PS8502, PS8502L1, PS8502L2, PS8502L3

HIGH SPEED ANALOG OUTPUT TYPE
8-PIN PHOTOCOUPLER

R08DS0263EJ0100
Rev.1.00
Dec 23, 2021

DESCRIPTION

The PS8502, PS8502L1, PS8502L2 and PS8502L3 are 8-pin high speed photocouplers containing an AlGaAs LED on input side and a PN photodiode and a high speed amplifier transistor on output side on one chip.

The PS8502 is in a plastic DIP (Dual In-line Package).

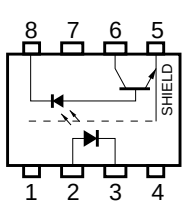
The PS8502L1 is lead bending type for long creepage distance.

The PS8502L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.
The PS8502L3 is lead bending type (Gull-wing) for surface mounting.

FEATURES

- Long creepage distance (8 mm MIN. : PS8502L1, PS8502L2)
- High common mode transient immunity (CM_H, CM_L = ±15 kV/μs MIN)
- High supply voltage (V_{CC} = 35 V MAX.)
- High speed response (t_{PHL}, t_{PLH} = 0.8 μs MAX.)
- High isolation voltage (BV = 5 000 Vr.m.s.)
- TTL, CMOS compatible with a resistor
- Ordering number of tape product : PS8502L2-E3 : 1 000 pcs/reel
  : PS8502L3-E3 : 1 000 pcs/reel
- Pb-Free product
- Safety standards
- - UL approved: UL1577, Double protection
- - CSA approved: CAN/CSA-C22.2 No.62368-1, Reinforced insulation
- - BSI approved: BS EN 62368-1, Reinforced insulation
- - SEMKO approved: EN 62368-1, IEC 62368-1, Reinforced insulation
- - NEMKO approved: EN 62368-1, Reinforced insulation
- - DEMKO approved: EN 62368-1, Reinforced insulation
- - FIMKO approved: EN 62368-1, Reinforced insulation
- - VDE approved: DIN EN 60747-5-5 (Option)

PIN CONNECTION
(Top View)



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

APPLICATIONS

- Interface for measurement or control equipment
- Substitutions for relays and pulse transformers
- Modem, communications device
- General purpose inverter

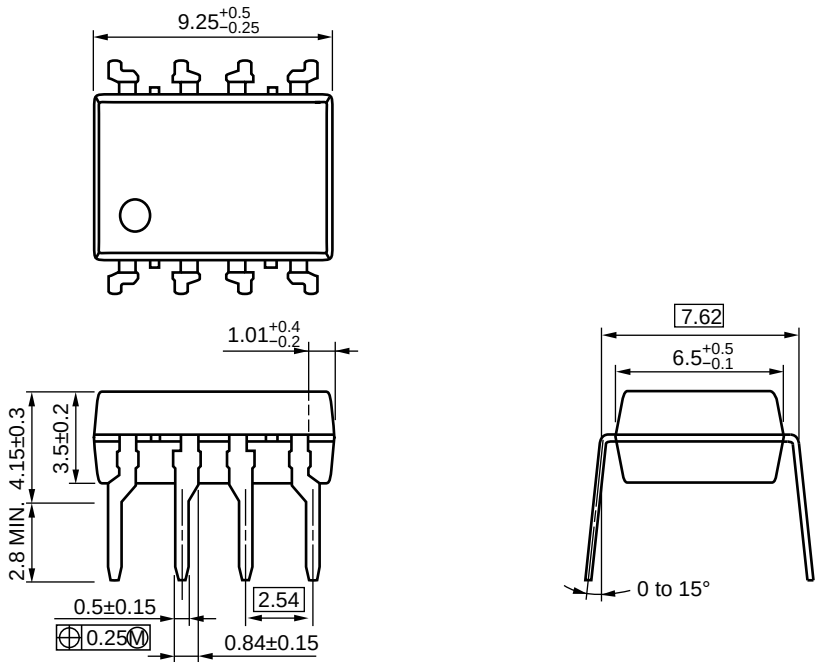
Start of mass production

Jun.2006

PACKAGE DIMENSIONS (UNIT: mm)

DIP Type

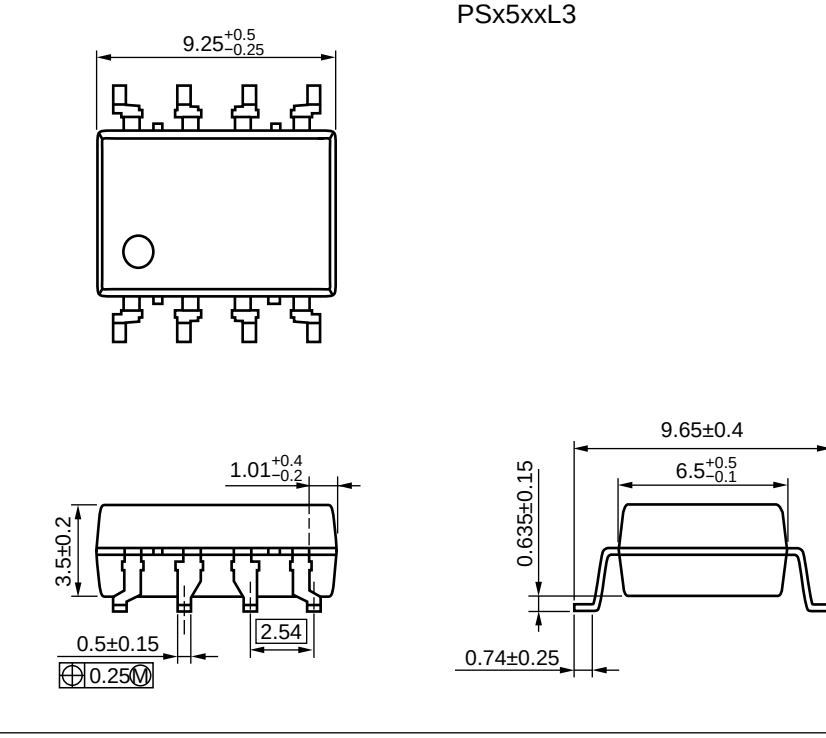
PSx5xx



Weight: 0.55g (typ.)

