

# PS2561D-1, PS2561DL-1, PS2561DL1-1, PS2561DL2-1

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DIP PHOTOCOUPLER OPERATING AMBIENT TEMPERATURE 110°C

## DESCRIPTION

The PS2561D-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor.

The PS2561D-1 is in a plastic DIP (Dual In-line Package) and the PS2561DL-1 is lead bending type (Gull-wing) for surface mount.

The PS2561DL1-1 is lead bending type for long creepage distance.

The PS2561DL2-1 is lead bending type for long creepage distance (Gull-wing) for surface mount.

## FEATURES

- Operating ambient temperature: 110°C
- High isolation voltage (BV = 5 000 Vr.m.s.)
- High collector to emitter voltage ( $V_{CEO} = 80\text{ V}$ )
- High current transfer ratio (CTR = 160% TYP.)
- High-speed switching ( $t_r = 3\ \mu\text{s}$  TYP.,  $t_f = 5\ \mu\text{s}$  TYP.)
- Ordering number of taping product: PS2561DL-1-F3 : 2 000 pcs/reel
- : PS2561DL2-1-F3 : 2 000 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
  - FIMKO approved: EN 62368-1, Reinforced insulation
  - DEMKO approved: EN 62368-1, Reinforced insulation
  - CQC approved: GB8898, GB4943.1, Reinforced insulation
  - VDE approved: DIN EN 60747-5-5 (Option)



## APPLICATIONS

- Power supply
- Telephone/FAX.
- FA/OA equipment
- Programmable logic controllers

**PACKAGE DIMENSIONS (UNIT: mm)**

**DIP Type**



**Long Creepage Distance**



**Lead Bending Type**



**Long Creepage Distance (Gull-Wing)**



Weight ( 4-pin DIP ) : 0.26 g (typ.)

**PHOTOCOUPLER CONSTRUCTION**

Parameter	PS2561D-1, PS2561DL-1	PS2561DL1-1, PS2561DL2-1
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 *1	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number *2
PS2561D-1	PS2561D-1Y-A	Pb-Free and Halogen Free	Magazine case 100 pcs	Standard products (UL, CSA, BSI, SEMKO, NEMKO, FIMKO, DEMKO, CQC approved)	PS2561D-1
PS2561DL-1	PS2561DL-1Y-A				PS2561DL-1
PS2561DL1-1	PS2561DL1-1Y-A				PS2561DL1-1
PS2561DL2-1	PS2561DL2-1Y-A				PS2561DL2-1
PS2561DL-1-F3	PS2561DL-1Y-F3-A		Embossed Tape 2 000 pcs/reel		PS2561DL-1
PS2561DL2-1-F3	PS2561DL2-1Y-F3-A		Embossed Tape 2 000 pcs/reel		PS2561DL2-1
PS2561D-1-V	PS2561D-1Y-V-A		Magazine case 100 pcs	UL, CSA, BSI, SEMKO, NEMKO, FIMKO, DEMKO, CQC, DIN EN 60747-5-5 approved	PS2561D-1
PS2561DL-1-V	PS2561DL-1Y-V-A				PS2561DL-1
PS2561DL1-1-V	PS2561DL1-1Y-V-A				PS2561DL1-1
PS2561DL2-1-V	PS2561DL2-1Y-V-A				PS2561DL2-1
PS2561DL-1-V-F3	PS2561DL-1Y-V-F3-A	Embossed Tape 2 000 pcs/reel			PS2561DL-1
PS2561DL2-1-V-F3	PS2561DL2-1Y-V-F3-A	Embossed Tape 2 000 pcs/reel			PS2561DL2-1

Notes: \*1. When specifying CTR rank, please add "/CTR rank" after Order Number.

ex. L rank : PS2561D-1Y-A/L

Notes: \*2. 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	Reverse Voltage	V <sub>R</sub>	6	V
	Forward Current (DC)	I <sub>F</sub>	40	mA
	Power Dissipation Derating	ΔP <sub>D</sub> /°C	1.5	mW/°C
	Power Dissipation	P <sub>D</sub>	150	mW
	Peak Forward Current*1	I <sub>FP</sub>	1	A
Transistor	Collector to Emitter Voltage	V <sub>CEO</sub>	80	V
	Emitter to Collector Voltage	V <sub>ECO</sub>	7	V
	Collector Current	I <sub>C</sub>	50	mA
	Power Dissipation Derating	ΔP <sub>C</sub> /°C	1.5	mW/°C
	Power Dissipation	P <sub>C</sub>	150	mW
Isolation Voltage*2		BV	5 000	Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	-55 to +110	°C
Storage Temperature		T <sub>stg</sub>	-55 to +150	°C

