To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

PHOTOCOUPLER
PS9851-1,-2

HIGH NOISE REDUCTION, 15 Mbps CMOS OUTPUT TYPE 8-PIN SSOP (SO-8) HIGH-SPEED PHOTOCOUPLER

–NEPOC Series–

DESCRIPTION

The PS9851-1, -2 are optically coupled isolators containing GaAlAs LED on the input side and a CMOS output IC on the output side.

They are high common mode transient immunity (CMR), high-speed CMOS output type photocouplers designed for high-speed logic interface circuits.

FEATURES

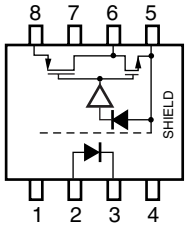
- High-speed response (15 Mbps)
- Operable at high temperature (–40 to +100°C)
- High common mode transient immunity (CM_H, CM_L = ±20 kV/μs TYP.)
- High isolation voltage (BV = 2 500 Vr.m.s.)
- Pulse width distortion ($|t_{PHL}-t_{PLH}|$ = 3 ns TYP.)
- Ordering number of tape product : PS9851-1-F3, F4: 1 500 pcs/reel
  : PS9851-2-F3, F4: 1 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved No.40008347 (Option)

APPLICATIONS

- FA Network
- Measurement equipment
- PDP

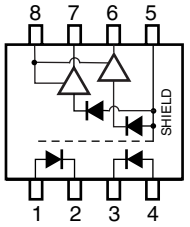
PIN CONNECTION
(Top View)

PS9851-1



1. NC
2. Anode
3. Cathode
4. NC
5. GND
6. V_O
7. NC
8. V_{DD}

PS9851-2



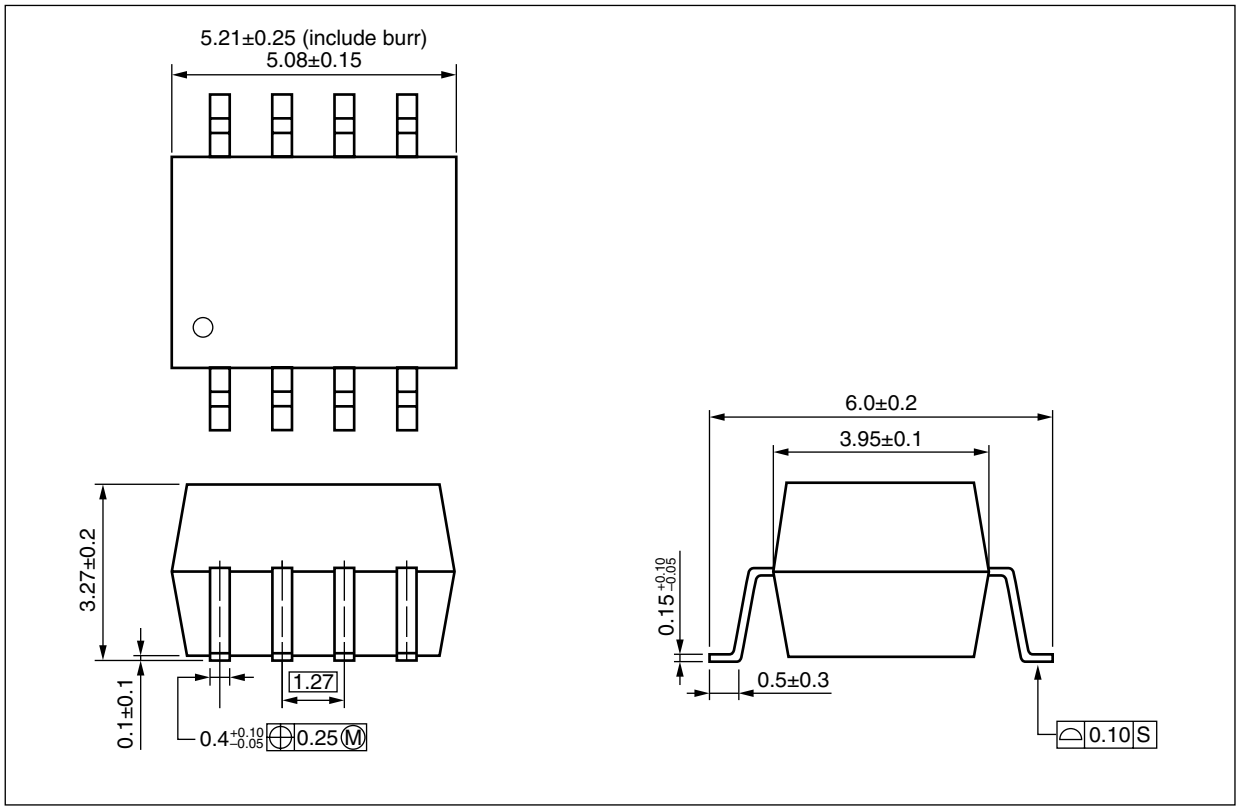
1. Anode1
2. Cathode1
3. Cathode2
4. Anode2
5. GND
6. $V_{O}2$
7. $V_{O}1$
8. V_{DD}

