

PS2702-1

HIGH ISOLATION VOLTAGE DARLINGTON TRANSISTOR
SOP MULTI PHOTOCOUPLER SERIES

R08DS0099EJ0302

Rev.3.02

May 14, 2020

DESCRIPTION

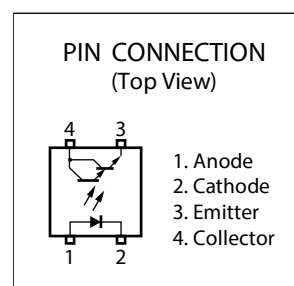
The PS2702-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon Darlington-connected phototransistor.

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.

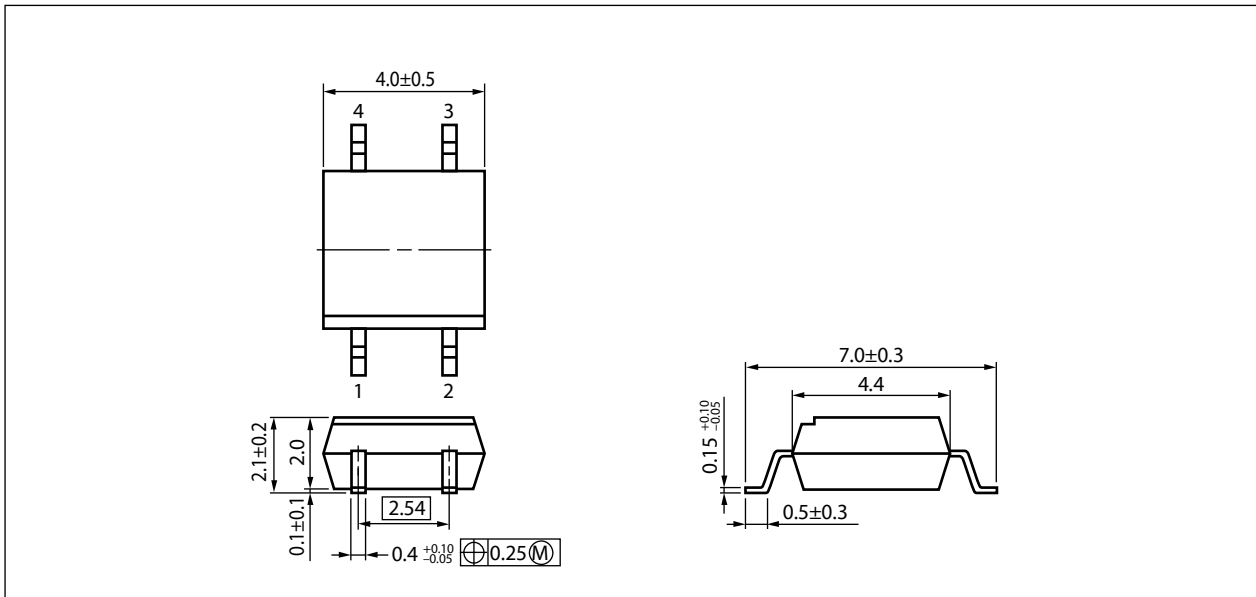
FEATURES

- 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
- Safety standards
 - UL approved: UL1577, Single protection
 - CSA approved: CAN/CSA-C22.2 No. 62368-1, Basic/Supplementary insulation
 - BSI approved: BS EN 62368-1, Basic/Supplementary insulation
 - VDE approved: DIN EN 60747-5-5 (Option)



APPLICATIONS

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

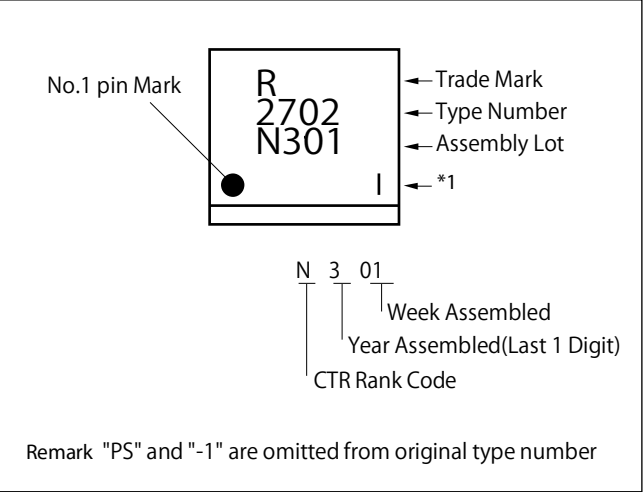
PACKAGE DIMENSIONS (UNIT: mm)

Weight : 0.08 g (typ.)