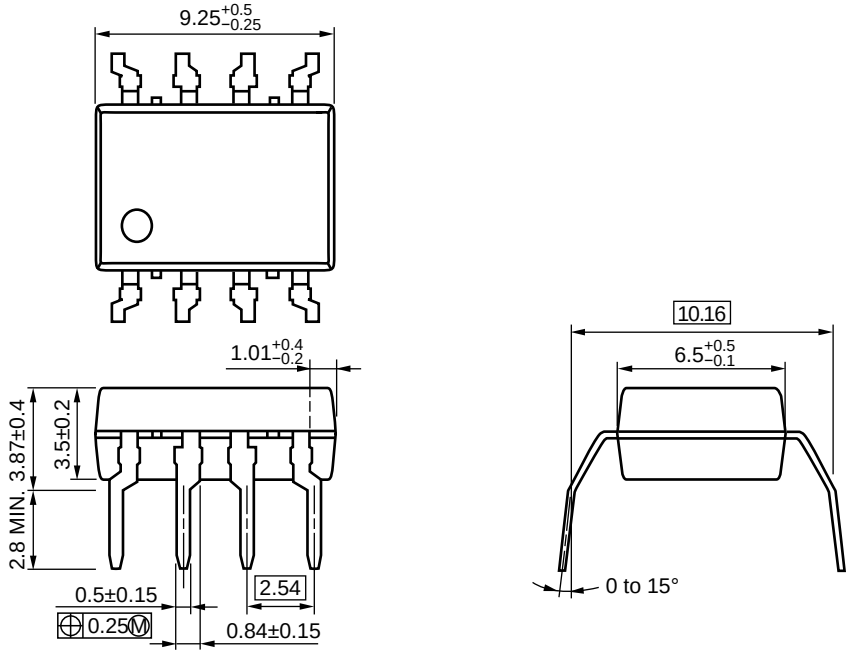
Lead Bending Type (Gull-wing) For Surface Mount

PSx5xxL3



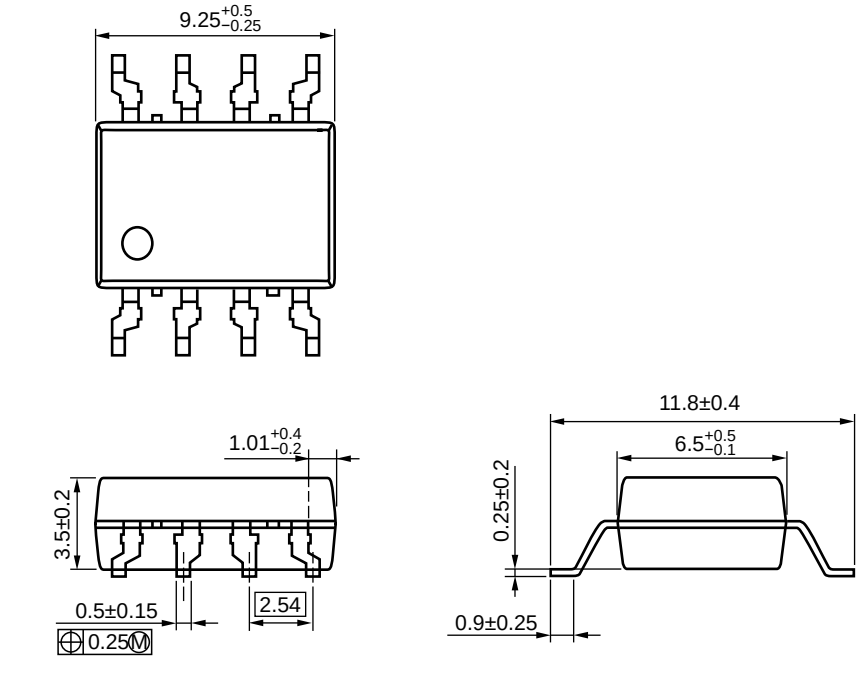
Lead Bending Type For Long Creepage Distance