Document No. PN10493EJ03V0DS (3rd edition)
Date Published August 2008 NS
Printed in Japan

The mark <R> shows major revised points.

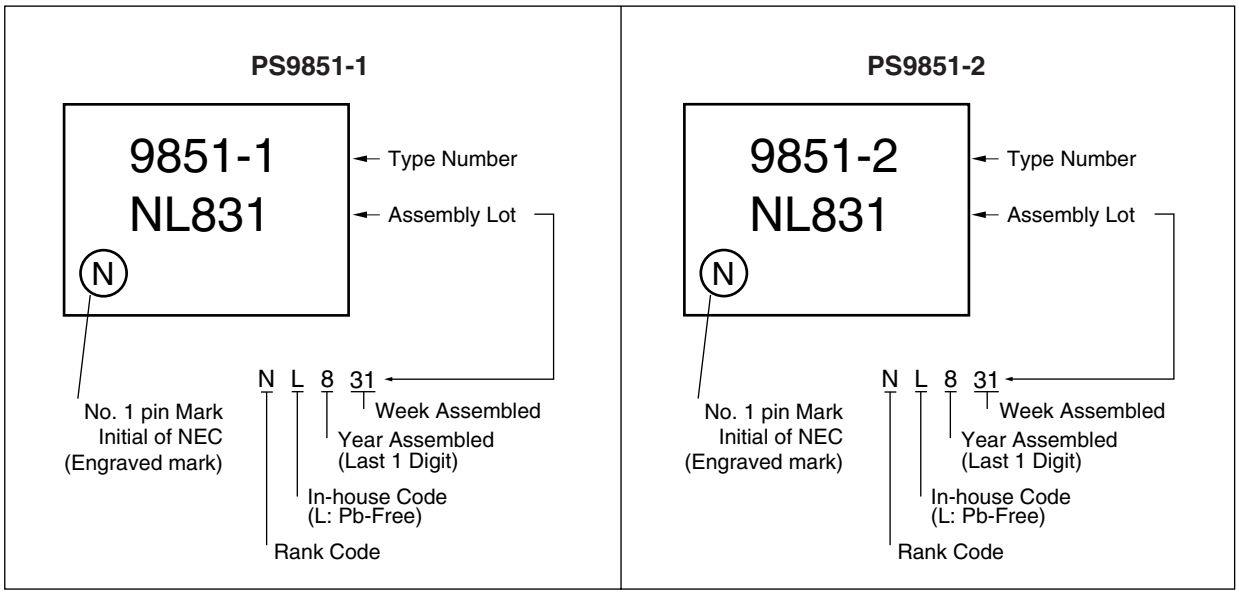
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

PACKAGE DIMENSIONS (UNIT: mm)