PHOTOCOUPLER CONSTRUCTION

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

MARKING EXAMPLE



Note: Bar indication contents of *1.

Made in Taiwan (*1: No indication)	<p>The diagram shows a rectangular marking area with a black dot in the bottom-left corner. The text inside the rectangle is: R, 2702, N301. There is no vertical bar in the bottom-right corner.</p>
Made in Japan (*1: " " (Vertical bar))	<p>The diagram shows a rectangular marking area with a black dot in the bottom-left corner. The text inside the rectangle is: R, 2702, N301, and a vertical bar () in the bottom-right corner. An arrow points from the label '" " (Vertical bar) :Made in Japan' to the vertical bar in the diagram.</p>

ORDERING INFORMATION

Part Number	Order Number ^{*1}	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number ^{*2}
PS2702-1	PS2702-1-A	Pb-Free	20 pcs (Tape 20 pcs cut)	Standard products (UL, CSA, BSI, approved)	PS2702-1
PS2702-1-F3	PS2702-1-F3-A		Embossed Tape 3 500 pcs/reel		
PS2702-1-V	PS2702-1-V-A		20 pcs (Tape 20 pcs cut)	UL, CSA, BSI,	
PS2702-1-V-F3	PS2702-1-V-F3-A		Embossed Tape 3 500 pcs/reel	DIN EN 60747-5-5 approved	

Note: ^{*1}. When specifying CTR rank, please add "/CTR rank" after Order Number.
ex. L rank : PS2702-1-A /L

Note: ^{*2}. 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 (DC)	I_F	50	mA
	Reverse Voltage	V_R	6.0	V
	Power Dissipation Derating	$\Delta P_D/^\circ\text{C}$	0.8	mW/ $^\circ\text{C}$
	Power Dissipation	P_D	80	mW
	Peak Forward Current ^{*1}	I_{FP}	1	A
Transistor	Collector to Emitter Voltage	V_{CEO}	40	V
	Emitter to Collector Voltage	V_{ECO}	6	V
	Collector Current	I_C	200	mA
	Power Dissipation Derating	$\Delta P_D/^\circ\text{C}$	1.5	mW/ $^\circ\text{C}$
	Power Dissipation	P_C	150	mW
Isolation Voltage ^{*2}		BV	3 750	Vr.m.s.
Operating Ambient Temperature		T_A	-55 to +100	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55 to +150	$^\circ\text{C}$

Notes: ^{*1}. PW = 100 μs , Duty Cycle = 1%

^{*2}. AC voltage for 1 minute at $T_A = 25^\circ\text{C}$, RH = 60% between input and output.
Pins 1-2 shorted together, 3-4 shorted together.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

