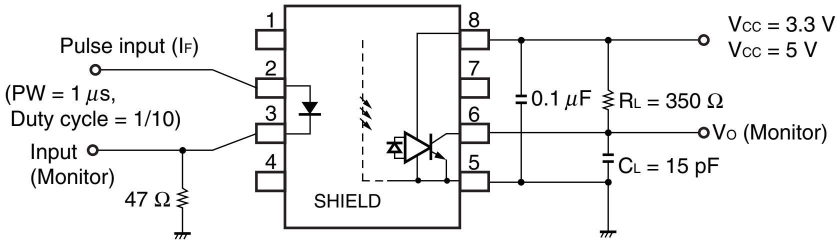
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Low Level Forward Voltage	$V_{F(OFF)}$	–2		0.8	V
High Level Forward Current	$I_{F(ON)}$	8	10	12	mA
Supply Voltage	V_{CC}	2.7		5.5	V
Pull-up Resistor	R_L	330		4k	Ω

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

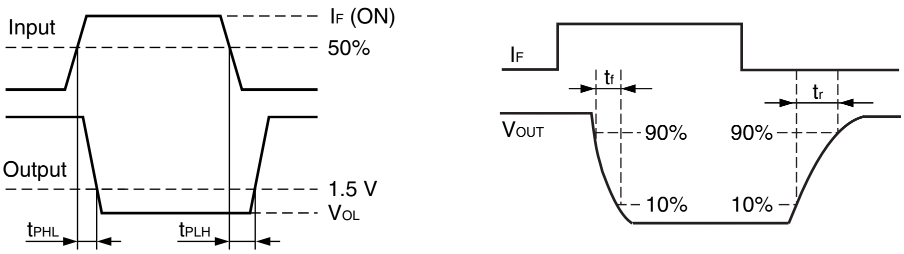
Parameter		Symbol	Conditions		MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C		1.3	1.56	1.8	V
	Reverse Current	I_R	V_R = 3 V, T_A = 25°C				10	μA
	Terminal Capacitance	C_t	f = 1 MHz, V_F = 0 V, T_A = 25°C			30		pF
Detector	High Level Output Current	I_{OH}	V_{CC} = V_O = 3.3 V, 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 = 10 mA, I_{OL} = 13 mA			0.2	0.6	V
			V_{CC} = 5.5 V, I_F = 10 mA, I_{OL} = 13 mA					
	High Level Supply Current	I_{CCH}	V_{CC} = 3.3 V, I_F = 0 mA, V_O = open			2	7	mA
			V_{CC} = 5.5 V, I_F = 0 mA, V_O = open			3	7	
	Low Level Supply Current	I_{CCL}	V_{CC} = 3.3 V, I_F = 10 mA, V_O = open			4	10	mA
			V_{CC} = 5.5 V, I_F = 10 mA, V_O = open			5	10	
Coupled	Threshold Input Voltage (H → L)	I_{FHL}	V_{CC} = 3.3 V, R_L = 350 Ω, V_O = 0.8 V			2	5	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			1.0		pF
	Propagation Delay Time (H → L) *2	t_{PHL}	V_{CC} = 3.3 V, I_F = 10 mA, R_L = 350 Ω, C_L = 15 pF	T_A = 25°C		45	75	ns
				T_A = –40°C to 110°C			100	
			V_{CC} = 5 V, I_F = 10 mA, R_L = 350 Ω, C_L = 15 pF	T_A = 25°C		45	75	
				T_A = –40°C to 110°C			100	
	Propagation Delay Time (L → H) *2	t_{PLH}	V_{CC} = 3.3 V, I_F = 10 mA, R_L = 350 Ω, C_L = 15 pF	T_A = 25°C		40	75	ns
				T_A = –40°C to 110°C			100	
			V_{CC} = 5 V, I_F = 10 mA, R_L = 350 Ω, C_L = 15 pF	T_A = 25°C		40	75	
				T_A = –40°C to 110°C			100	
	Pulse Width Distortion (PWD)*2	$\|t_{PHL}-t_{PLH}\|$	V_{CC} = 3.3/5 V, I_F = 10 mA, R_L = 350 Ω, C_L = 15 pF			5	35	ns
	Propagation Delay Skew*2	t_{psk}					40	
	Rise Time*2	t_r				20		
	Fall Time*2	t_f				5		
	Common Mode Transient Immunity at High Level Output*3	CM_H	V_{CC} = 3.3/5 V, I_F = 0 mA, V_O > 2 V, R_L = 350 Ω, V_{CM} = 1 kV, T_A = 25°C		15	20		kV/μs
	Common Mode Transient Immunity at Low Level Output*3	CM_L	V_{CC} = 3.3/5 V, I_F = 10 mA, V_O < 0.8 V, R_L = 350 Ω, V_{CM} = 1 kV, T_A = 25°C		15	20		kV/μs