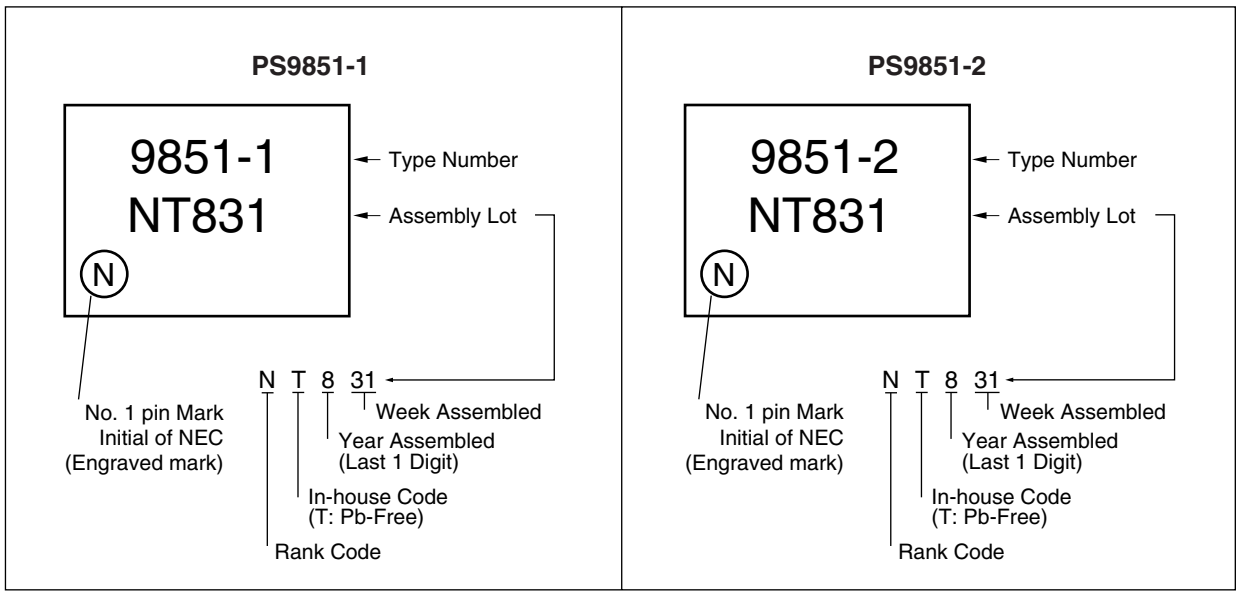


<R> **MARKING EXAMPLE**

SnBi PLATING



Ni/Pd/Au PLATING



<R> **ORDERING INFORMATION**

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9851-1	PS9851-1-A	Pb-Free (SnBi)	20 pcs (Tape 20 pcs cut)	Standard products (UL approved)	PS9851-1
PS9851-1-F3	PS9851-1-F3-A		Embossed Tape 1 500 pcs/reel		
PS9851-1-F4	PS9851-1-F4-A				
PS9851-2	PS9851-2-A		20 pcs (Tape 20 pcs cut)		PS9851-2
PS9851-2-F3	PS9851-2-F3-A		Embossed Tape 1 500 pcs/reel		
PS9851-2-F4	PS9851-2-F4-A				
PS9851-1-V	PS9851-1-V-A		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2 (VDE0884 Part2) approved (Option)	PS9851-1
PS9851-1-V-F3	PS9851-1-V-F3-A		Embossed Tape 1 500 pcs/reel		
PS9851-1-V-F4	PS9851-1-V-F4-A				
PS9851-2-V	PS9851-2-V-A		20 pcs (Tape 20 pcs cut)		PS9851-2
PS9851-2-V-F3	PS9851-2-V-F3-A		Embossed Tape 1 500 pcs/reel		
PS9851-2-V-F4	PS9851-2-V-F4-A				
PS9851-1	PS9851-1-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products (UL approved)	PS9851-1
PS9851-1-F3	PS9851-1-F3-AX		Embossed Tape 1 500 pcs/reel		
PS9851-1-F4	PS9851-1-F4-AX				
PS9851-2	PS9851-2-AX		20 pcs (Tape 20 pcs cut)		PS9851-2
PS9851-2-F3	PS9851-2-F3-AX		Embossed Tape 1 500 pcs/reel		
PS9851-2-F4	PS9851-2-F4-AX				
PS9851-1-V	PS9851-1-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2 (VDE0884 Part2) approved (Option)	PS9851-1
PS9851-1-V-F3	PS9851-1-V-F3-AX		Embossed Tape 1 500 pcs/reel		
PS9851-1-V-F4	PS9851-1-V-F4-AX				
PS9851-2-V	PS9851-2-V-AX		20 pcs (Tape 20 pcs cut)		PS9851-2
PS9851-2-V-F3	PS9851-2-V-F3-AX		Embossed Tape 1 500 pcs/reel		
PS9851-2-V-F4	PS9851-2-V-F4-AX				

