



**THE DATASHEET OF
PS9851-1-F3-AX**



PS9851-1, PS9851-2

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

Data Sheet
 R08DS0107EJ0400
 Rev4.00
 Apr 09, 2013

DESCRIPTION

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

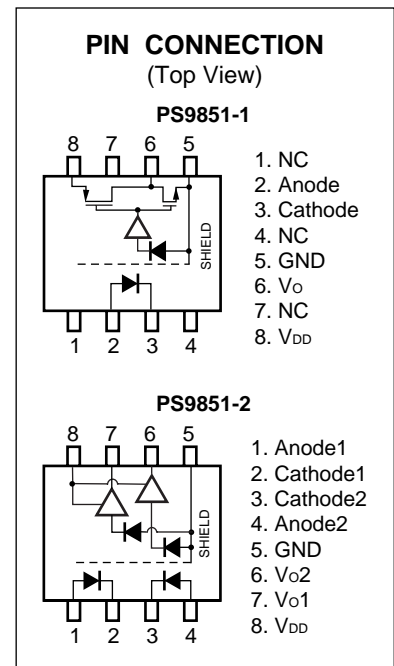
They are high common mode transient immunity (CMR), high-speed CMOS output type photocouplers designed for high-speed logic interface circuits.

FEATURES

- High-speed response (15 Mbps)
- Operable at high temperature (-40 to +100°C)
- High common mode transient immunity ($CM_H, CM_L = \pm 20 \text{ kV}/\mu\text{s}$ TYP.)
- High isolation voltage ($BV = 2\,500 \text{ V r.m.s.}$)
- Pulse width distortion ($|t_{PHL} - t_{PLH}| = 3 \text{ ns}$ TYP.)
- Ordering number of tape product : PS9851-1-F3: 1 500 pcs/reel
- : PS9851-2-F3: 1 500 pcs/reel
- <R> • Pb-Free product
- Safety standards
 - UL approved: No. E72422
 - DIN EN 60747-5-5 (VDE 0884-5) approved (Option)