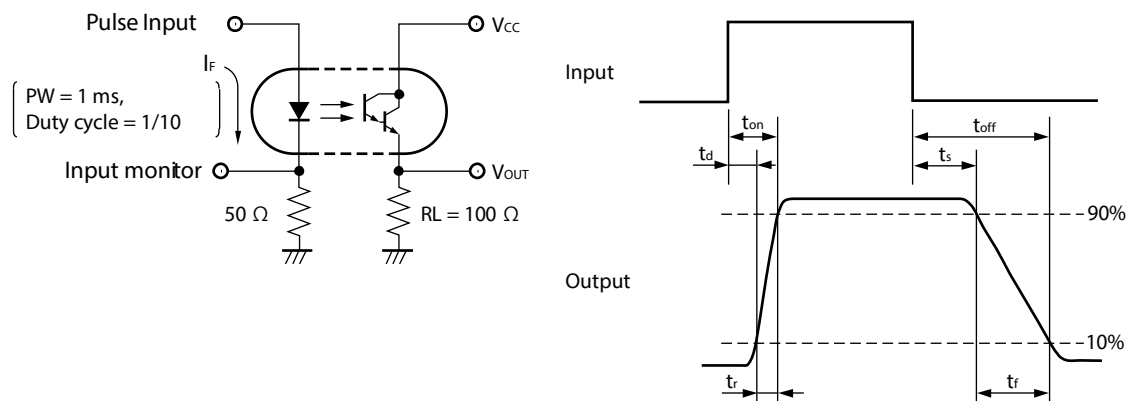
	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V _F	I _F = 5 mA		1.1	1.4	V
	Reverse Current	I _R	V _R = 5 V			5	μA
	Terminal Capacitance	C _t	V = 0 V, f = 1 MHz		30		pF
Transistor	Collector to Emitter Dark Current	I _{CEO}	I _F = 0 mA, V _{CE} = 40 V			400	nA
Coupled	Current Transfer Ratio (I _C /I _F) ^{*1}	CTR	I _F = 1 mA, V _{CE} = 2 V	200	2 000		%
	Collector Saturation Voltage	V _{CE(sat)}	I _F = 1 mA, I _C = 2 mA			1.0	V
	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		0.4		pF
	Rise Time ^{*2}	t _r	V _{CC} = 5 V, I _C = 2 mA, R _L = 100 Ω		70		μs
	Fall Time ^{*2}	t _f			60		
	Turn-on Time ^{*2}	t _{on}			90		
	Turn-off Time ^{*2}	t _{off}			60		

Notes: ^{*1}. CTR rank

K: 2 000 and larger (%)

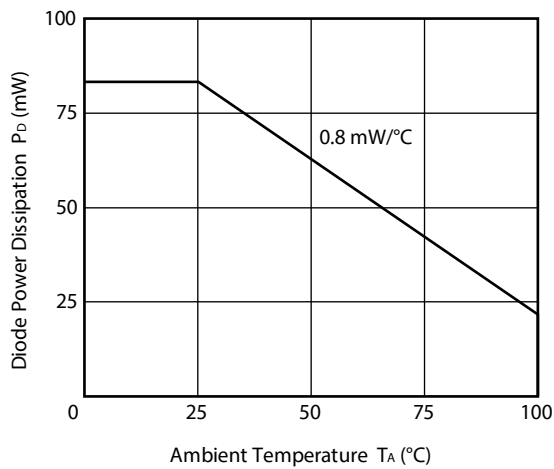
L: 700 to 3 400 (%)

M: 200 to 1 000 (%)

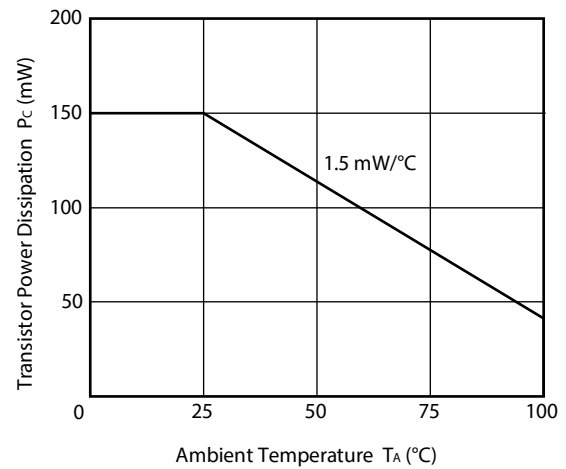
^{*2}. Test circuit for switching time

TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)

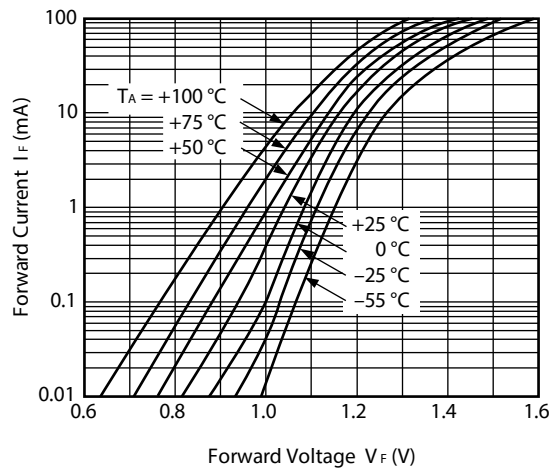
DIODE POWER DISSIPATION vs.
AMBIENT TEMPERATURE