***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	20	mA
	Reverse Voltage	V_R	5	V
Detector	Supply Voltage	V_{DD}	0 to 5.5	V
	Output Voltage	V_O	–0.5 to V_{DD}+0.5	V
	Output Current	I_O	2	mA
Isolation Voltage *2		BV	2 500	Vr.m.s.
Operating Ambient Temperature		T_A	–40 to +100	°C
Storage Temperature		T_{stg}	–55 to +125	°C

***1** Reduced to 0.33 mA/°C at T_A = 85°C or more for PS9851-2.

***2** 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 (T_A = 25°C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward Current	I_F	10		16	mA
Supply Voltage	V_{DD}	4.5	5.0	5.5	V

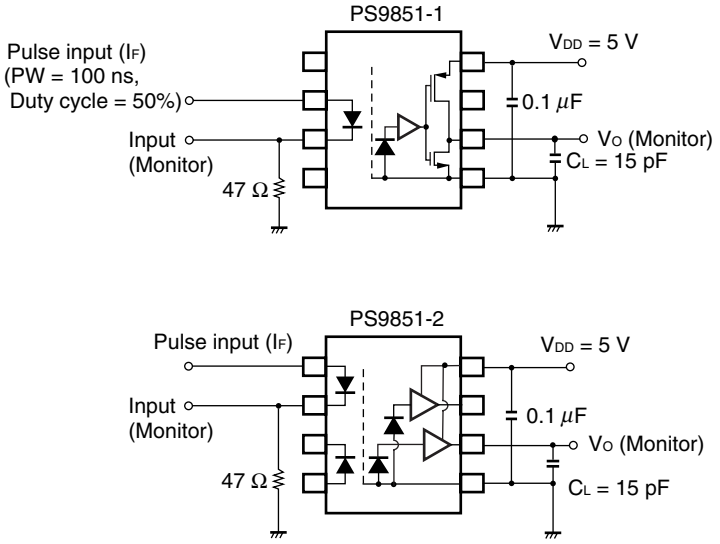
ELECTRICAL CHARACTERISTICS (T_A = –40 to +100°C, V_{DD} = 4.5 to 5.5 V, unless otherwise specified)

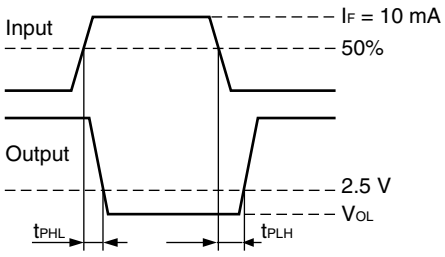
Parameter		Symbol	Conditions	MIN.	TYP. *1	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C		1.6	1.9	V
	Reverse Current	I_R	V_R = 3 V, T_A = 25°C			10	μA
	Terminal Capacitance	C_t	V = 0 V, f = 1 MHz, T_A = 25°C		30		pF
Detector	High Level Supply Current	I_{DDH}	I_F = 0 mA (1ch)		2.5	5	mA/ch
	Low Level Supply Current	I_{DDL}	I_F = 10 mA (1ch)		2	5	
	High Level Output Voltage	V_{OH}	I_O = –20μA, I_F = 0 mA	4.0	5.0		V
	Low Level Output Voltage *2	V_{OL}	I_O = 20μA, I_F = 10 mA		0	0.1	
Coupled	Threshold Input Current	I_{FHL}	V_O < 1 V		2.8	6	mA
	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) *3	t_{PHL}	I_F = 10 mA, V_{DD} = 5 V, C_L = 15 pF, CMOS Levels		34	60	ns
	Propagation Delay Time (L → H) *3	t_{PLH}			37	60	
	Pulse Width	PW		100			
	Pulse Width Distortion (PWD) *3	$\lvert t_{PHL}-t_{PLH} \rvert$			3	30	
	Propagation Delay Skew	t_{PSK}				40	
	Rise Time	t_r			4		
	Fall Time	t_f			4		
	Common Mode Transient Immunity at High Level Output *4	CM_H	V_{DD} = 5 V, I_F = 0 mA, V_{CM} = 1 kV, V_O > 4 V, T_A = 25°C	10	20		kV/μs
	Common Mode Transient Immunity at Low Level Output *4	CM_L	V_{DD} = 5 V, I_F = 10 mA, V_{CM} = 1 kV, V_O < 1 V, T_A = 25°C	10	20		