Note: \*1. PW = 100 μs, Duty Cycle = 1%

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

Pins 1-2 shorted together, 3-4 shorted together.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA		1.2	1.4	V
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 5 V			5	μA
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1.0 MHz		10		pF
Transistor	Collector to Emitter Dark Current	I <sub>CEO</sub>	V <sub>CE</sub> = 48 V, I <sub>F</sub> = 0 mA			100	nA
Coupled	Current Transfer Ratio (I <sub>c</sub> /I <sub>F</sub> )*1	CTR	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V	50	160	400	%
			I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V	10	80		
	Collector Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>F</sub> = 10 mA, I <sub>c</sub> = 2 mA			0.3	V
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1.0 kV <sub>DC</sub>	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1.0 MHz		0.5		pF
	Rise Time*2	t <sub>r</sub>	V <sub>CC</sub> = 10 V, I <sub>c</sub> = 2 mA, R <sub>L</sub> = 100 Ω		3		μs
	Fall Time*2	t <sub>f</sub>			5		

Note: \*1. CTR rank

CTR Rank	CTR (%)	Conditions
H	80 to 160	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V
	16 and larger	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V
Q	100 to 200	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V
	20 and larger	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V
W	130 to 260	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V
	26 and larger	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V
L	200 to 400	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V
	40 and larger	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V
N	50 to 400	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V
	10 and larger	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V

\*2. Test Circuit for Switching Time



**TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C, unless otherwise specified)**



**Remark** The graphs indicate nominal characteristics.

NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



CURRENT TRANSFER RATIO vs. FORWARD CURRENT



SWITCHING TIME vs. LOAD RESISTANCE



SWITCHING TIME vs. LOAD RESISTANCE



FREQUENCY RESPONSE



**Remark** The graphs indicate nominal characteristics.

**TAPING SPECIFICATIONS (UNIT: mm)**

Taping Direction



Outline and Dimensions (Tape)



Outline and Dimensions (Reel)



Packing: 2 000 pcs/reel



**TAPING SPECIFICATIONS (UNIT: mm)**

Taping Direction



Outline and Dimensions (Tape)



Outline and Dimensions (Reel)



**RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)**



Part Number	Lead Bending	A	B	C	D
PS2561DL	lead bending type (Gull-wing) for long creepage distance (surface mount)	8.2	2.54	1.7	2.2
PS2561DL2	lead bending type (Gull-wing) for surface mount	10.2	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 collector-emitters at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

3. Measurement conditions of current transfer ratios (CTR), which differ according to photocoupler

Check the setting values before use, since the forward current conditions at CTR measurement differ according to product.

When using products other than at the specified forward current, the characteristics curves may differ from the standard curves due to CTR value variations or the like. Therefore, check the characteristics under the actual operating conditions and thoroughly take variations or the like into consideration before use.

## **USAGE CAUTIONS**

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.
3. Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
4. Do not use fixing agents or coatings containing halogen-based substances.

**SPECIFICATION OF VDE MARKS LICENSE DOCUMENT (1/2)  
(PS2561D-1, PS2561DL-1)**

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		55/110/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	890 1 424	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{pr}$	1 669	$V_{peak}$
Highest permissible overvoltage	$U_{IOTM}$	8 000	$V_{peak}$
Degree of pollution (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303-11))	CTI	175	
Material group (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		III a	
Storage temperature range	$T_{stg}$	-55 to +150	°C
Operating temperature range	$T_A$	-55 to +110	°C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	$R_{is \text{ MIN.}}$ $R_{is \text{ MIN.}}$	$10^{12}$ $10^{11}$	$\Omega$ $\Omega$
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 $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	$T_{si}$ $I_{si}$ $P_{si}$ $R_{is \text{ MIN.}}$	175 400 700 $10^9$	°C mA mW $\Omega$

Dependence of maximum safety ratings with package temperature



**SPECIFICATION OF VDE MARKS LICENSE DOCUMENT (2/2)  
(PS2561DL1-1, PS2561DL2-1)**

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		55/110/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	1 130 1 808	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{pr}$	2 119	$V_{peak}$
Highest permissible overvoltage	$U_{IOTM}$	8 000	$V_{peak}$
Degree of pollution (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303-11))	CTI	175	
Material group (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		III a	
Storage temperature range	$T_{stg}$	-55 to +150	°C
Operating temperature range	$T_A$	-55 to +110	°C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	$R_{is \text{ MIN.}}$ $R_{is \text{ MIN.}}$	$10^{12}$ $10^{11}$	$\Omega$ $\Omega$
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 $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	$T_{si}$ $I_{si}$ $P_{si}$ $R_{is \text{ MIN.}}$	175 400 700 $10^9$	°C mA mW $\Omega$

Dependence of maximum safety ratings with package temperature



Method a) Destructive Test, Type and Sample Test (PS2561D-1, PS2561DL-1)



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

Method b) Non-destructive Test, 100% Production Test (PS2561D-1, PS2561DL-1)



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

Method a) Destructive Test, Type and Sample Test (PS2561DL1-1, PS2561DL2-1)



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

Method b) Non-destructive Test, 100% Production Test (PS2561DL1-1, PS2561DL2-1)



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



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