



# PS2702-1

### **Data Sheet**

R08DS0099EJ0300 Rev.3.00 Jan 29, 2013

# HIGH ISOLATION VOLTAGE DARLINGTON TRANSISTOR SOP MULTI PHOTOCOUPLER SERIES

#### **DESCRIPTION**

The PS2702-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon darlington-connected phototransistor.

This is mounted in a plastic SOP (Small Out-line Package) for high density applications.

This package has shield effect to cut off ambient light.

#### **FEATURES**

- High current transfer ratio (CTR = 2 000% TYP.)
- High isolation voltage (BV = 3 750 Vr.m.s.)
- Small and thin (SOP) package
- High-speed switching ( $t_r = 70 \mu s$  TYP.,  $t_f = 60 \mu s$  TYP.)
- Ordering number of taping product: PS2702-1-F3

<R> • Safety standards

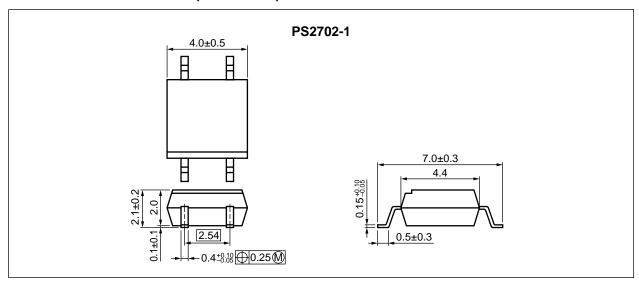
- UL approved: No. E72422
- BSI approved (BS EN 60065, BS EN 60950)
- CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
- DIN EN 60747-5-5 (VDE 0884-5) approved (Option)

# PIN CONNECTION (Top View) 1. Anode 2. Cathode 3. Emitter 4. Collector

#### **APPLICATIONS**

- Hybrid IC
- Telephone/FAX
- FA/OA equipment
- Programmable logic controllers

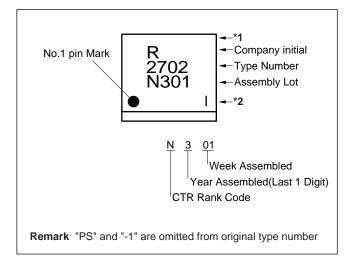
## PACKAGE DIMENSIONS (UNIT: mm)



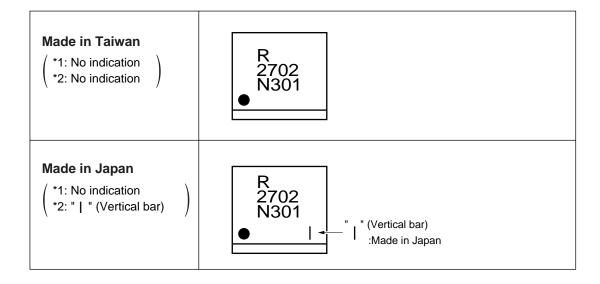
## <R> PHOTOCOUPLER CONSTRUCTION

Parameter	Unit (MIN.)	
Air Distance	5 mm	
Outer Creepage Distance	5 mm	
Inner Creepage Distance	2.5 mm	
Isolation Thickness	0.3 mm	

#### <R> MARKING EXAMPLE



Note: Bar indication contents of \*1 and \*2



#### <R> ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS2702-1-F3	PS2702-1-F3-A	Pb-Free	Embossed Tape 3 500 pcs/reel	Standard products (UL, BSI, CSA approved)	PS2702-1
PS2702-1-V-F3	PS2702-1-V-F3-A		Embossed Tape 3 500 pcs/reel	DIN EN 60747-5-5 (VDE 0884-5) Approved (Option)	

Note: \*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 (DC)	I <sub>F</sub>	50	mA	
	Reverse Voltage	V <sub>R</sub>	6.0	V	
	Power Dissipation Derating	⊿P <sub>D</sub> /°C	0.8	mW/°C	
	Power Dissipation	P <sub>D</sub>	80	mW	
	Peak Forward Current*1	I <sub>FP</sub>	1	Α	
Transistor	Collector to Emitter Voltage	V <sub>CEO</sub>	40	V	
	Emitter to Collector Voltage	V <sub>ECO</sub>	6	V	
	Collector Current	I <sub>C</sub>	200	mA	
	Power Dissipation Derating	⊿P <sub>C</sub> /°C	1.5	mW/°C	
	Power Dissipation	Pc	150	mW	
Isolation Voltage *2		BV	3 750	Vr.m.s.	
Operating Ambient Temperature		T <sub>A</sub>	-55 to +100	°C	
Storage Temperature		T <sub>stg</sub>	–55 to +150	°C	