PSx5xxL1



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

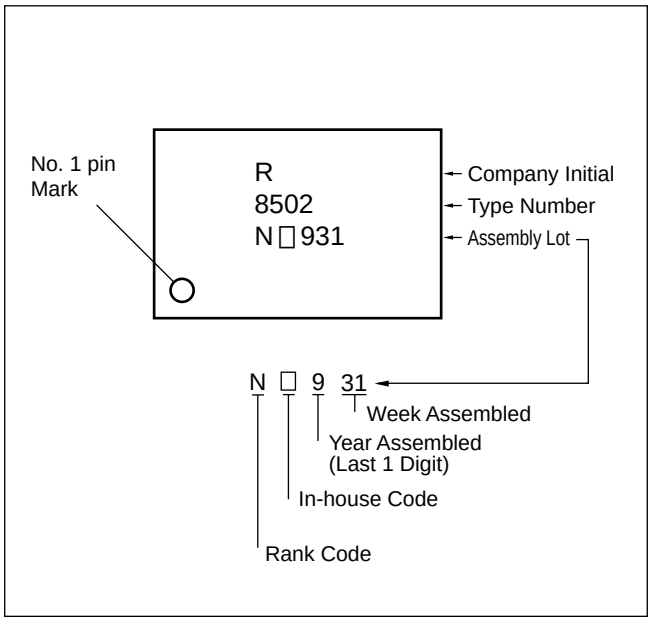
PSx5xxL2



PHOTOCOUPLER CONSTRUCTION

Parameter	PS8502, PS8502L3	PS8502L1, PS8502L2
Air Distance (MIN.)	7 mm	8 mm
Creepage Distance (MIN.)	7 mm	8 mm
Isolation Distance (MIN.)	0.4 mm	0.4 mm

MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number *1
PS8502	PS8502-AX	Pb-Free (Ni/Pd/Au)	Magazine case 50 pcs	Standard products (UL, CSA, BSI, SEMKO, NEMKO, DEMKO, FIMKO approved)	PS8502
PS8502L1	PS8502L1-AX				PS8502L1
PS8502L2	PS8502L2-AX				PS8502L2
PS8502L3	PS8502L3-AX				PS8502L3
PS8502L2-E3	PS8502L2-E3-AX		Embossed Tape 1 000 pcs/reel		PS8502L2
PS8502L3-E3	PS8502L3-E3-AX				PS8502L3
PS8502-V	PS8502-V-AX		Magazine case 50 pcs	UL, CSA, BSI, SEMKO, NEMKO, FIMKO, DEMKO, DIN EN 60747-5-5 approved	PS8502
PS8502L1-V	PS8502L1-V-AX				PS8502L1
PS8502L2-V	PS8502L2-V-AX				PS8502L2
PS8502L3-V	PS8502L3-V-AX				PS8502L3
PS8502L2-V-E3	PS8502L2-V-E3-AX		Embossed Tape 1 000 pcs/reel		PS8502L2
PS8502L3-V-E3	PS8502L3-V-E3-AX				PS8502L3

Notes*: 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}	35	V
	Output Voltage	V_O	35	V
	Output Current	I_O	8	mA
	Power Dissipation *2	P_C	100	mW
Isolation Voltage *3		BV	5 000	Vr.m.s.
Operating Ambient Temperature		T_A	–55 to +100	°C
Storage Temperature		T_{stg}	–55 to +125	°C

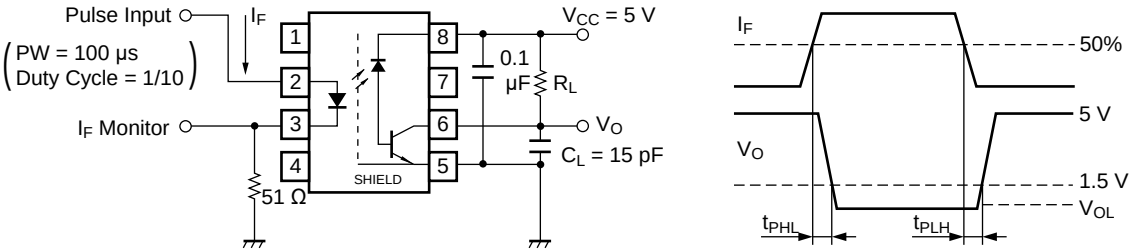
Notes*: 1. Reduced to 0.33 mA/°C at T_A = 70 °C or more.
2. Reduced to 2.0 mW/°C at T_A = 75 °C or more.
3. AC voltage for 1 minute at T_A = 25 °C, RH = 60% between input and output.
Pins 1-4 shorted together, 5-8 shorted together.

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 16 mA		1.7	2.2	V
	Reverse Current	I_R	V_R = 3 V			10	μA
	Forward Voltage Temperature Coefficent	$\Delta V_F/\Delta T_A$	I_F = 16 mA		–2.1		mV/°C
	Terminal Capacitance	C_t	V = 0 V, f = 1 MHz		30		pF
Detector	High Level Output Current	I_{OH} (1)	I_F = 0 mA, V_{CC} = V_O = 5.5 V		3	500	nA
	High Level Output Current	I_{OH} (2)	I_F = 0 mA, V_{CC} = V_O = 35 V			100	μA
	Low Level Output Voltage	V_{OL}	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA		0.15	0.4	V
	Low Level Supply Current	I_{CCL}	I_F = 16 mA, V_O = Open, V_{CC} = 35 V		150		μA
	High Level Supply Current	I_{CCH}	I_F = 0 mA, V_O = Open, V_{CC} = 35 V		0.01	1	μA
Coupled	Current Transfer Ratio	CTR	I_F = 16 mA, V_{CC} = 4.5 V, V_O = 0.4 V	15			%
	Isolation Resistance	R_{I-O}	V_{I-O} = 1 kV_{DC}	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V = 0 V, f = 1 MHz		0.7		pF
	Propagation Delay Time (H → L)*2	t_{PHL}	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ		0.22	0.8	μs
	Propagation Delay Time (L → H)*2	t_{PLH}	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ		0.35	0.8	μs
	Common Mode Transient Immunity at High Level Output*3	CM_H	I_F = 0 mA, V_{CC} = 5 V, V_{CM} = 1.5 kV, R_L = 4.1 kΩ	15			kV/μs
	Common Mode Transient Immunity at Low Level Output*3	CM_L	I_F = 16 mA, V_{CC} = 5 V, V_{CM} = 1.5 kV, R_L = 4.1 kΩ	–15			kV/μs

