

## HIGH NOISE REDUCTION, 15 Mbps CMOS OUTPUT TYPE 5-PIN SOP (SO-5) PHOTOCOUPLER

–NEPOC Series–

### DESCRIPTION

The PS9151 is an optically coupled isolator containing a GaAlAs LED on the input side and a CMOS output IC on the output side.

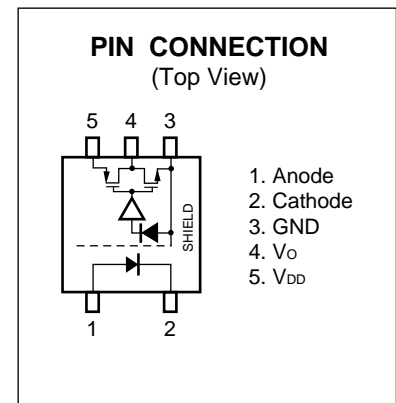
This photocopler is high common mode transient immunity (CMR), a high-speed CMOS output type device designed for high-speed logic interface circuits.

### FEATURES

- High-speed response (15 Mbps)
- Operable at high temperature (–40 to +100°C)
- High common mode transient immunity (CMH, CML = ±20 kV/μs TYP.)
- High isolation voltage (BV = 3 750 Vr.m.s.)
- Pulse width distortion (|t<sub>PHL</sub>–t<sub>PLH</sub>| = 3 ns TYP.)
- Ordering number of tape product : PS9151-F3: 2 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved No.40008902 (Option)