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

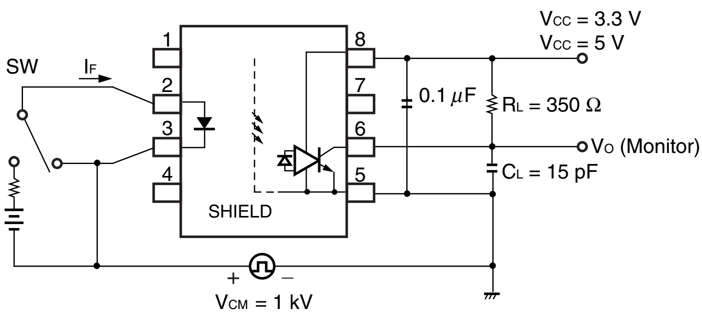
*2. Test circuit for propagation delay time

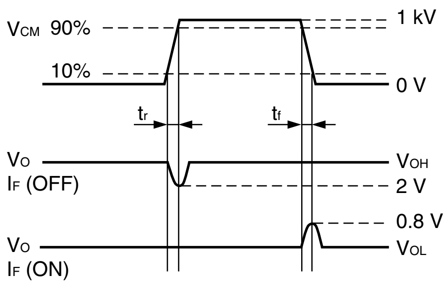


Remark C_L includes probe and stray wiring capacitance.



*3. Test circuit for common mode transient immunity

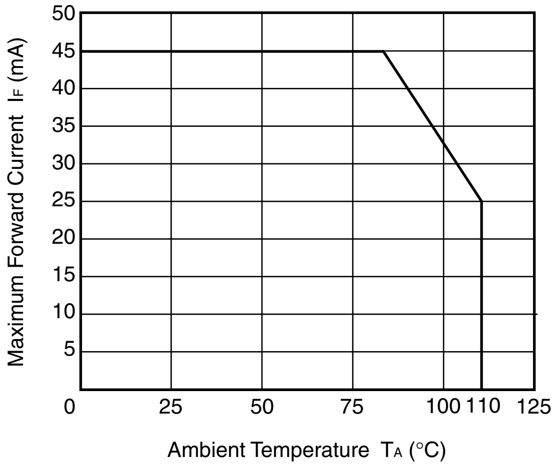




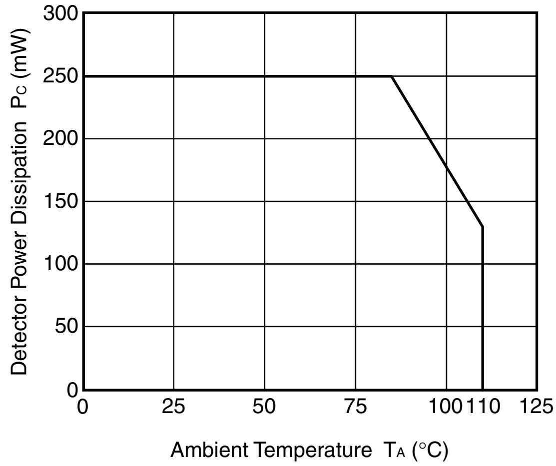
Remark C_L includes probe and stray wiring capacitance.