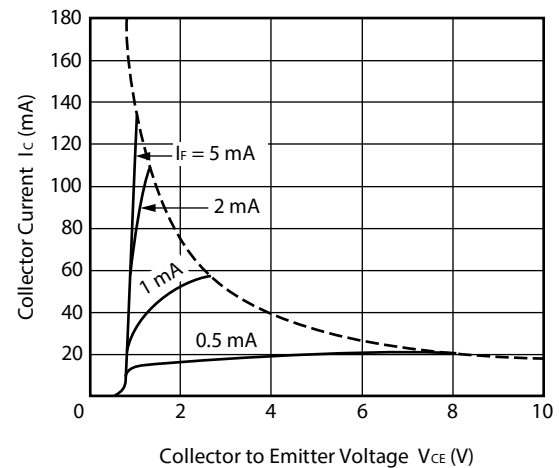
TRANSISTOR POWER DISSIPATION vs.
AMBIENT TEMPERATURE



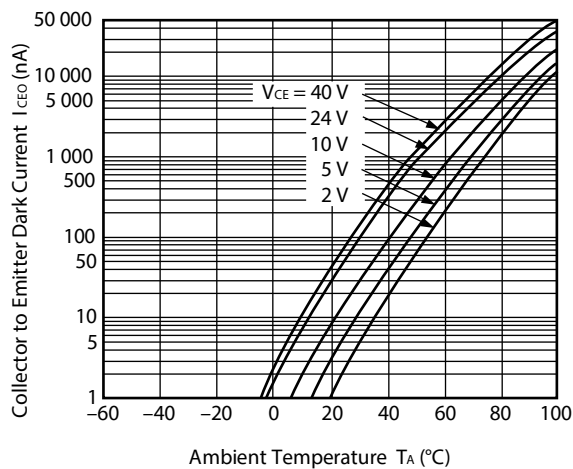
FORWARD CURRENT vs.
FORWARD VOLTAGE



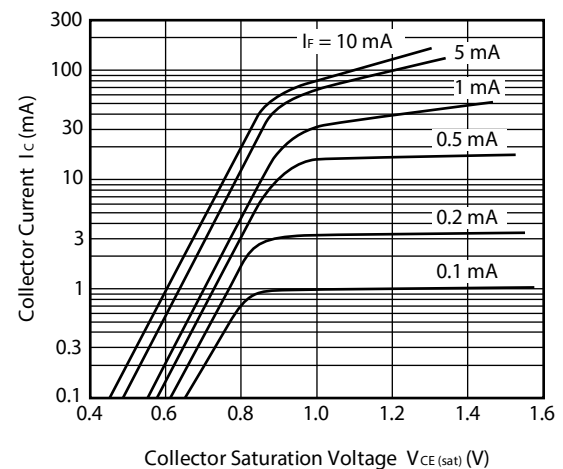
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