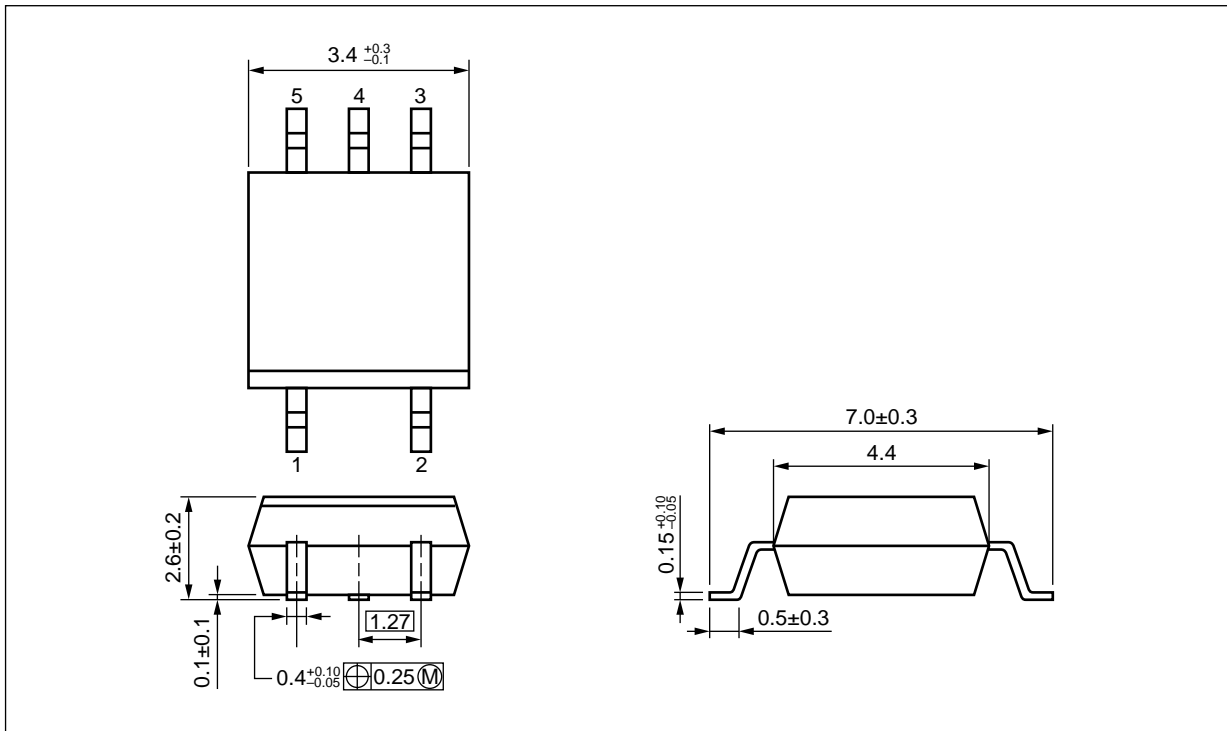
### APPLICATIONS

- FA Network
- Measurement equipment
- PDP

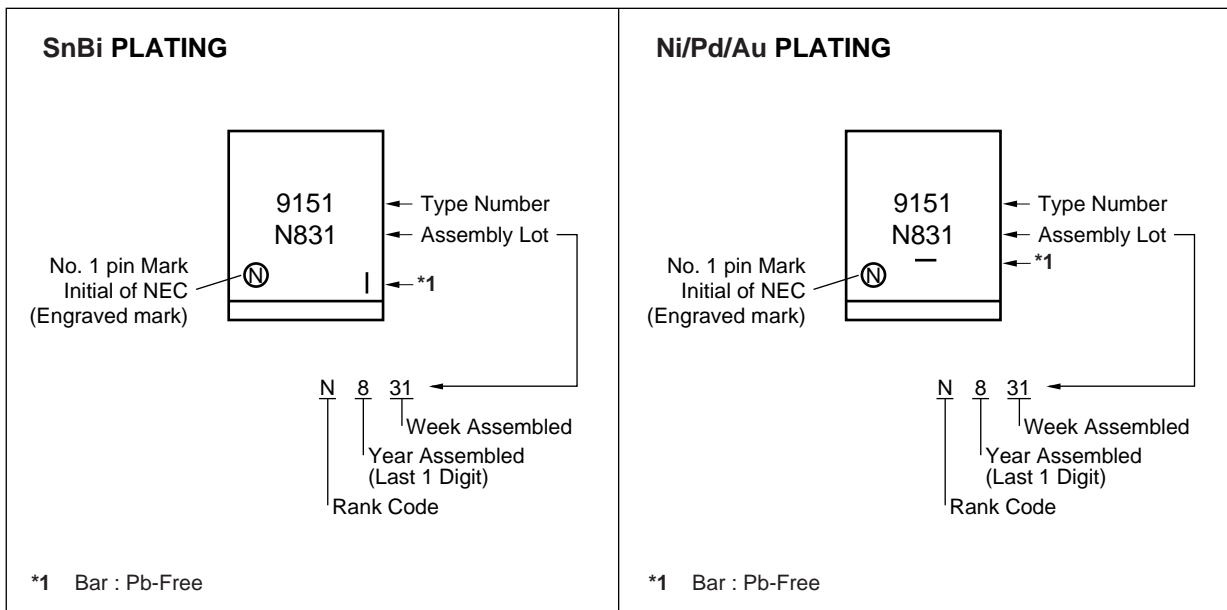


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PACKAGE DIMENSIONS (UNIT: mm)



<R> MARKING EXAMPLE



<R> **ORDERING INFORMATION**

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS9151	PS9151-A	Pb-Free (SnBi)	20 pcs (Tape 20 pcs cut)	Standard products	PS9151
PS9151-F3	PS9151-F3-A		Embossed Tape 2 500 pcs/reel	(UL approved)	
PS9151-V	PS9151-V-A		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2	
PS9151-V-F3	PS9151-V-F3-A		Embossed Tape 2 500 pcs/reel	(VDE0884 Part2) approved (Option)	
PS9151	PS9151-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products	
PS9151-F3	PS9151-F3-AX		Embossed Tape 2 500 pcs/reel	(UL approved)	
PS9151-V	PS9151-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2	
PS9151-V-F3	PS9151-V-F3-AX		Embossed Tape 2 500 pcs/reel	(VDE0884 Part2) approved (Option)	