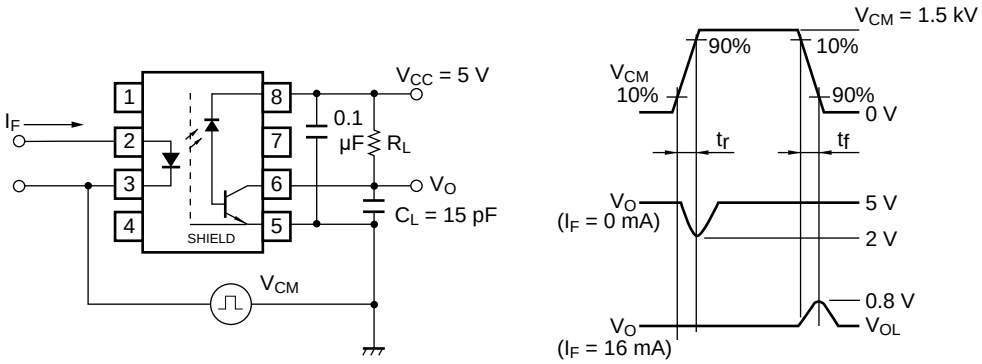
Notes*: 1. Typical values at T_A = 25 °C.

2. Test circuit for propagation delay time



Remark: C_L includes probe and stray wiring capacitance.

3. Test circuit for common mode transient immunity



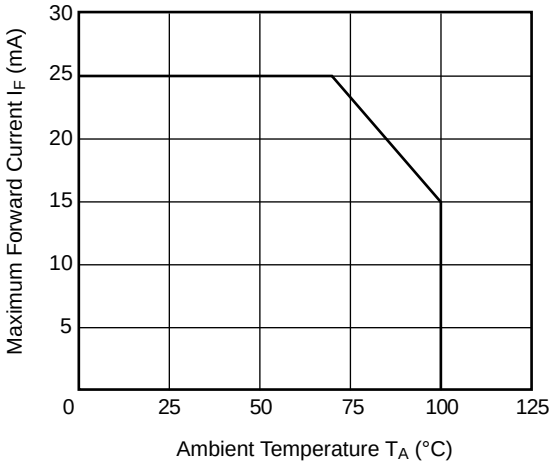
Remark: C_L includes probe and stray wiring capacitance.

USAGE CAUTIONS

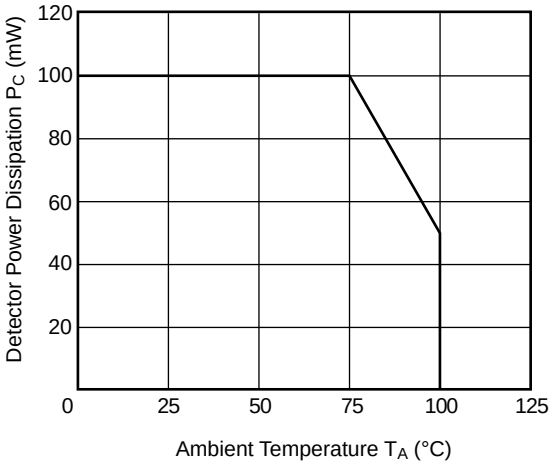
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 µF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
3. Pins 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.
   *1 NC: Non-Connection (No Connection)
4. Avoid storage at a high temperature and high humidity.
5. Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
6. Do not use fixing agents or coatings containing halogen-based substances.

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

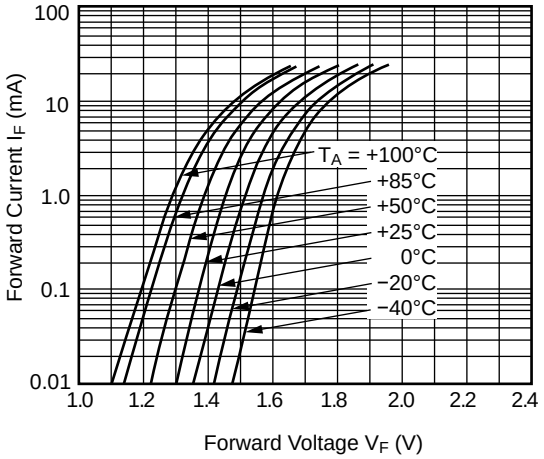
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



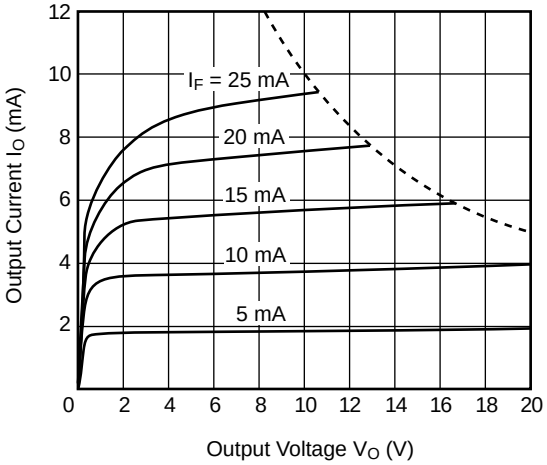
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