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

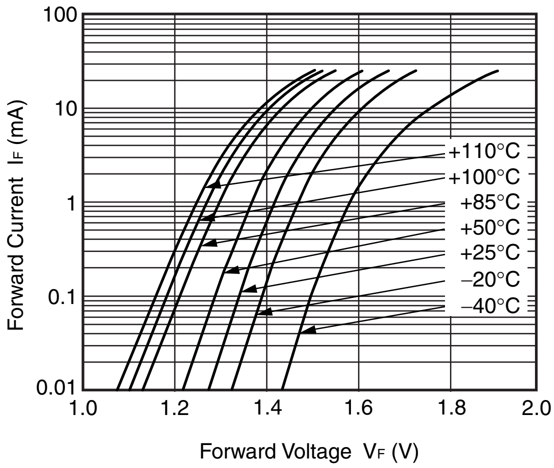
MAXIMUM FORWARD CURRENT
vs. AMBIENT TEMPERATURE



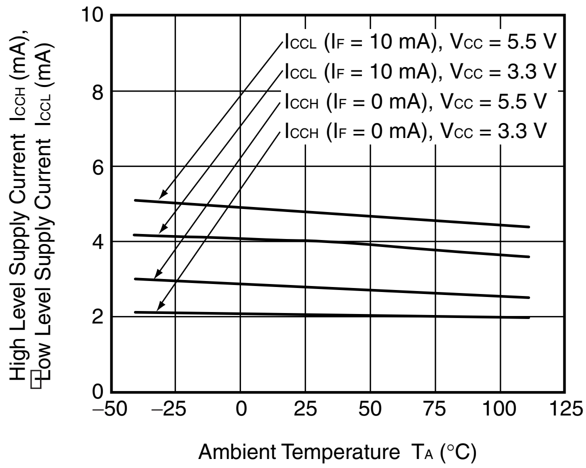
DETECTOR POWER DISSIPATION
vs. AMBIENT TEMPERATURE



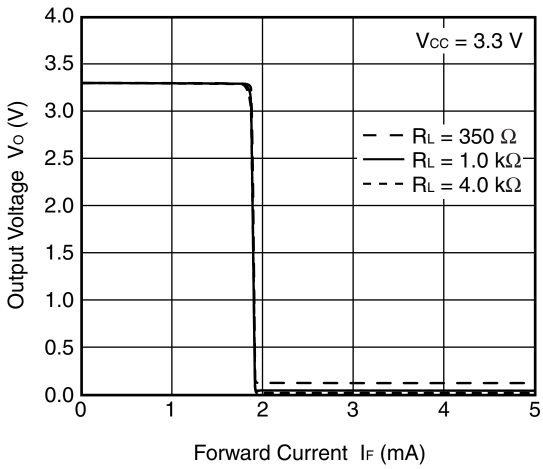
FORWARD CURRENT vs.
FORWARD VOLTAGE



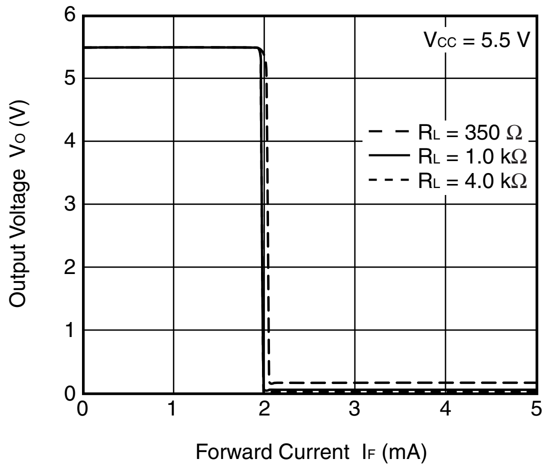
SUPPLY CURRENT vs.
AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs.
FORWARD CURRENT