***1** Typical values at T_A = 25°C

***2** Because V_{OL} of 2 V or more may be output when LED current input and when output supply, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

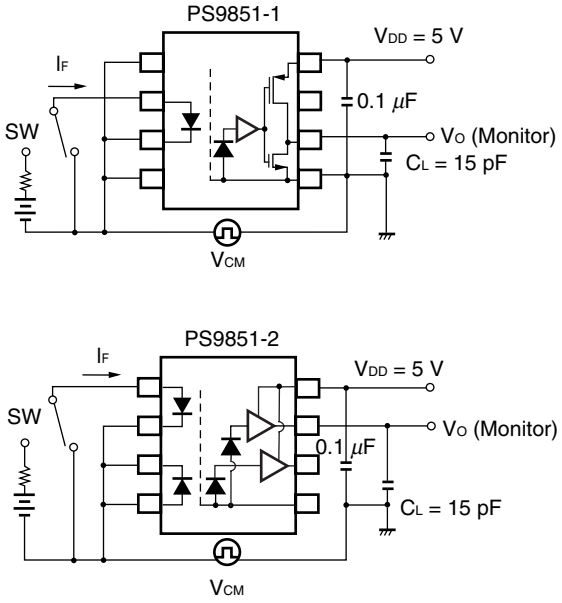
***3** Test circuit for propagation delay time

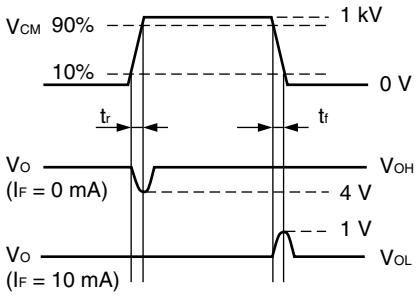




Remark C_L includes probe and stray wiring capacitance.

***4** Test circuit for common mode transient immunity





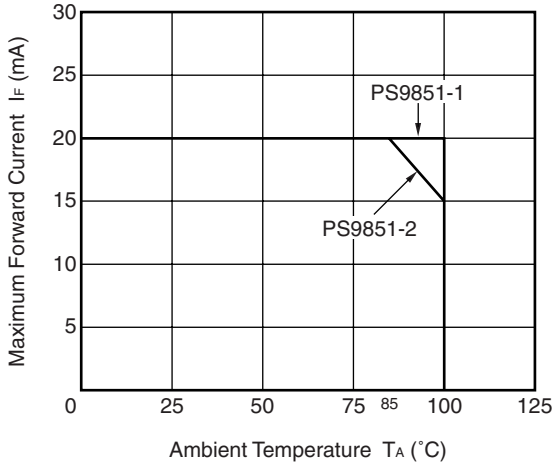
Remark C_L includes probe and stray wiring capacitance.

USAGE CAUTIONS

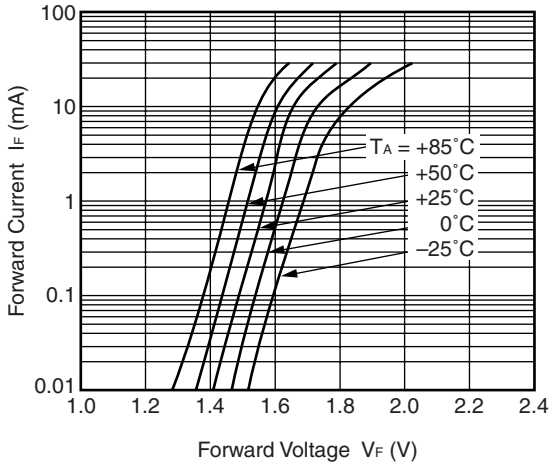
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 μF is used between V_{DD} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
3. Avoid storage at a high temperature and high humidity.