COLLECTOR TO EMITTER DARK
CURRENT vs. AMBIENT TEMPERATURE

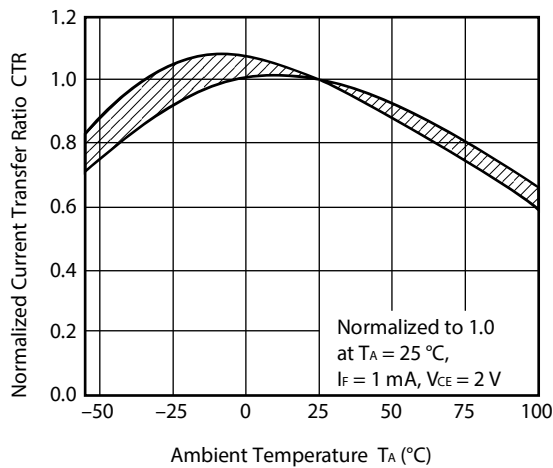


COLLECTOR CURRENT vs.
COLLECTOR SATURATION VOLTAGE

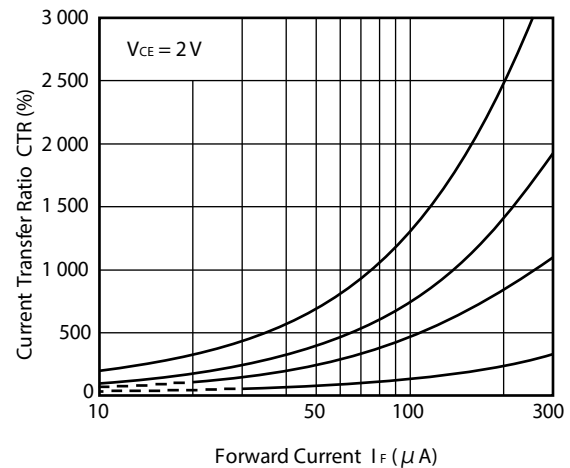


Remark The graphs indicate nominal characteristics.

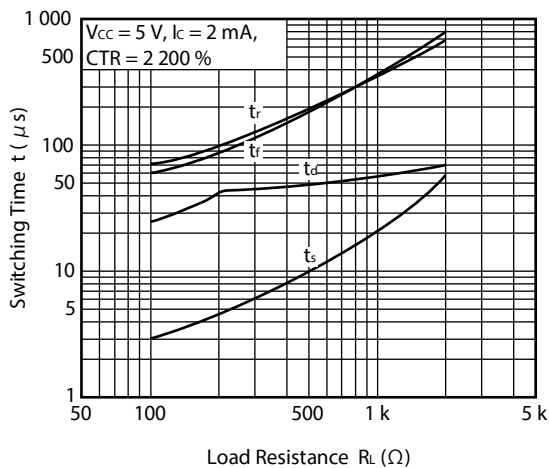
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



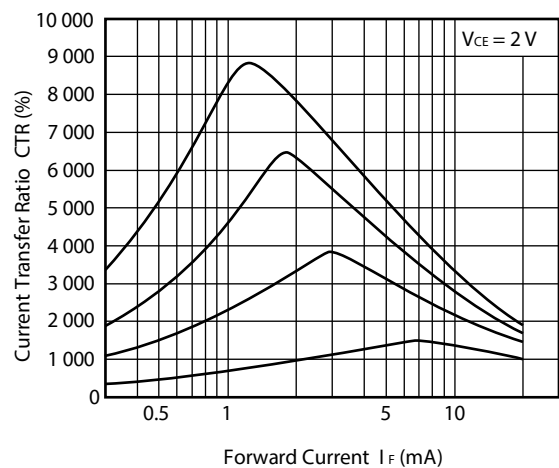
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



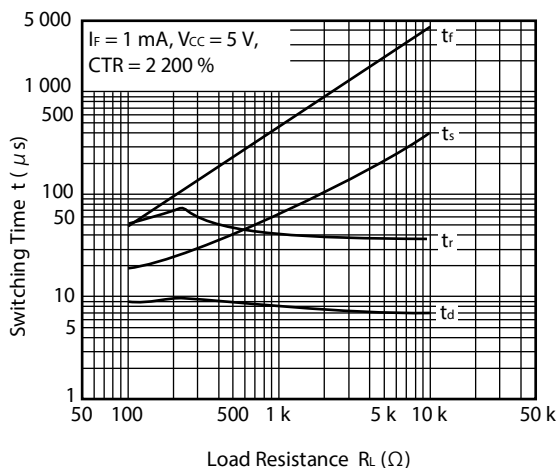
SWITCHING TIME vs. LOAD RESISTANCE



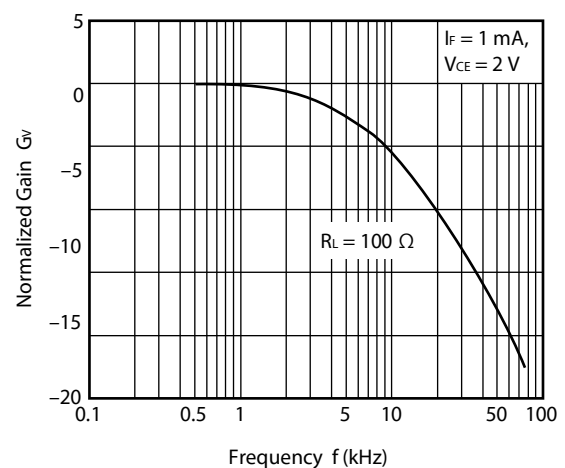
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