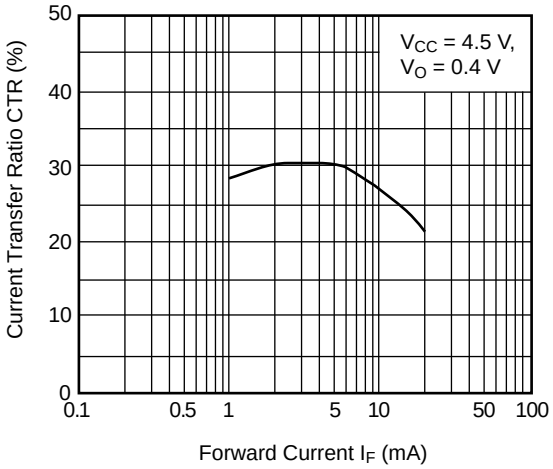
FORWARD CURRENT vs. FORWARD VOLTAGE



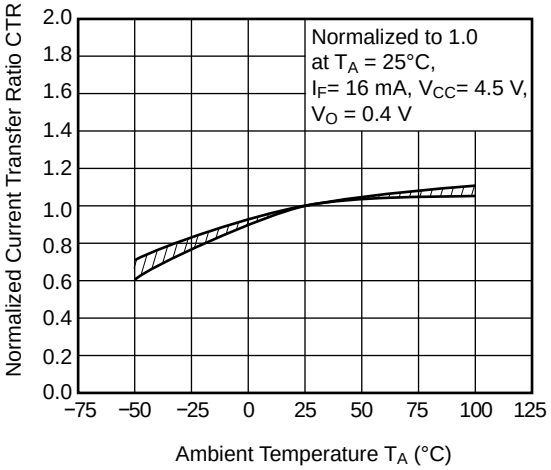
OUTPUT CURRENT vs. OUTPUT VOLTAGE



CURRENT TRANSFER RATIO vs. FORWARD CURRENT

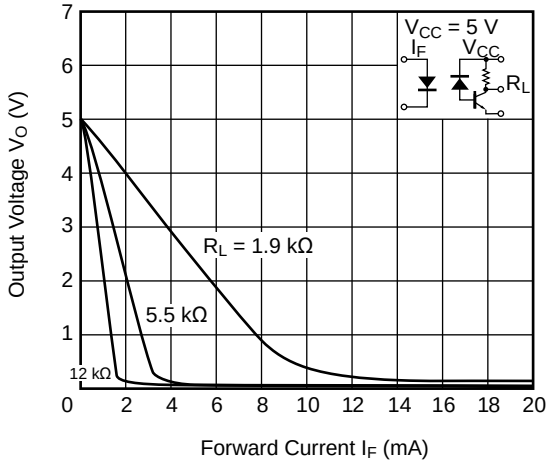


NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE

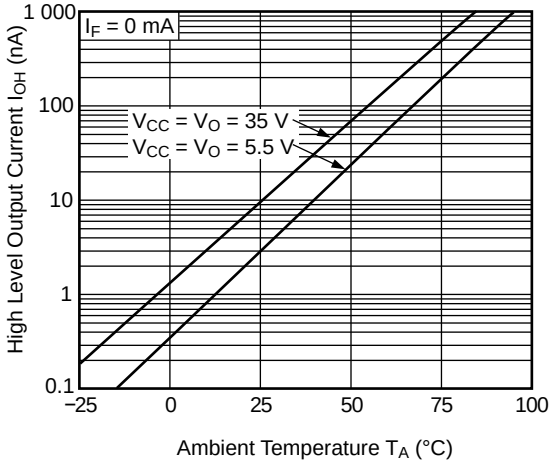


Remark The graphs indicate nominal characteristics.

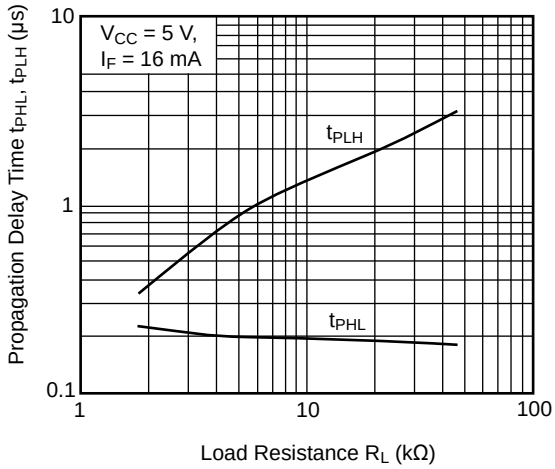
OUTPUT VOLTAGE vs.
FORWARD CURRENT



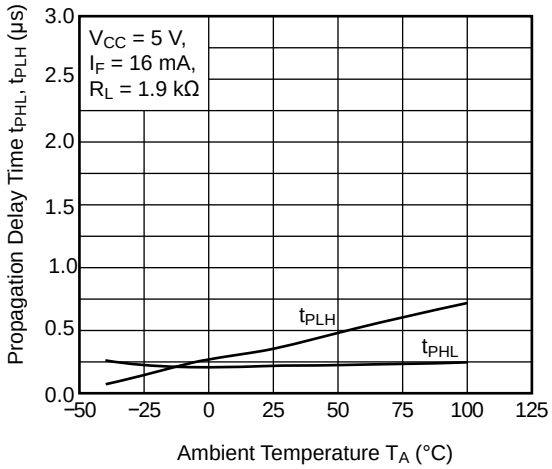
HIGH LEVEL OUTPUT CURRENT
vs. AMBIENT TEMPERATURE