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

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise specified)**

Parameter		Symbol	Ratings	Unit
Diode	Forward Current <sup>*1</sup>	I <sub>F</sub>	20	mA
	Reverse Voltage	V <sub>R</sub>	5	V
Detector	Supply Voltage	V <sub>DD</sub>	0 to 5.5	V
	Output Voltage	V <sub>O</sub>	-0.5 to V <sub>DD</sub> +0.5	V
	Output Current	I <sub>O</sub>	2	mA
Isolation Voltage <sup>*2</sup>		BV	3 750	V <sub>r.m.s.</sub>
Operating Ambient Temperature		T <sub>A</sub>	-40 to +100	°C
Storage Temperature		T <sub>stg</sub>	-55 to +125	°C

\*1 Reduced to 0.8 mA/°C at T<sub>A</sub> = 95°C or more.

\*2 AC voltage for 1 minute at T<sub>A</sub> = 25°C, RH = 60% between input and output.

Pins 1-2 shorted together, 3-5 shorted together.

**RECOMMENDED OPERATING CONDITIONS (T<sub>A</sub> = 25°C)**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward Current	I <sub>F</sub>	10		16	mA
Supply Voltage	V <sub>DD</sub>	4.5	5.0	5.5	V

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

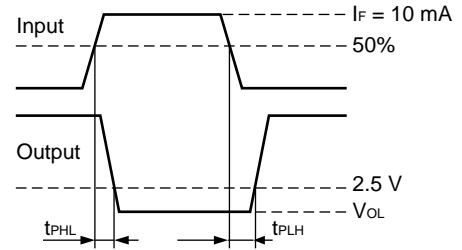
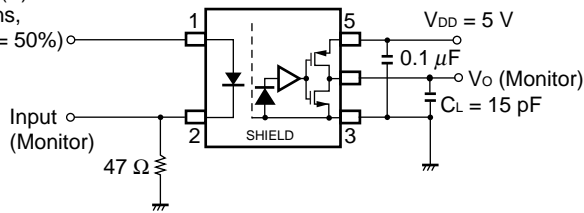
Parameter		Symbol	Conditions	MIN.	TYP. *1	MAX.	Unit		
Diode	Forward Voltage	$V_F$	$I_F = 10$ mA, $T_A = 25^\circ\text{C}$	1.4	1.65	1.8	V		
	Reverse Current	$I_R$	$V_R = 3$ V, $T_A = 25^\circ\text{C}$			10	$\mu\text{A}$		
	Terminal Capacitance	$C_t$	$V = 0$ V, $f = 1$ MHz, $T_A = 25^\circ\text{C}$		30		pF		
Detector	High Level Supply Current	$I_{DDH}$	$I_F = 0$ mA		2.5	5	mA		
	Low Level Supply Current	$I_{DDL}$	$I_F = 10$ mA		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 *2	$V_{OL}$	$I_O = 20$ $\mu\text{A}$ , $I_F = 10$ mA		0	0.1			
Coupled	Threshold Input Current	$I_{FHL}$	$V_O < 1$ V		2.2	5	mA		
	Isolation Resistance	$R_{I-O}$	$V_{I-O} = 1$ kV <sub>DC</sub> , RH = 40 to 60%, $T_A = 25^\circ\text{C}$	$10^{11}$				$\Omega$	
	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) *3	$t_{PHL}$	$I_F = 10$ mA, $V_{DD} = 5$ V, $C_L = 15$ pF, CMOS Levels		35	60	ns		
	Propagation Delay Time (L $\rightarrow$ H) *3	$t_{PLH}$			35	60			
	Pulse Width	PW		100					
	Pulse Width Distortion (PWD) *3	$ 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 *4	$CM_H$		$V_{DD} = 5$ V, $I_F = 0$ mA, $V_{CM} = 1$ kV, $V_O > 4$ V, $T_A = 25^\circ\text{C}$	15	20			kV/ $\mu\text{s}$
	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, $T_A = 25^\circ\text{C}$	15	20			

\*1 Typical values at  $T_A = 25^\circ\text{C}$

\*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.