APPLICATIONS

- FA Network
- Measurement equipment
- PDP

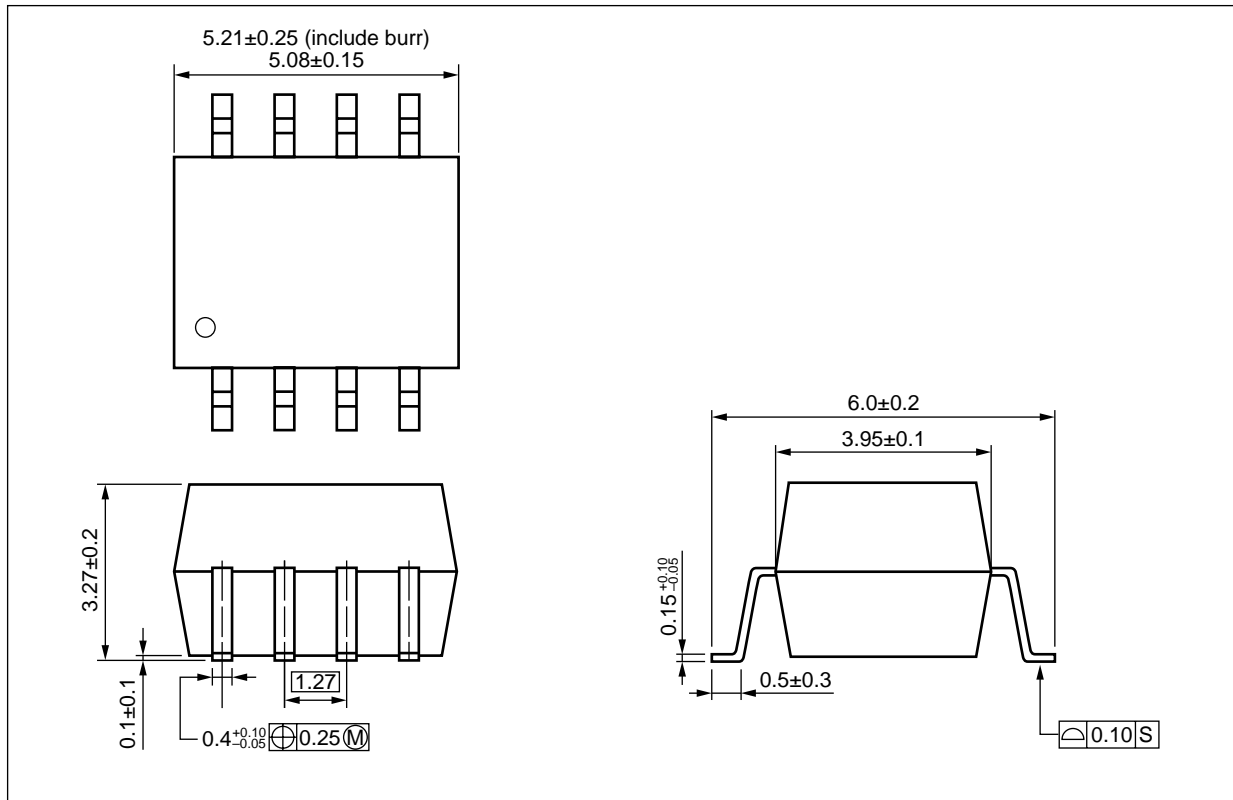


The mark <R> shows major revised points.

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

PS9851-1, PS9851-2

PACKAGE DIMENSIONS (UNIT: mm)



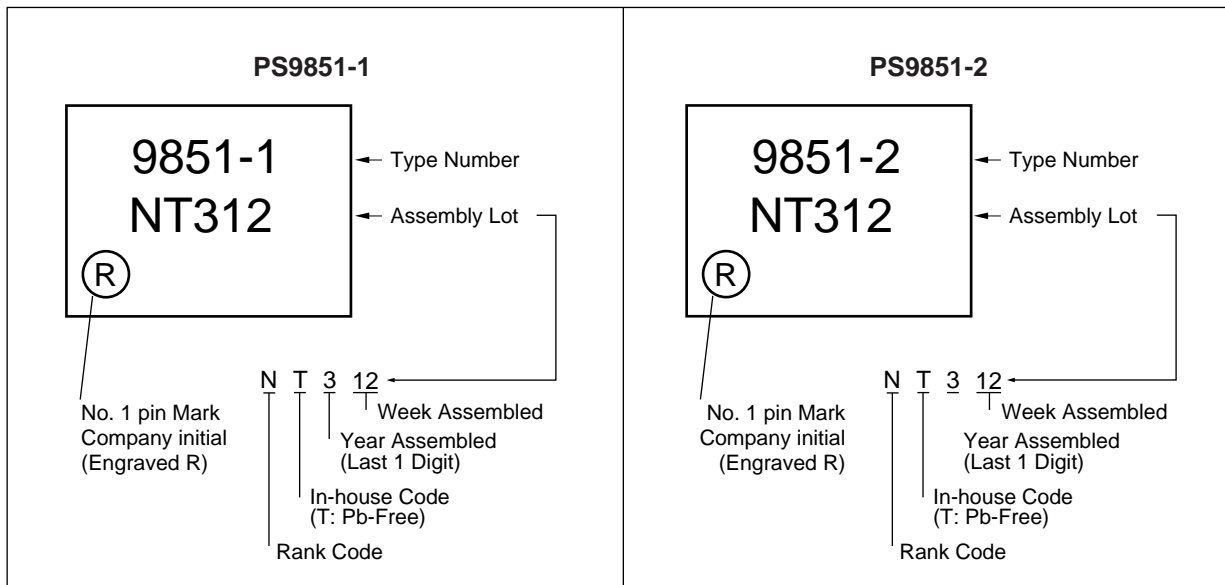
<R> **PHOTOCOUPLER CONSTRUCTION**

Parameter	Unit (MIN.)
Air Distance	4.0 mm
Outer Creepage Distance	4.0 mm
Isolation Distance	0.2 mm

PS9851-1, PS9851-2

<R> MARKING EXAMPLE

Ni/Pd/Au PLATING



PS9851-1, PS9851-2

<R> ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number ^{*1}
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		
PS9851-2	PS9851-2-AX		20 pcs (Tape 20 pcs cut)		PS9851-2
PS9851-2-F3	PS9851-2-F3-AX		Embossed Tape 1 500 pcs/reel		
PS9851-1-V	PS9851-1-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN 60747-5-5 (VDE 0884-5)	PS9851-1
PS9851-1-V-F3	PS9851-1-V-F3-AX		Embossed Tape 1 500 pcs/reel		
PS9851-2-V	PS9851-2-V-AX		20 pcs (Tape 20 pcs cut)	approved(Optional)	PS9851-2
PS9851-2-V-F3	PS9851-2-V-F3-AX		Embossed Tape 1 500 pcs/reel		

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

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, 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	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55 to +125	$^\circ\text{C}$

Notes: *1. Reduced to 0.33 mA/ $^\circ\text{C}$ at $T_A = 85^\circ\text{C}$ or more for PS9851-2.