Notes:  $^*$ 1. PW = 100  $\mu$ s, Duty Cycle = 1%

<sup>&</sup>lt;sup>\*</sup>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 $(T_A = 25^{\circ}C)$

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	$V_{F}$	I <sub>F</sub> = 5 mA		1.1	1.4	V
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 5 V			5	μА
	Terminal Capacitance	Ct	V = 0 V, f = 1 MHz		30		pF
Transistor	Collector to Emitter Dark Current	I <sub>CEO</sub>	I <sub>F</sub> = 0 mA, V <sub>CE</sub> = 40 V			400	nA
Coupled	Current Transfer Ratio $(I_C/I_F)^{*1}$	CTR	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 2 V	200	2 000		%
	Collector Saturation Voltage	V <sub>CE (sat)</sub>	I <sub>F</sub> = 1 mA, I <sub>C</sub> = 2 mA			1.0	V
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1 kV <sub>DC</sub>	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1 MHz		0.4		pF
	Rise Time *2	t <sub>r</sub>	$V_{CC}$ = 5 V, $I_{C}$ = 2 mA, $R_{L}$ = 100 $\Omega$		70		μs
	Fall Time *2	t <sub>f</sub>			60		
	Turn-on Time *2	t <sub>on</sub>			90		
	Turn-off Time *2	t <sub>off</sub>			60		

<R> <R>

Notes: \*1. CTR rank

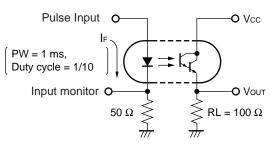
K: 2 000 and larger (%)

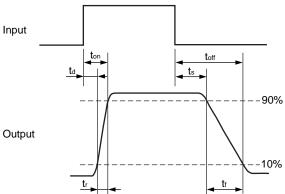
L: 700 to 3 400 (%)

M: 200 to 1 000 (%)

<sup>\*</sup>2. Test circuit for switching time

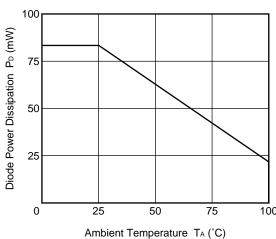
<R>



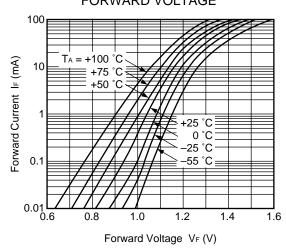


# <R> TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C, unless otherwise specified)

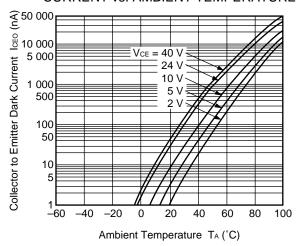




#### FORWARD CURRENT vs. FORWARD VOLTAGE

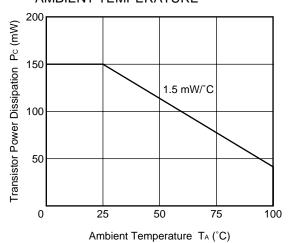


#### COLLECTOR TO EMITTER DARK **CURRENT vs. AMBIENT**

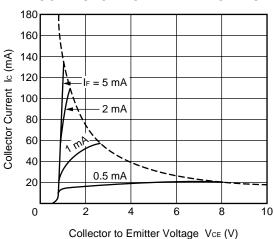


Remark The graphs indicate nominal characteristics.

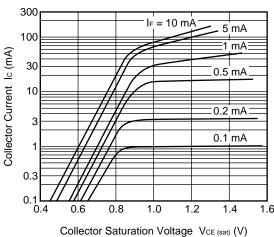
#### TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



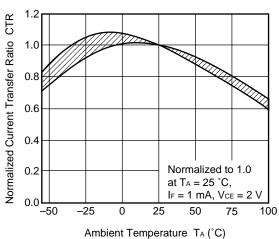
#### COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



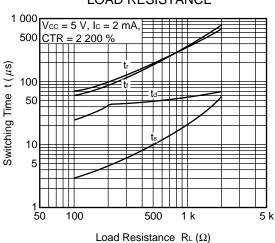
#### COLLECTOR CURRENT vs. **COLLECTOR SATURATION VOLTAGE**