PROPAGATION DELAY TIME
vs. LORD RESISTANCE



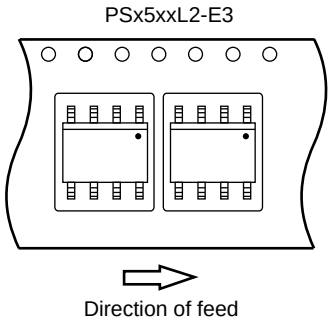
PROPAGATION DELAY TIME
vs. AMBIENT TEMPERATURE



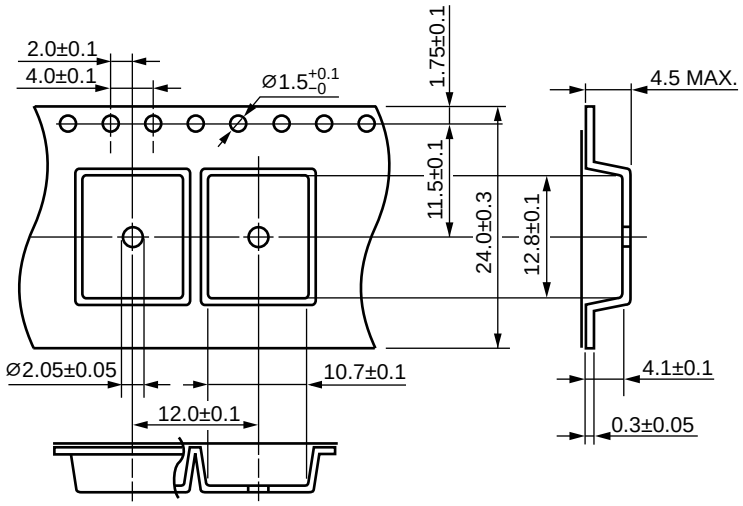
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

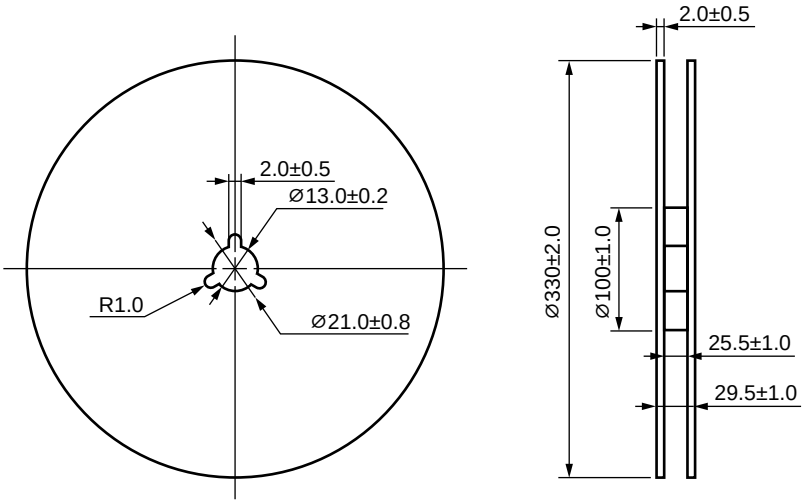
Tape Direction



Outline and Dimensions (Tape)

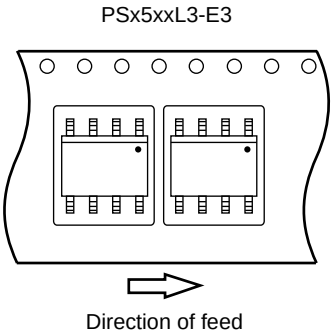


Outline and Dimensions (Reel)

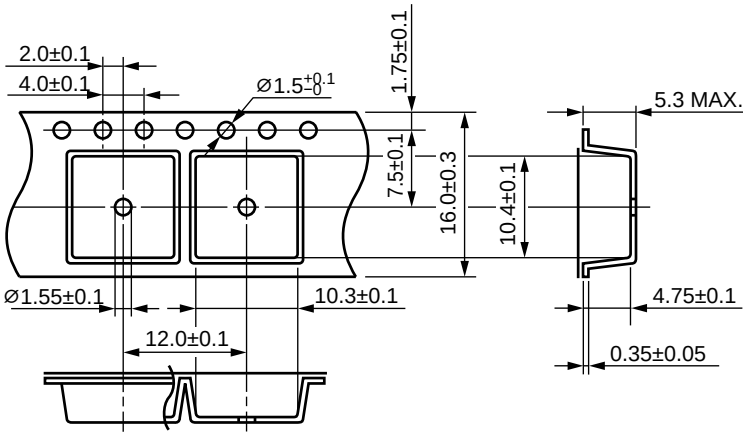


Packing: 1 000 pcs/reel

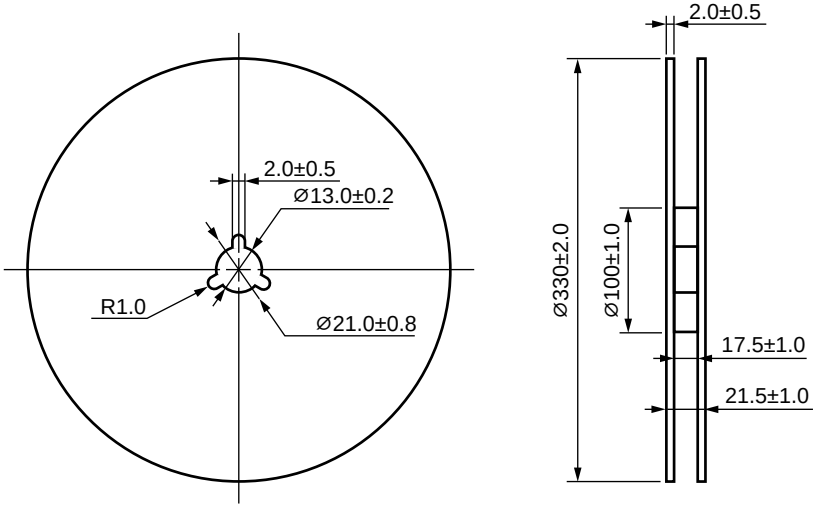
Tape Direction



Outline and Dimensions (Tape)