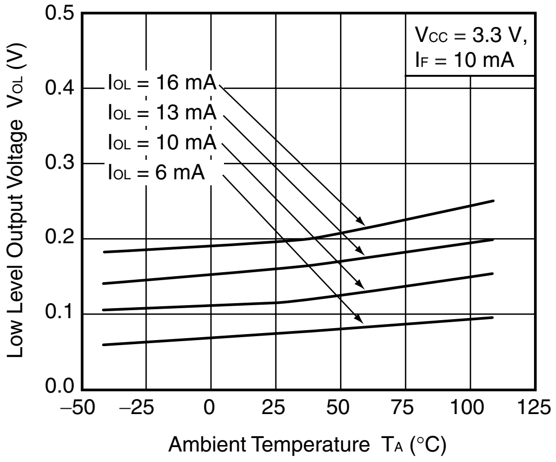


OUTPUT VOLTAGE vs.
FORWARD CURRENT

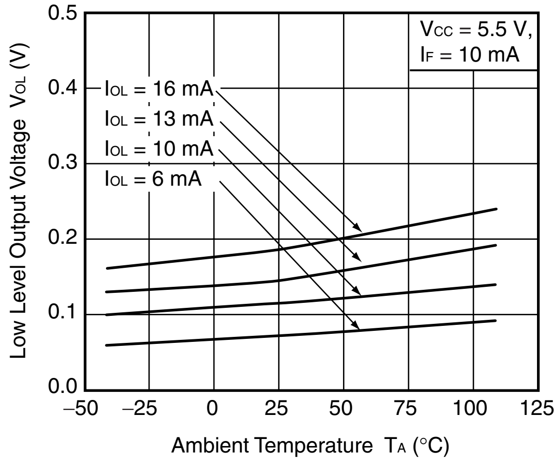


Remark The graphs indicate nominal characteristics.

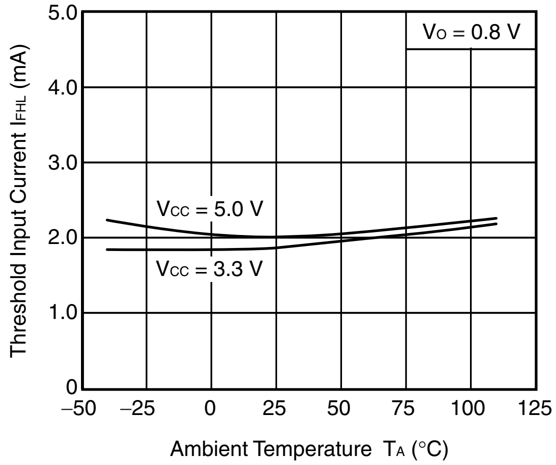
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



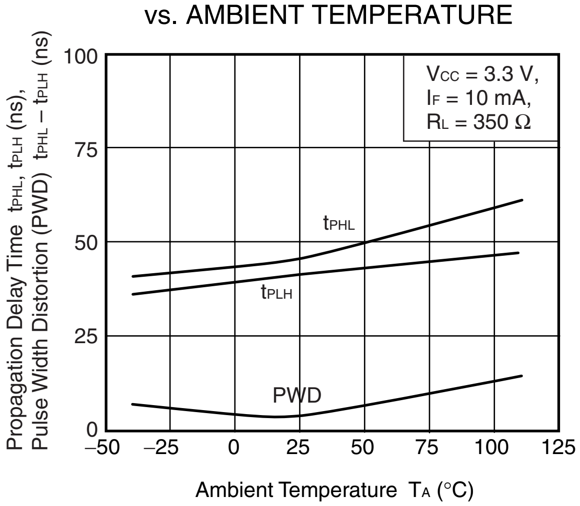
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



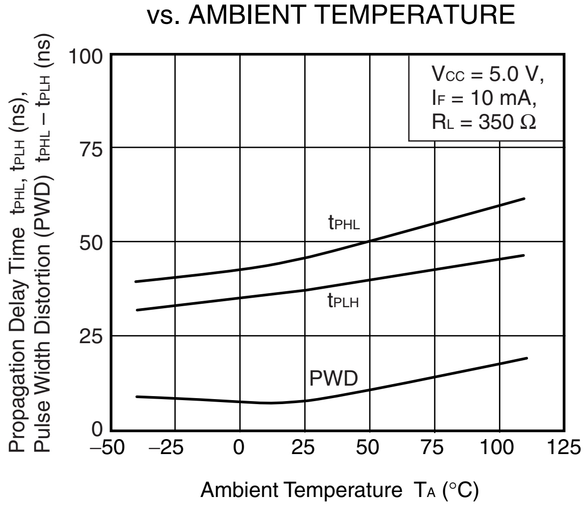
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



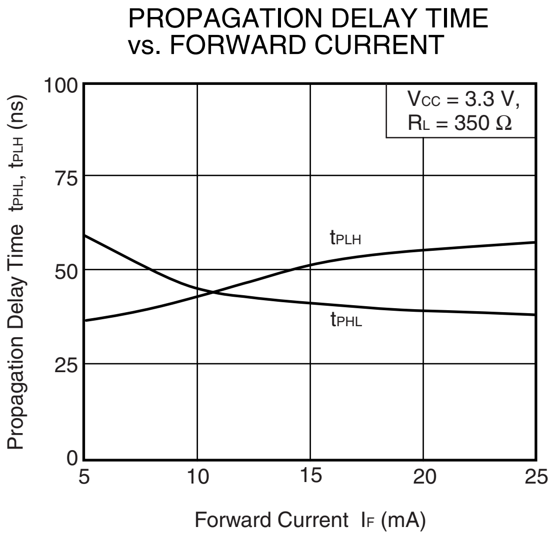
PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE