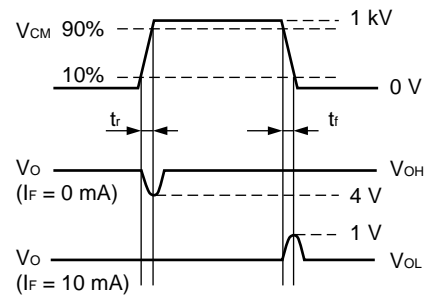
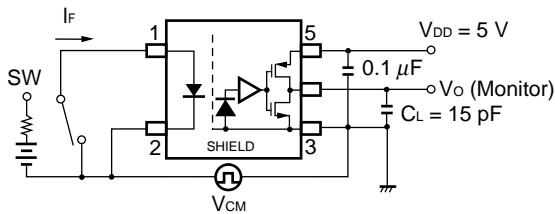
**\*3 Test circuit for propagation delay time**

Pulse input ( $I_F$ )  
 (PW = 100 ns,  
 Duty cycle = 50%)



**Remark**  $C_L$  includes probe and stray wiring capacitance.

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



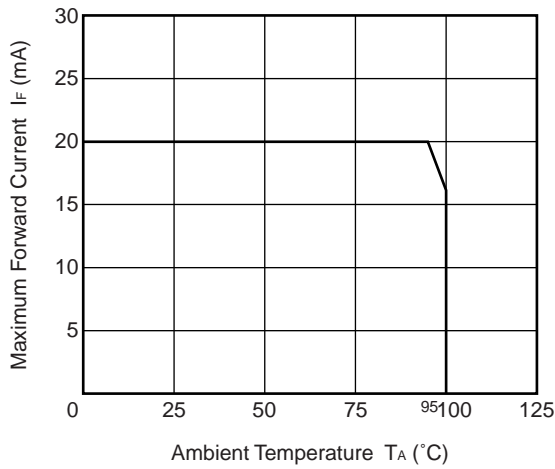
**Remark**  $C_L$  includes probe and stray wiring capacitance.

**USAGE CAUTIONS**

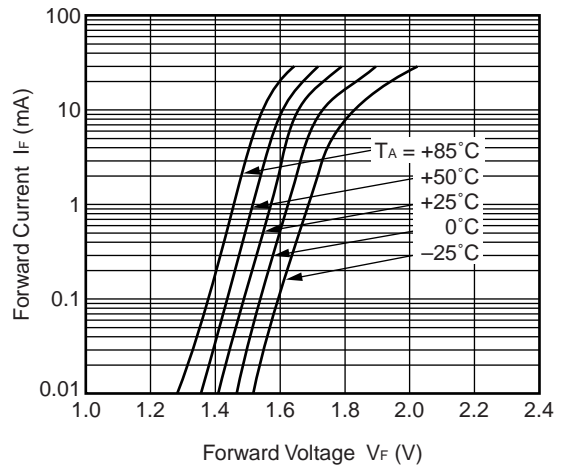
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1  $\mu F$  is used between  $V_{DD}$  and GND near device. Also, ensure that the distance between the leads of the photocopier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

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

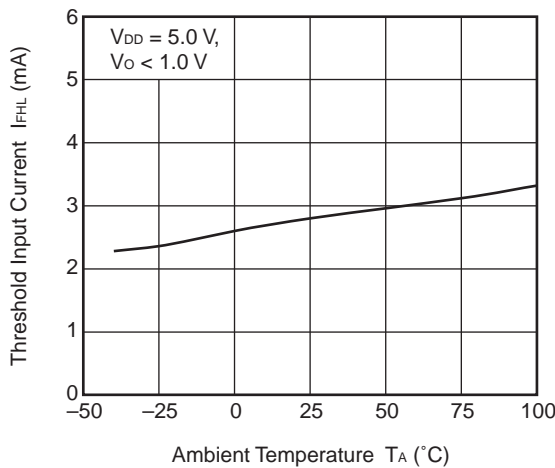
**MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE**