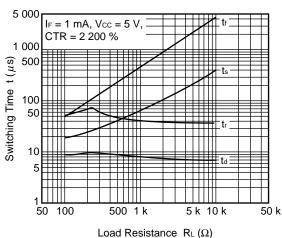
# NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



# SWITCHING TIME vs. LOAD RESISTANCE

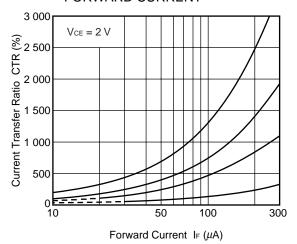


# SWITCHING TIME vs. LOAD RESISTANCE

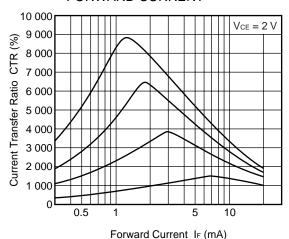


Remark The graphs indicate nominal characteristics.

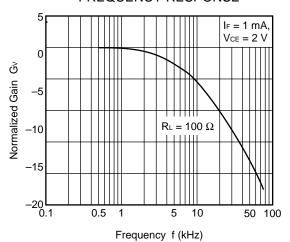
# CURRENT TRANSFER RATIO vs. FORWARD CURRENT



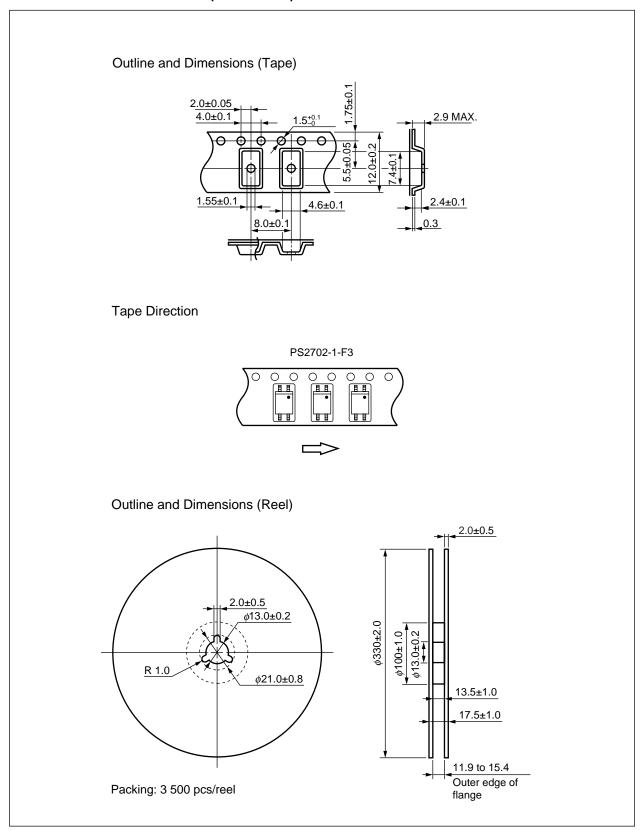
# CURRENT TRANSFER RATIO vs. FORWARD CURRENT



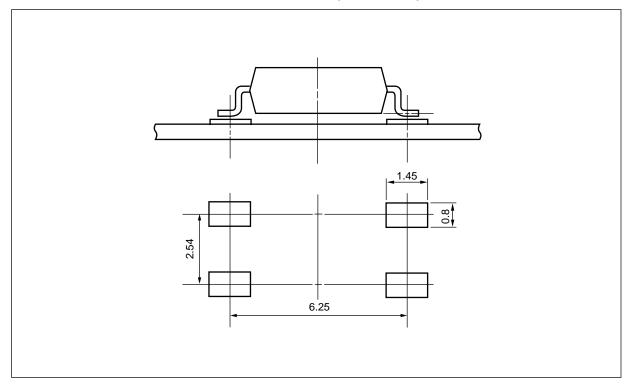
#### FREQUENCY RESPONSE



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



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



**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
    - Time of peak reflow temperature
    - Time of temperature higher than 220°C
    - Time to preheat temperature from 120 to 180°C
    - · Number of reflows
    - Flux

260°C or below (package surface temperature)