*2. AC voltage for 1 minute at $T_A = 25^\circ\text{C}$, RH = 60% between input and output.

Pins 1-4 shorted together, 5-8 shorted together.

RECOMMENDED OPERATING CONDITIONS ($T_A = 25^\circ\text{C}$)

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

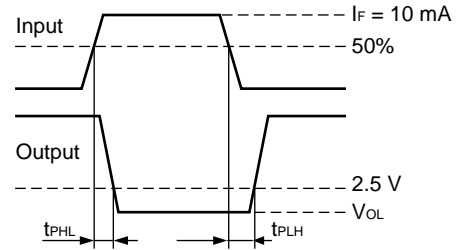
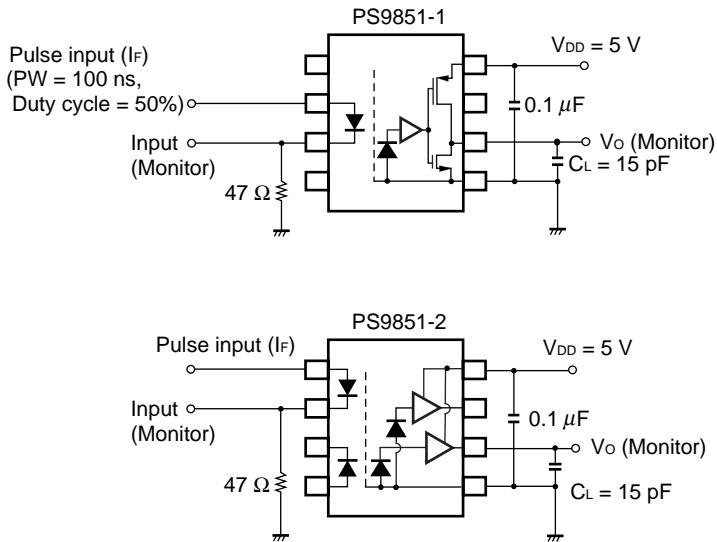
PS9851-1, PS9851-2

<R> ELECTRICAL CHARACTERISTICS ($T_A = -40$ to $+100^\circ\text{C}$, $V_{DD} = 4.5$ to 5.5 V, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit		
Diode	Forward Voltage	V_F	$I_F = 10$ mA, $T_A = 25^\circ\text{C}$		1.6	1.9	V		
	Reverse Current	I_R	$V_R = 3$ V, $T_A = 25^\circ\text{C}$			10	μA		
	Terminal Capacitance	C_t	$V = 0$ V, $f = 1$ MHz, $T_A = 25^\circ\text{C}$		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}	$I_O = -20\mu\text{A}$, $I_F = 0$ mA	4.0	5.0		V		
	Low Level Output Voltage	V_{OL}	$I_O = 20\mu\text{A}$, $I_F = 10$ mA		0	0.1			
Coupled	Threshold Input Voltage	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%, $T_A = 25^\circ\text{C}$	10^{11}			Ω		
	Isolation Capacitance	C_{I-O}	$V = 0$ V, $f = 1$ MHz, $T_A = 25^\circ\text{C}$		0.6		pF		
	Propagation Delay Time (H \rightarrow L) ^{*2}	t_{PHL}	$I_F = 10$ mA, $V_{DD} = 5$ V, $C_L = 15$ pF, CMOS Levels		34	60	ns		
	Propagation Delay Time (L \rightarrow H) ^{*2}	t_{PLH}			37	60			
	Pulse Width Distortion (PWD) ^{*2}	$ t_{PHL} - t_{PLH} $			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 ^{*3}	$ CM_H $		$V_{DD} = 5$ V, $I_F = 0$ mA, $V_{CM} = 1$ kV, $V_O > 4$ V, $T_A = 25^\circ\text{C}$	10	20			kV/ μs
	Common Mode Transient Immunity at Low Level Output ^{*3}	$ CM_L $		$V_{DD} = 5$ V, $I_F = 10$ mA, $V_{CM} = 1$ kV, $V_O < 1$ V, $T_A = 25^\circ\text{C}$	10	20			