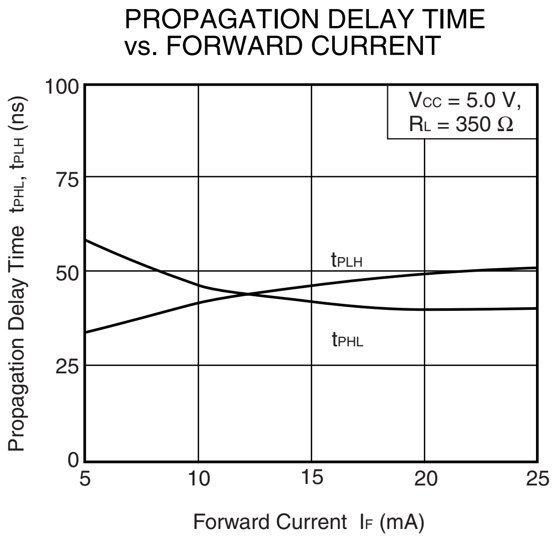


PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



Remark The graphs indicate nominal characteristics.

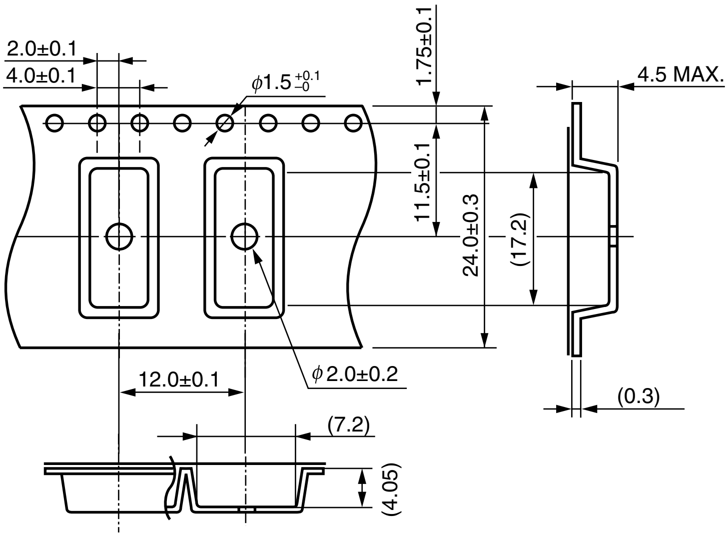




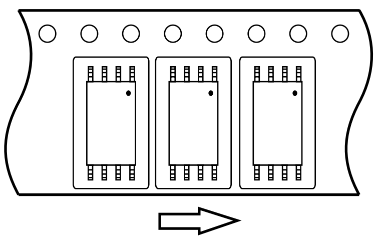
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

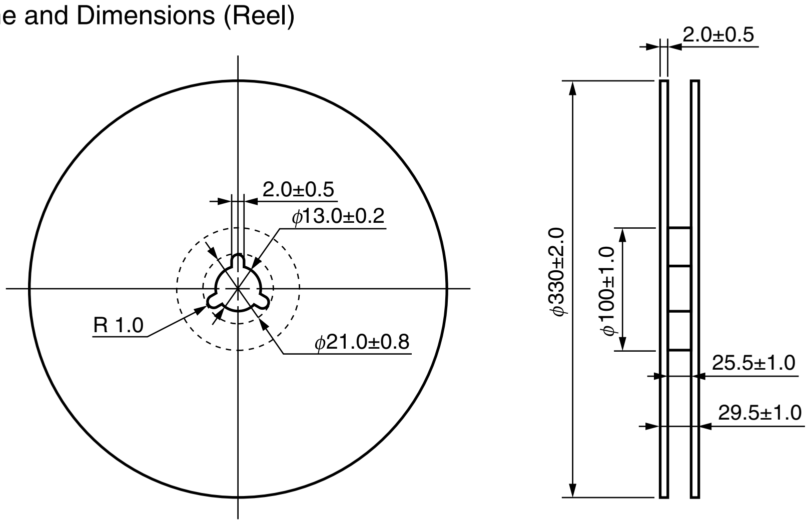
Outline and Dimensions (Tape)