10 seconds or less

60 seconds or less

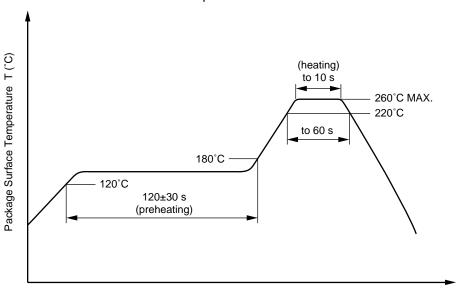
120±30 s

Three

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



Time (s)

(2) Wave soldering

Time

Temperature

Preheating conditions

Number of times

Flux

260°C or below (molten solder temperature)

10 seconds or less

120°C or below (package surface temperature)

One (Allowed to be dipped in solder including plastic

mold portion.)

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)

• Time (each pins)

Flux

350°C or below

3 seconds or less

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

(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 or between collectoremitters 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.



## <R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Spec.	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		55/100/21	
Dielectric strength			
maximum operating isolation voltage	$U_{IORM}$	707	$V_{peak}$
Test voltage (partial discharge test, procedure a for type test and random test)	$U_pr$	1 131	$V_{peak}$
$U_{pr} = 1.6 \times U_{IORM}, P_d < 5 pC$			
Test voltage (partial discharge test, procedure b for all devices) $U_{pr}$ = 1.875 $\times$ $U_{IORM}$ , $P_d$ < 5 pC	U <sub>pr</sub>	1 325	$V_{peak}$
Highest permissible overvoltage	$U_{TR}$	6 000	V <sub>peak</sub>
Degree of pollution (DIN EN 60664-1 VDE 0110 Part 1)		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))	СТІ	175	
Material group (DIN EN 60664-1 VDE 0110 Part 1)		III a	
Storage temperature range	T <sub>stg</sub>	-55 to +150	°C
Operating temperature range	T <sub>A</sub>	-55 to +100	°C
Isolation resistance, minimum value			
$V_{IO}$ = 500 V dc at $T_A$ = 25°C	Ris MIN.	10 <sup>12</sup>	Ω
V <sub>IO</sub> = 500 V dc at T <sub>A</sub> MAX. at least 100°C	Ris MIN.	10 <sup>11</sup>	Ω
Safety maximum ratings (maximum permissible in case of fault, see			
thermal derating curve)			
Package temperature	Tsi	150	°C
Current (input current I <sub>F</sub> , Psi = 0)	Isi	300	mA
Power (output or total power dissipation)	Psi	500	mW
Isolation resistance			
V <sub>IO</sub> = 500 V dc at T <sub>A</sub> = Tsi	Ris MIN.	10 <sup>9</sup>	Ω

Caution | G

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.
  - 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.

#### PS2702-1 Data Sheet

			Description age Summary		
Rev.	Date	Page			
1.00	Mar 31, 2003	_	This data sheet was released as PN10241EJ01V0DS		
3.00	Jan 29, 2013 Throughout Renesas format is applied to this data sheet.				
		p.1	The ordering number and safety standards are revised.		
		p.2	PHOTOCOUPLER CONSTRUCTION is added.		
		p.3	The explanation in MARKING EXAMPLE is revised.		
			One of the captions in MARKING EXAMPLE is revised from Trade Mark to Company initial.		
		p.4	ORDERING INFORMATION is modified with the revision of the safety standards.		
		p.5	Turn-on Time (t <sub>on</sub> ) and Turn-off Time (t <sub>off</sub> ) are added to the table in ELECTRICAL CHARACTERISTICS.		
		p.5	The timing chart is added in the note *2.		
		p.6	The graph of LONG TERM CTR DEGRADATION is deleted from those in		
			TYPICAL CHARACTERISTICS.		
		p.8	PS2702-1-F4 is deleted from Tape Direction image in TAPING		
			SPECIFICATIONS.		
		p.9	RECOMMENDED MOUNT PAD DIMENSIONS is added.		
		p.10	The note about temperature condition of the recommended soldering conditions is deleted.		
		p.12	The format of SPECIFICATION OF VDE MARKS LICENSE DOCUMENT is revised.		
			The value of maximum operating isolation voltage is changed to 707.		
			The value of test voltage (partial discharge test, procedure a for type test and random test) is changed to 1130.		
			The value of test voltage (partial discharge test, procedure b for all devices) is changed to 1325.		
			The value of Current (input current I <sub>F</sub> , Psi = 0) is changed to 300.		
			The value of Power (output or total power dissipation) is changed to 500.		

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