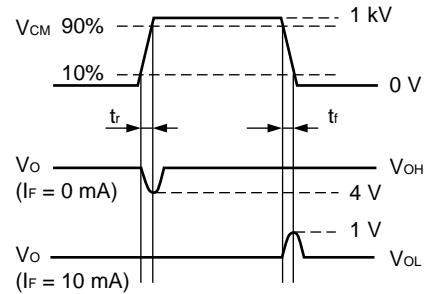
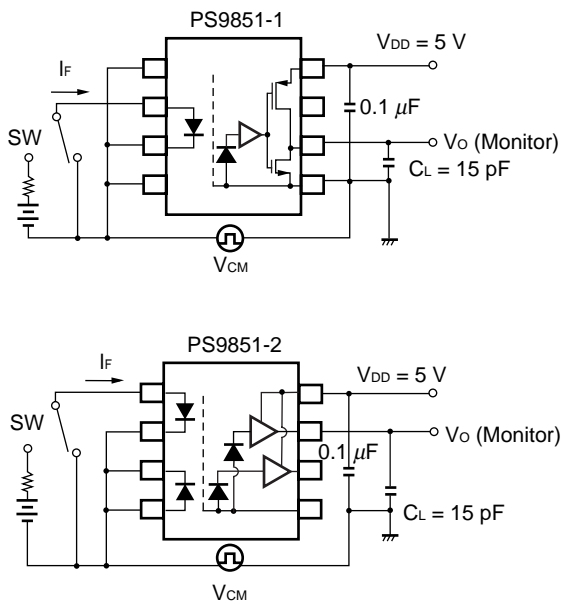
PS9851-1, PS9851-2

Notes: *1. Typical values at $T_A = 25^\circ\text{C}$
 *2 Test circuit for propagation delay time



Remark C_L includes probe and stray wiring capacitance.

Notes: * 3 Test circuit for common mode transient immunity

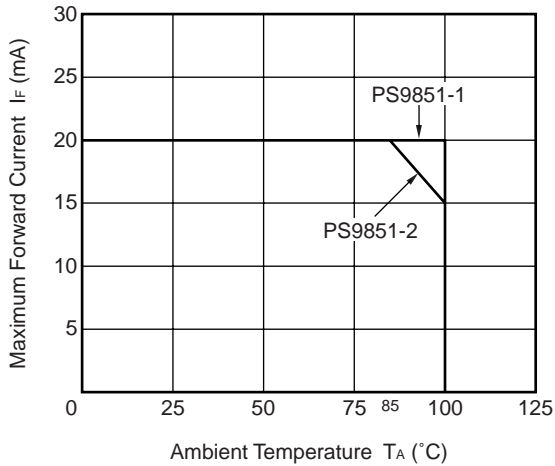


Remark C_L includes probe and stray wiring capacitance.

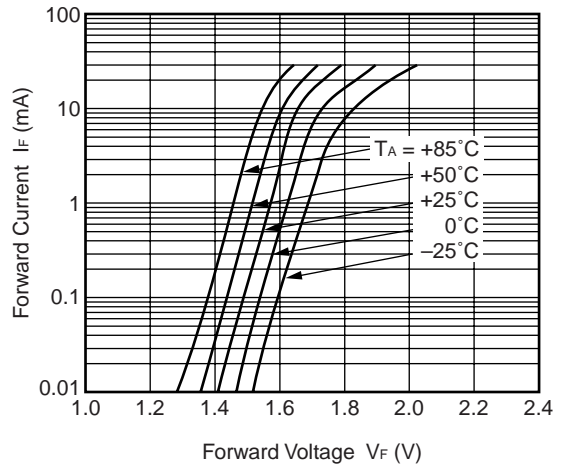
PS9851-1, PS9851-2

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

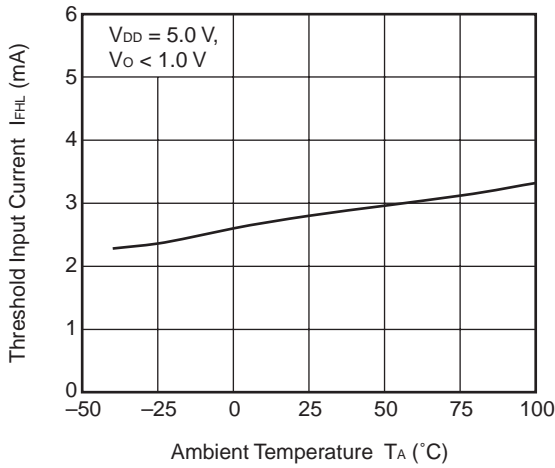
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