Tape Direction

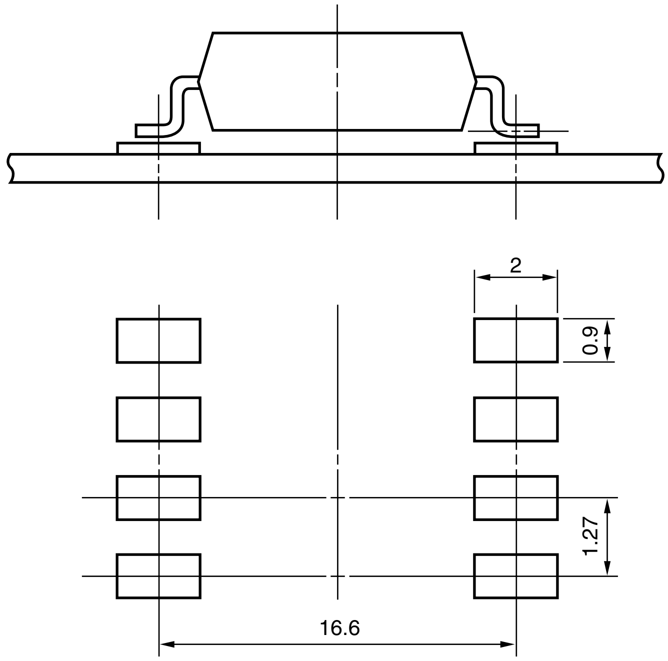


Outline and Dimensions (Reel)



Packing: 1 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



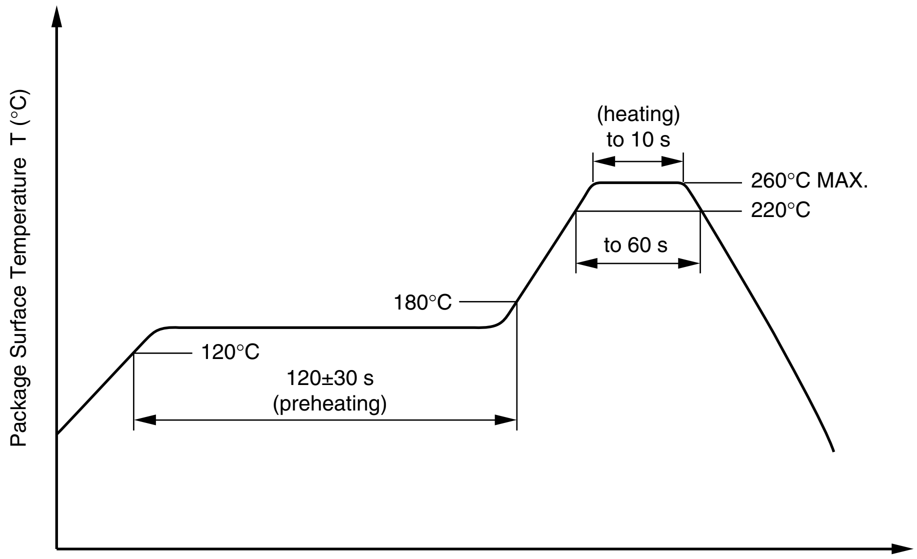
NOTES ON HANDLING

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



(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. Pin 1, 4 (which is an NC[*1] pin) can either be connected directly to the GND pin on the LED side or left open.
   Also, Pin 7 (which is an NC[*1] 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.
   Note: *1. NC: Non-Connection (No Connection).
4. Avoid storage at a high temperature and high humidity.

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	PS9924 Data Sheet

Rev.	Date	Description	
		Page	**Summary**
0.01	Apr 06, 2012	–	First edition issued
1.00	Jun 28, 2013	p.5	Modification of **ELECTRICAL CHARACTERISTICS**
		pp.7 to 9	Addition of **TYPICAL CHARACTERISTICS**

NOTICE

CEL Headquarters • 4590 Patrick Henry Drive, Santa Clara, CA 95054 • Phone (408) 919-2500 • www.cel.com

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