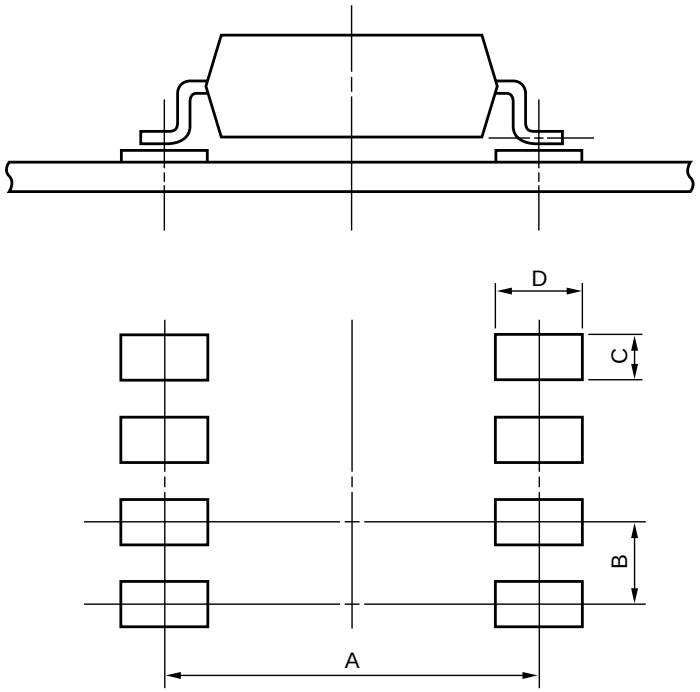


Outline and Dimensions (Reel)



Packing: 1 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



Part Number	Lead Bending	A	B	C	D
PSx5xxL2	lead bending type for long creepage distance (Gull-wing) for surface mount	10.2	2.54	1.7	2.2
PSx5xxL3	lead bending type (Gull-wing) for surface mount	8.2	2.54	1.7	2.2

Remark All dimensions in this figure must be evaluated before use.

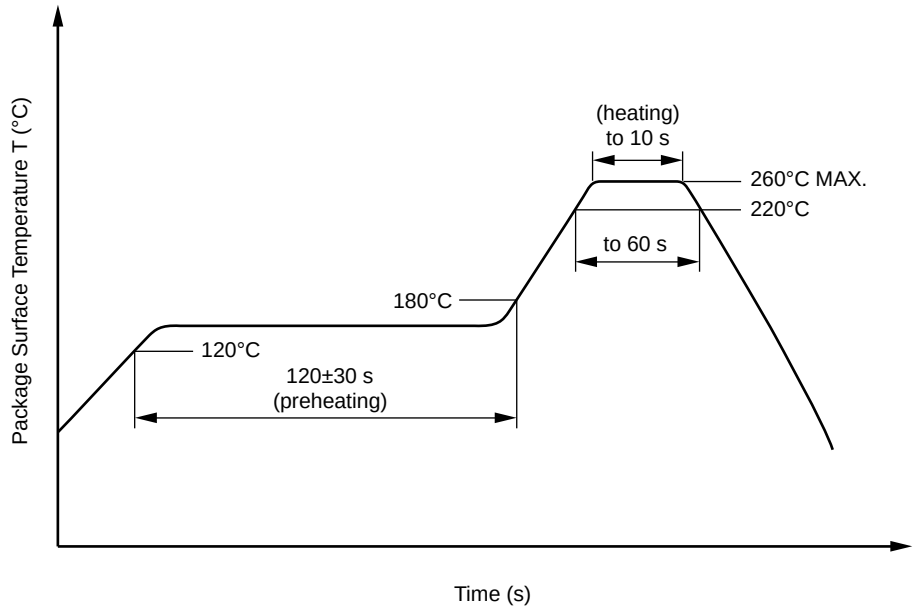
NOTES ON HANDLING

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

• Flux Cleaning

Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.

• Do not use fixing agents or coatings containing halogen-based substances.

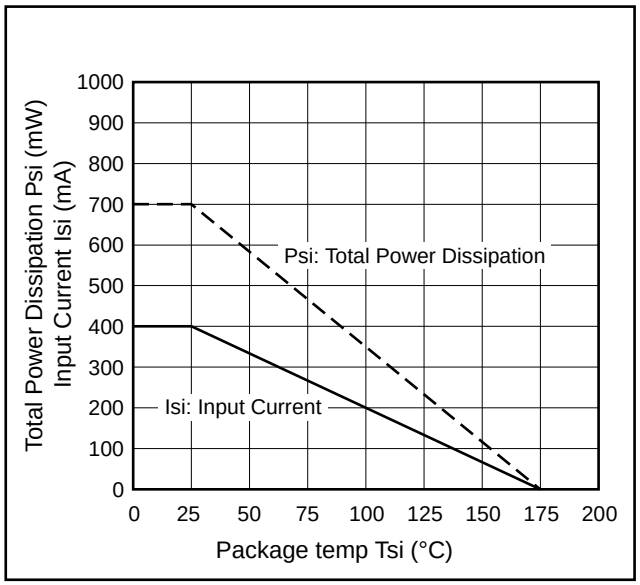
2. Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output or between V_{CC}-emitters at startup, the output side may enter the on state, even if the voltage is within the absolute maximum ratings.