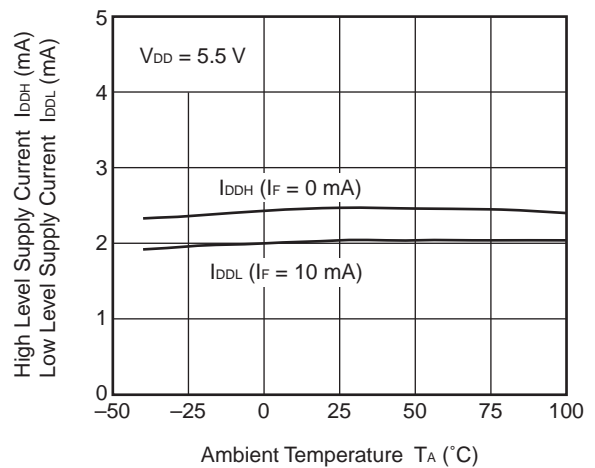
**FORWARD CURRENT vs. FORWARD VOLTAGE**



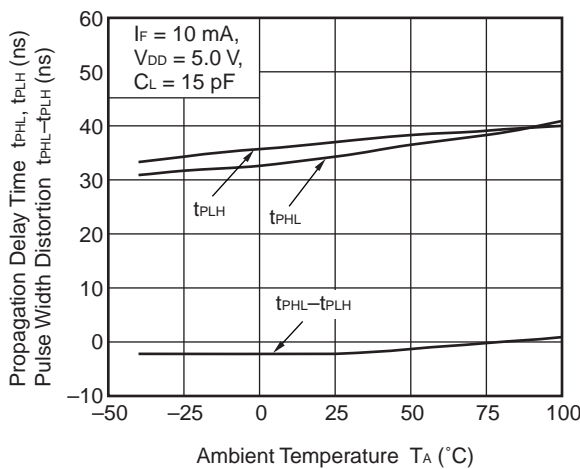
**THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE**



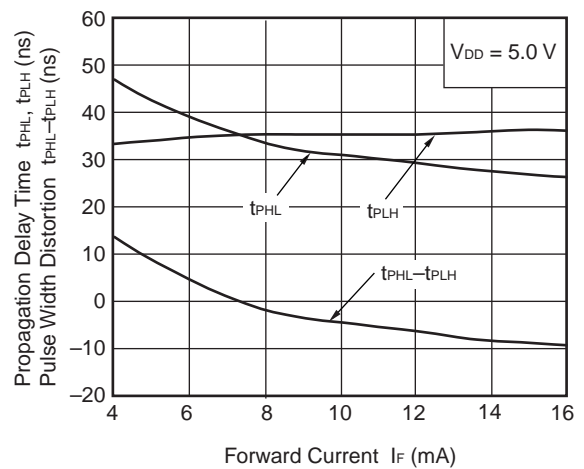
**SUPPLY CURRENT vs. AMBIENT TEMPERATURE**



**tPHL, tPLH, tPHL-tPLH vs. AMBIENT TEMPERATURE**



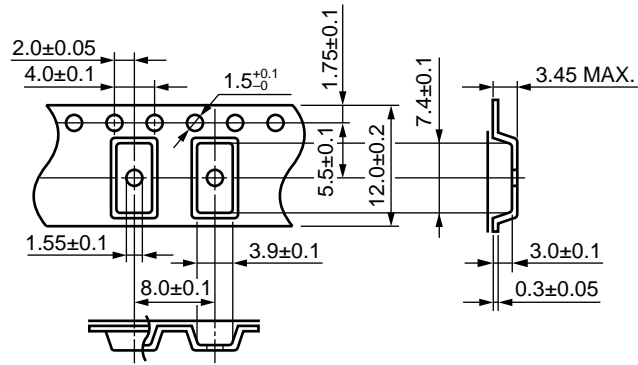
**tPHL, tPLH, tPHL-tPLH vs. FORWARD CURRENT**