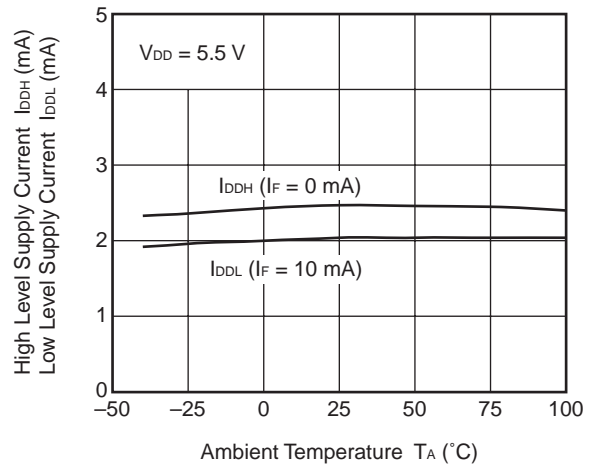
FORWARD CURRENT vs. FORWARD VOLTAGE



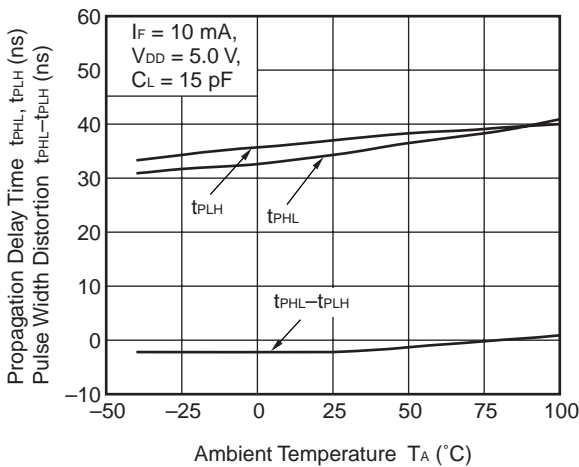
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



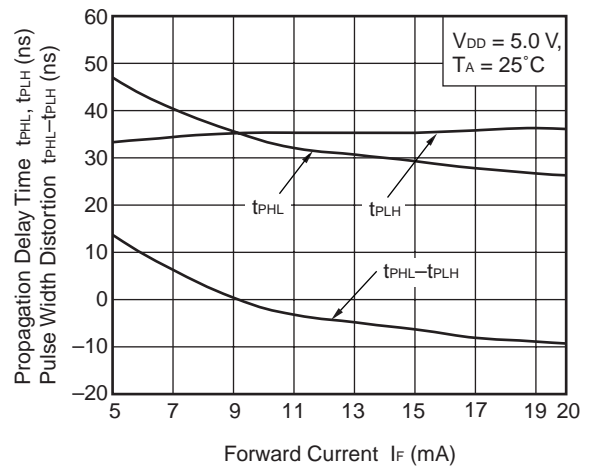
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



t_{PHL}, t_{PLH}, t_{PHL}-t_{PLH} vs. AMBIENT TEMPERATURE



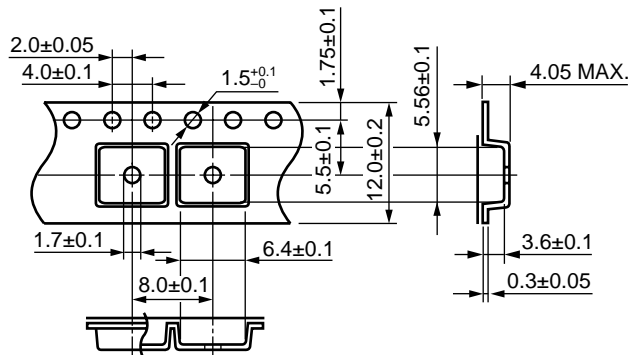
t_{PHL}, t_{PLH}, t_{PHL}-t_{PLH} vs. FORWARD CURRENT



Remark The graphs indicate nominal characteristics.