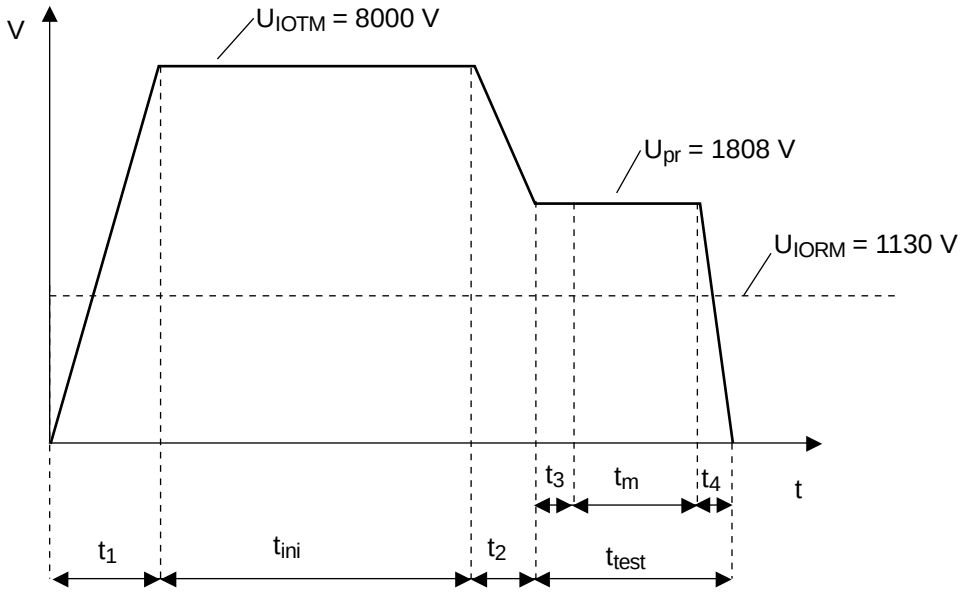
SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		55/100/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) U_{pr} = 1.6 × U_{IORM}, P_d < 5 pC	 U_{IORM} U_{pr}	 1 130 1 695	 V_{peak} V_{peak}
Test voltage (partial discharge test, procedure b for all devices) U_{pr} = 1.875 × U_{IORM}, P_d < 5 pC	U_{pr}	2 119	V_{peak}
Highest permissible overvoltage	U_{IOTM}	8 000	V_{peak}
Degree of pollution (DIN EN 60664-1 VDE 0110 Part 1)		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))	CTI	175	
Material group (DIN EN 60664-1 VDE 0110 Part 1)		III a	
Storage temperature range	T_{stg}	–55 to +125	°C
Operating temperature range	T_A	–55 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.	 175 400 700 10^9	 °C mA mW Ω

Dependence of maximum safety ratings with package temperature

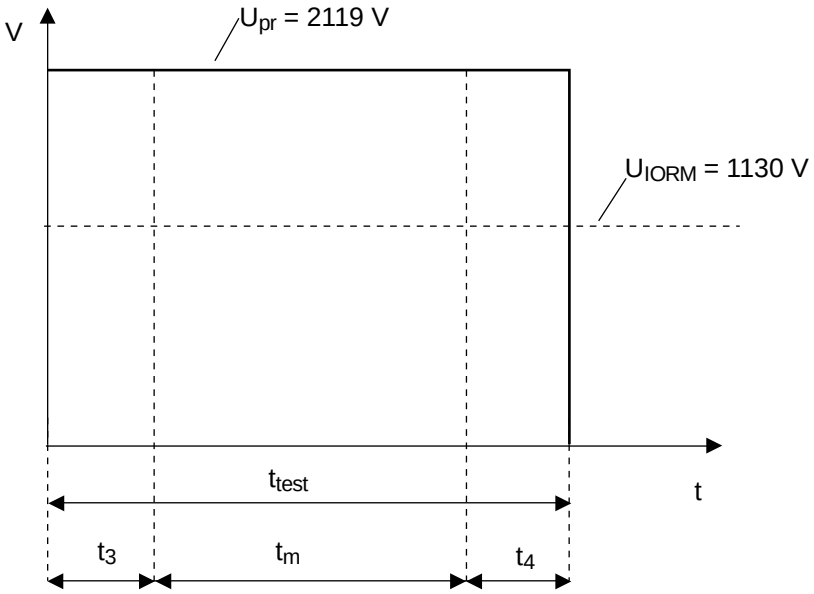


Method a) Destructive Test, Type and Sample Test



t_1, t_2 = 1 to 10 sec
t_3, t_4 = 1 sec
$t_{m(PARTIAL\ DISCHARGE)}$ = 10 sec
t_{test} = 12 sec
t_{ini} = 60 sec

Method b) Non-destructive Test, 100% Production Test



t_3, t_4 = 0.1 sec
$t_{m(PARTIAL\ DISCHARGE)}$ = 1.0 sec
t_{test} = 1.2 sec

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 i any way allow it to enter the mouth.

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