**Remark** The graphs indicate nominal characteristics.

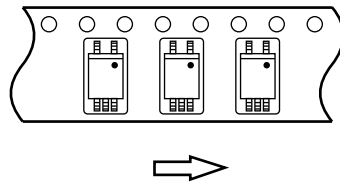
TAPING SPECIFICATIONS (UNIT: mm)

Outline and Dimensions (Tape)

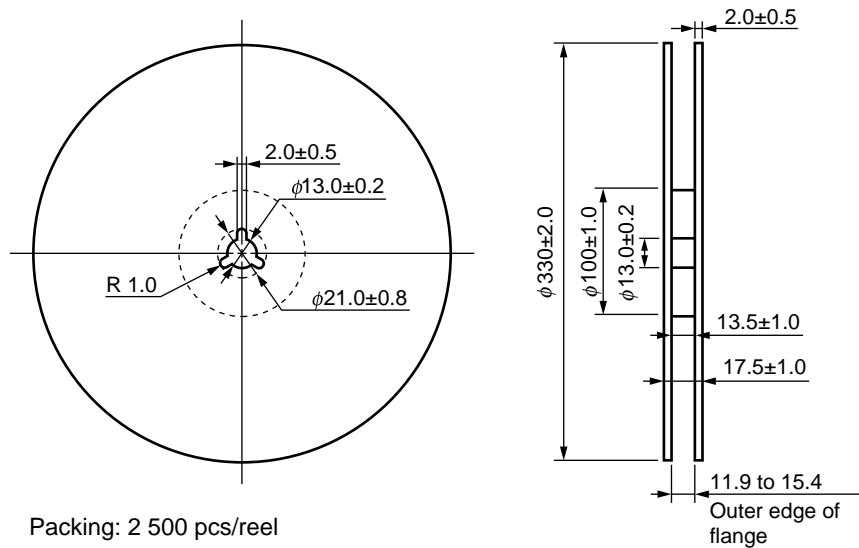


Tape Direction

PS9151-F3

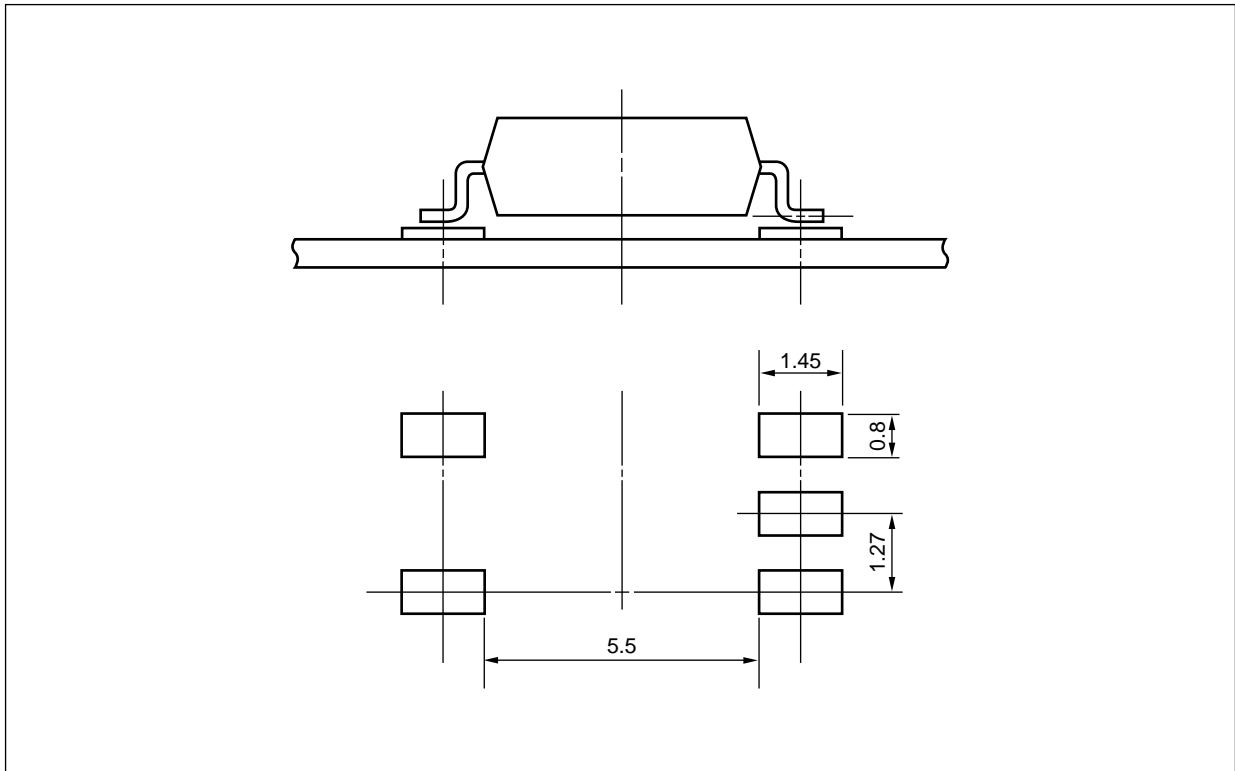


Outline and Dimensions (Reel)





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



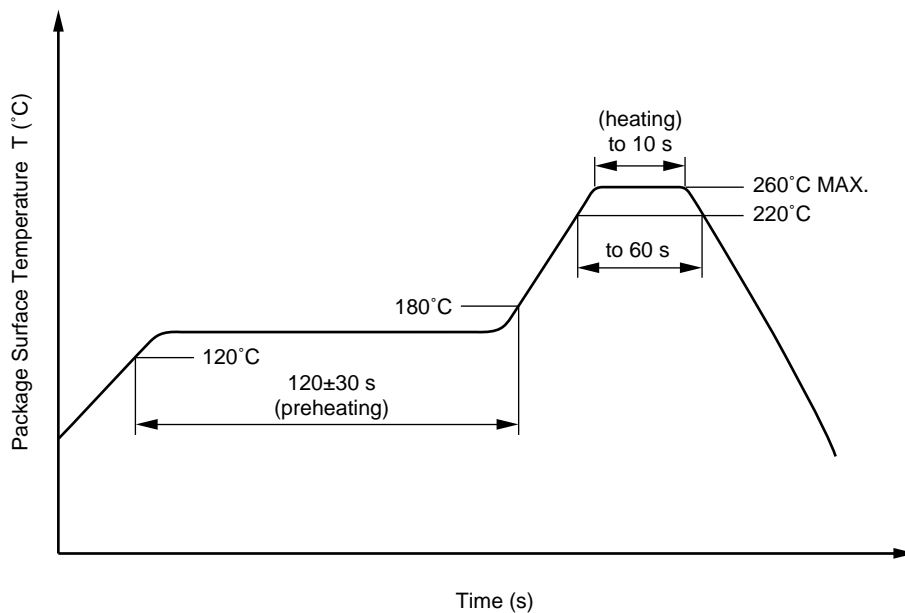
**NOTES ON HANDLING**

**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)		40/85/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.5 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	707 1 061	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{pr}$	1 326	$V_{peak}$
Highest permissible overvoltage	$U_{TR}$	6 000	$V_{peak}$
Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)		2	
Clearance distance		>4.2	mm
Creepage distance		>4.2	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 +85	°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.	$10^{12}$ $10^{11}$	$\Omega$ $\Omega$
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.	150 200 300 $10^9$	°C mA mW $\Omega$

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