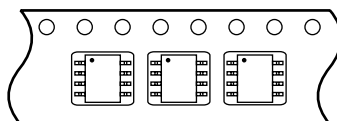
<R> **TAPING SPECIFICATIONS (UNIT: mm)**

Outline and Dimensions (Tape)

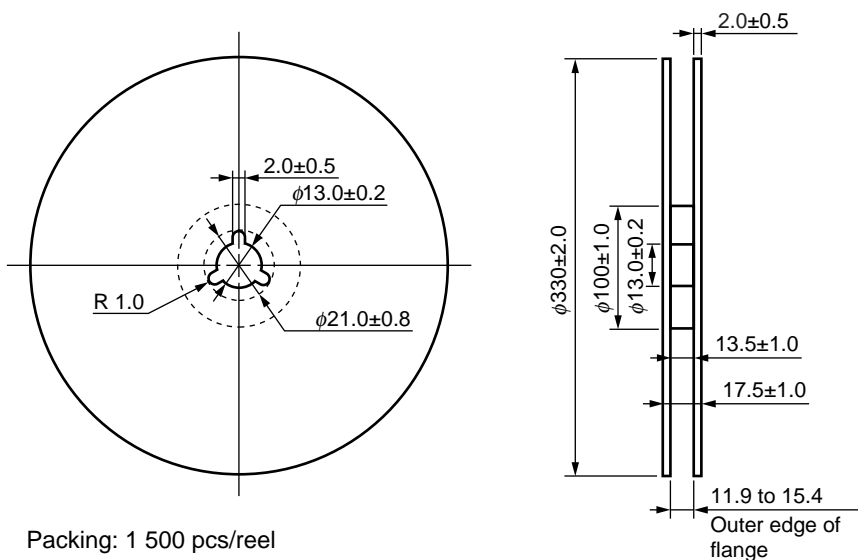


Taping Direction

PS9851-1-F3
PS9851-2-F3

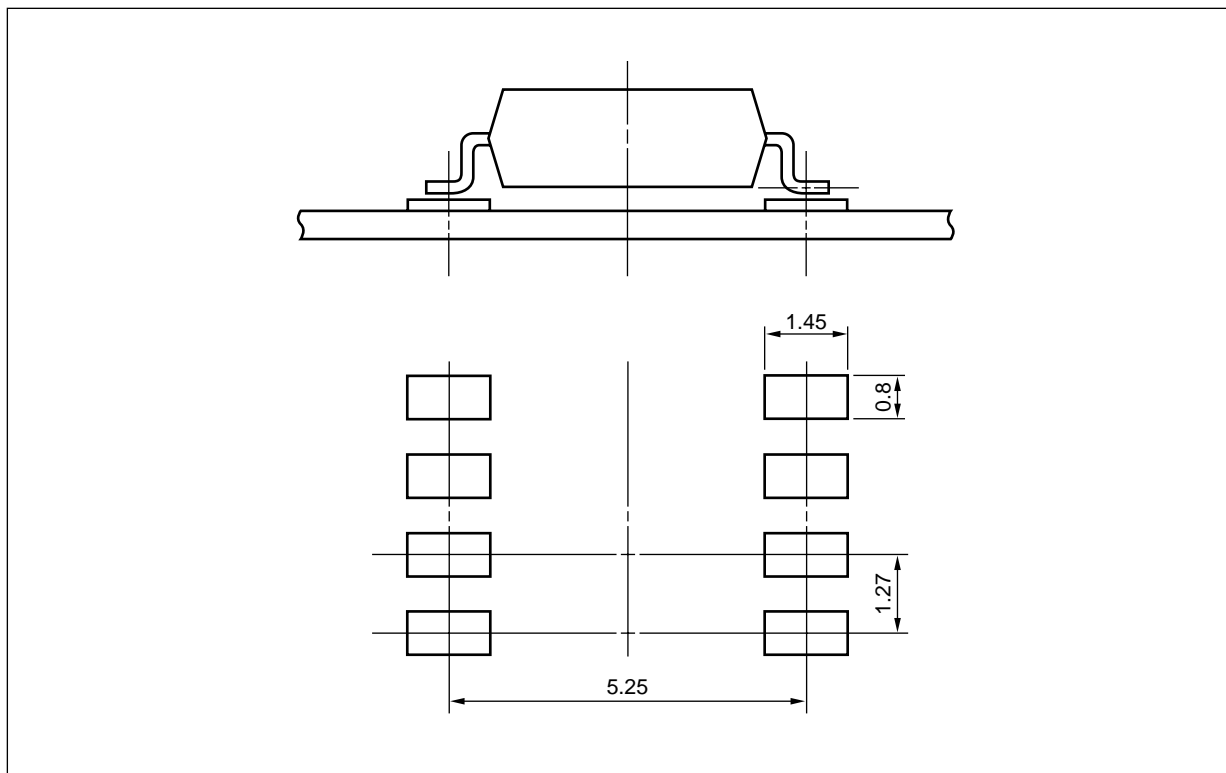


Outline and Dimensions (Reel)



Packing: 1 500 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



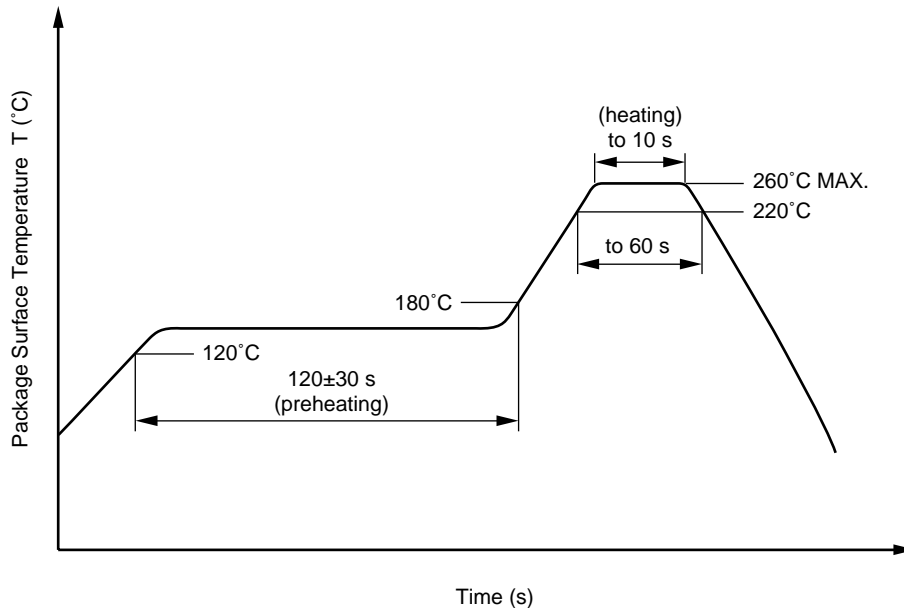
<R> **NOTES ON HANDLING**

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 pin) 3 seconds or less
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% or less 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 CMOS IC on output side may enter the on state, even if the voltage is within the absolute maximum ratings.

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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 VDD and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
- <R> 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. Avoid storage at a high temperature and high humidity.

PS9851-1, PS9851-2
<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Spec.	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/100/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$	U_{IORM} U_{pr}	566 905	V_{peak} V_{peak}
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$	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	