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

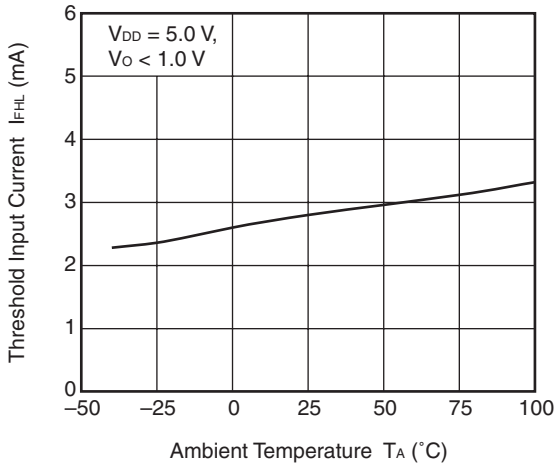
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



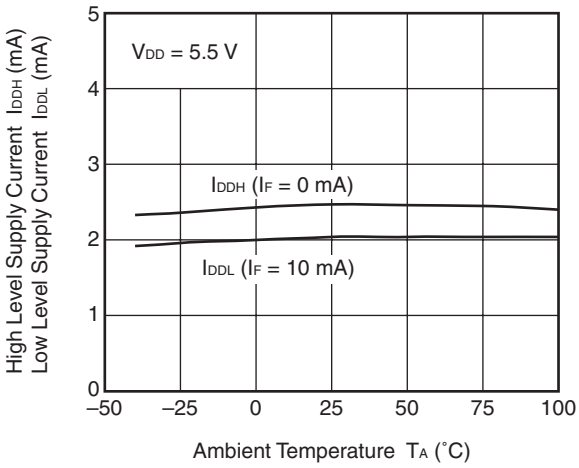
FORWARD CURRENT vs. FORWARD VOLTAGE



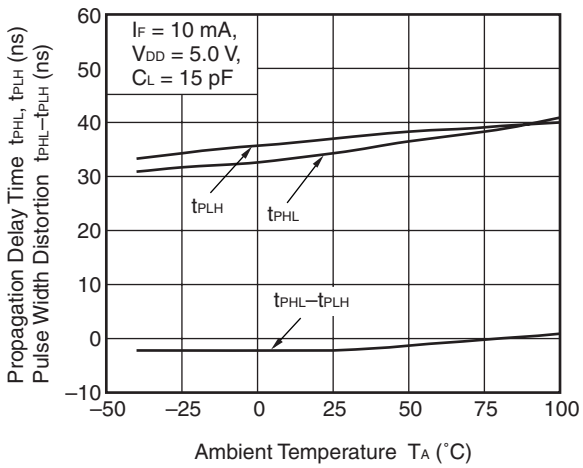
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



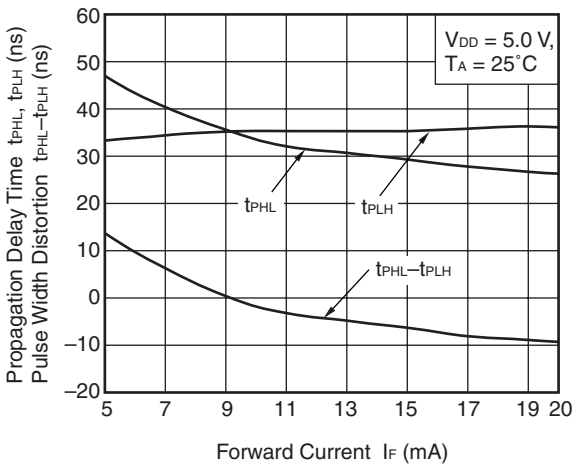
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



tPHL, tPLH, tPHL–tPLH vs. AMBIENT TEMPERATURE



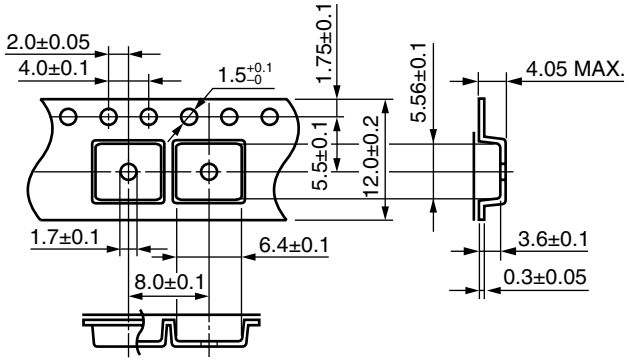
tPHL, tPLH, tPHL–tPLH vs. FORWARD CURRENT