SWITCHING TIME vs. LOAD RESISTANCE



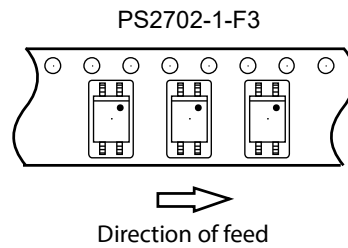
FREQUENCY RESPONSE



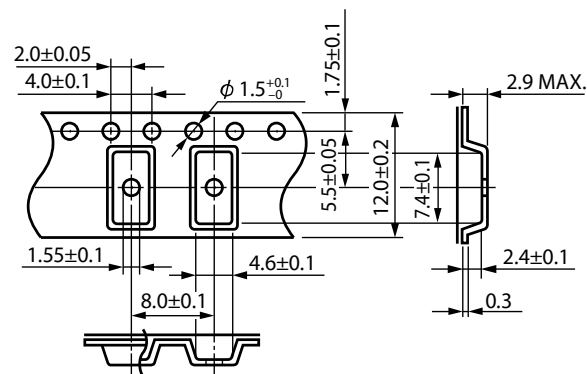
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

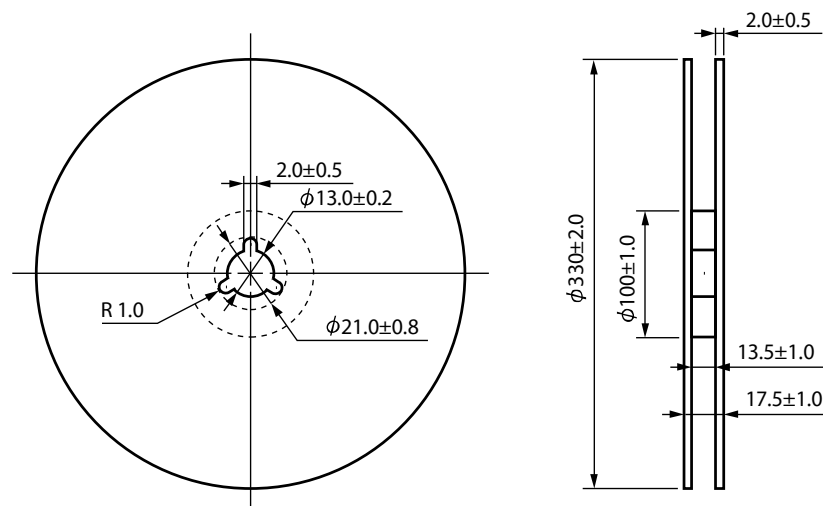
Tape Direction



Outline and Dimensions (Tape)