Comparative tracking index (IEC 60112/DIN EN 60112(VDE 0303 Part11)	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 $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	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 I_F , $P_{si} = 0$) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	T_{si} I_{si} P_{si} Ris MIN.	150 150 600 10^9	°C mA mW Ω

Caution	GaAs Products	<p>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.</p> <ul style="list-style-type: none">• 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.<ol style="list-style-type: none">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.
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Revision History**PS9851-1, PS9851-2 Data Sheet**

Rev.	Date	Description	
		Page	Summary
1.00	Jun 21, 2004	–	First edition issued
2.00	Aug 22, 2008	–	Second edition issued
3.00	Aug 27, 2008	–	Third edition issued
4.00	Apr 09, 2013	Throughout	Renesas format is applied to this data sheet.
		p.1	Modification of FEATURES
		p.2	Addition of PHOTOCOUPLER CONSTRUCTION
		p.3	Modification of MARKING EXAMPLE
		p.4	Modification of ORDERING INFORMATION
		pp.5, 6	Modification of ELECTRICAL CHARACTERISTICS
		p.8	Modification of TAPING SPECIFICATIONS
		pp.10, 11	Modification of NOTES ON HANDLING
p.12	Modification of SPECIFICATION OF VDE MARKS LICENSE DOCUMENT		

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