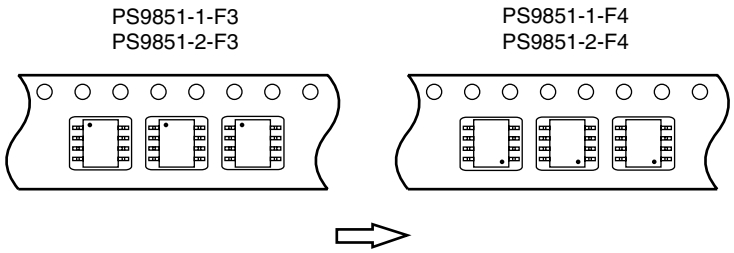
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

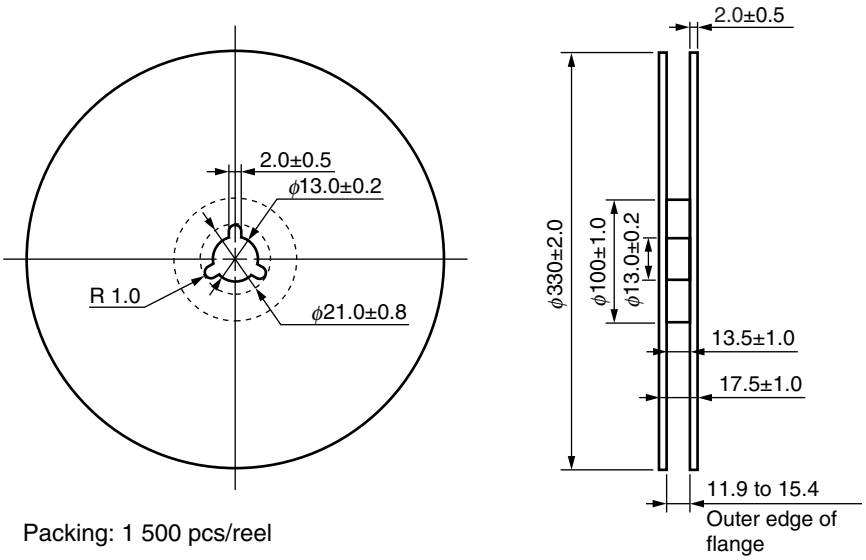
Outline and Dimensions (Tape)



Taping Direction

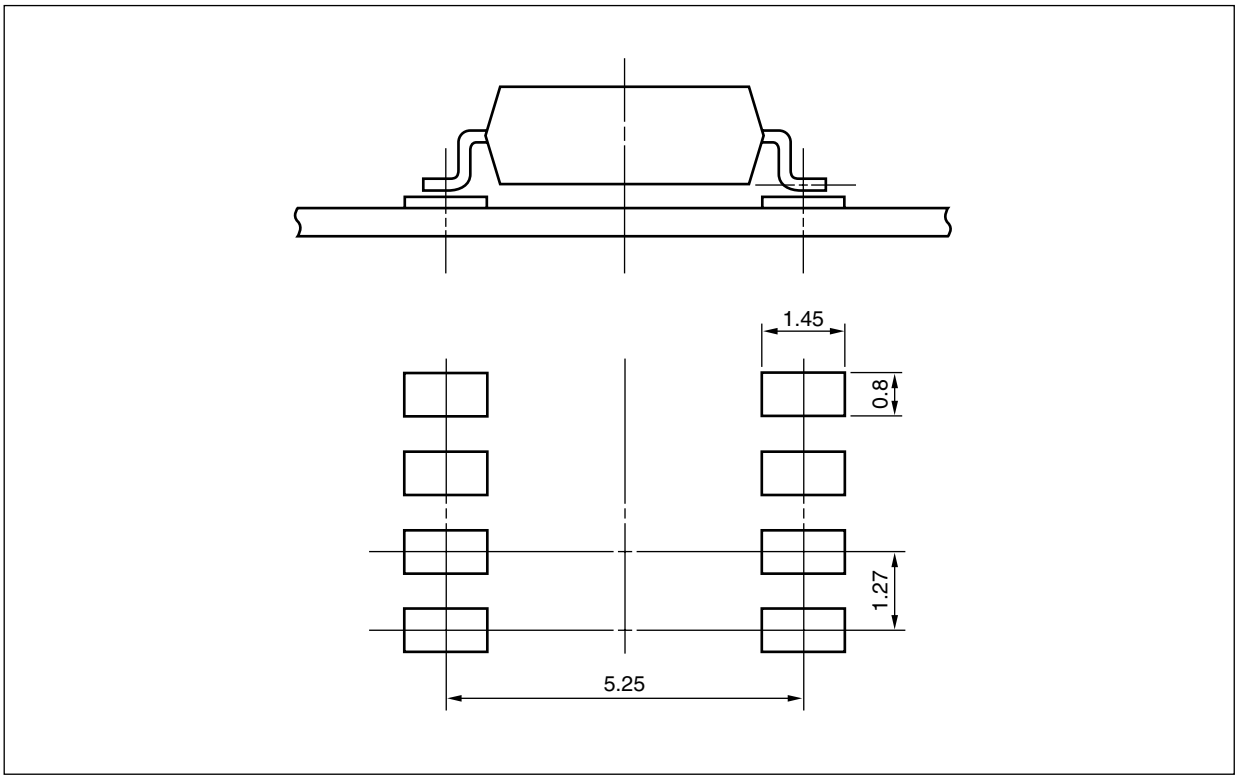


Outline and Dimensions (Reel)



Packing: 1 500 pcs/reel

<R> **RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)**



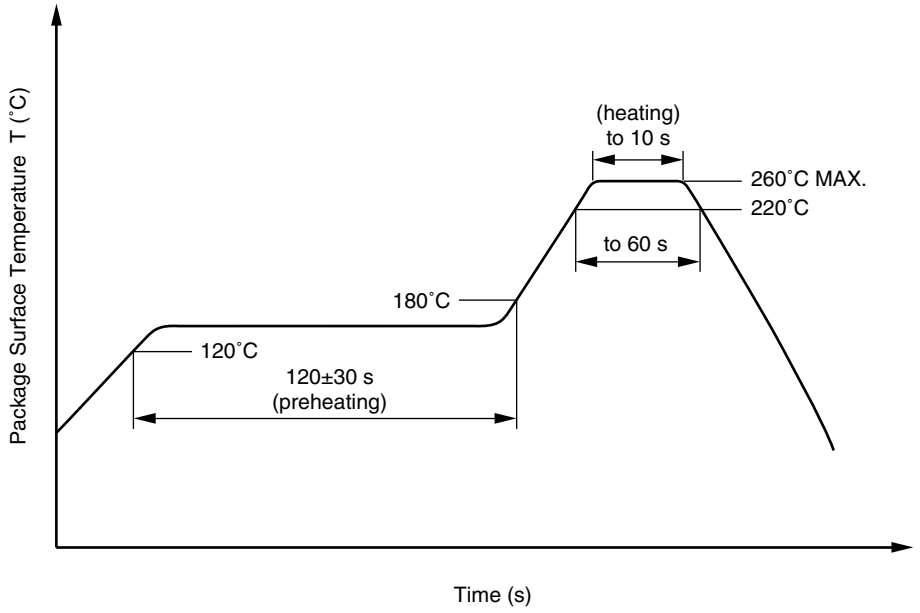
NOTES ON HANDLING

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.

(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 at startup, the CMOS IC on output side 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 ≤ 300 Vr.m.s. for rated line voltages ≤ 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) $U_{pr} = 1.5 \times U_{IORM}$, $P_d < 5$ pC	 U_{IORM} U_{pr}	 566 849	 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}	1 061	V_{peak}
Highest permissible overvoltage	U_{TR}	4 000	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)	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 +100	°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.	 150 150 600 10^9	 °C mA mW Ω

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