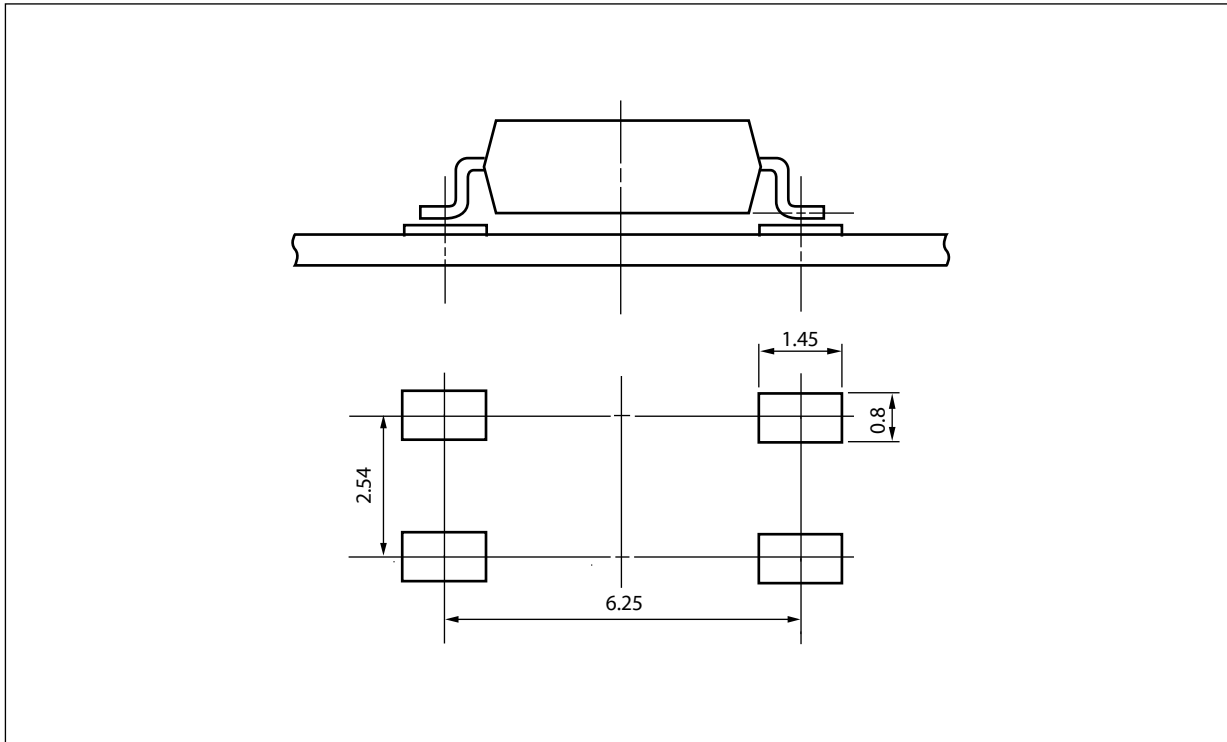


Outline and Dimensions (Reel)



Packing: 3 500 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



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

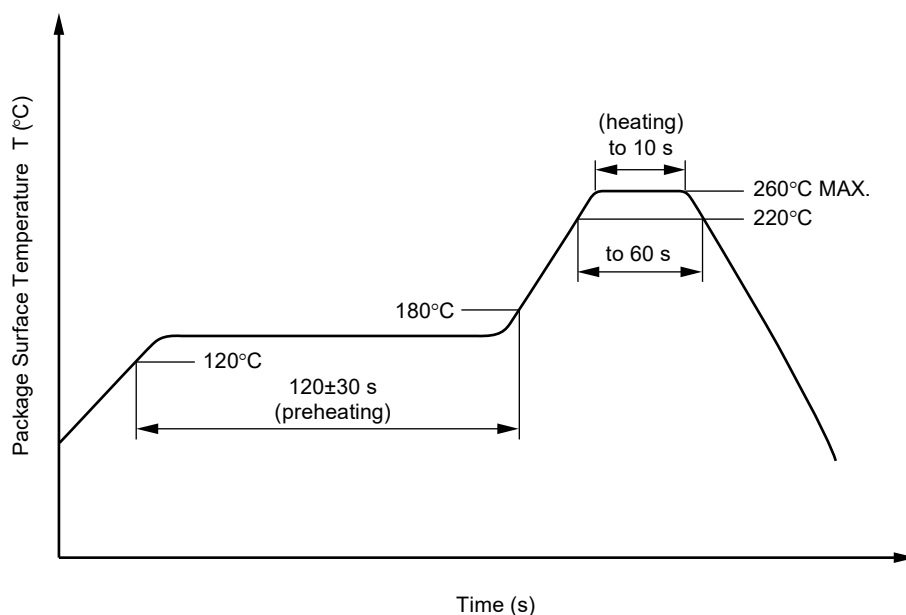
NOTES ON HANDLING

1. Recommended soldering conditions

(1) Infrared reflow soldering

- Peak reflow temperature 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.

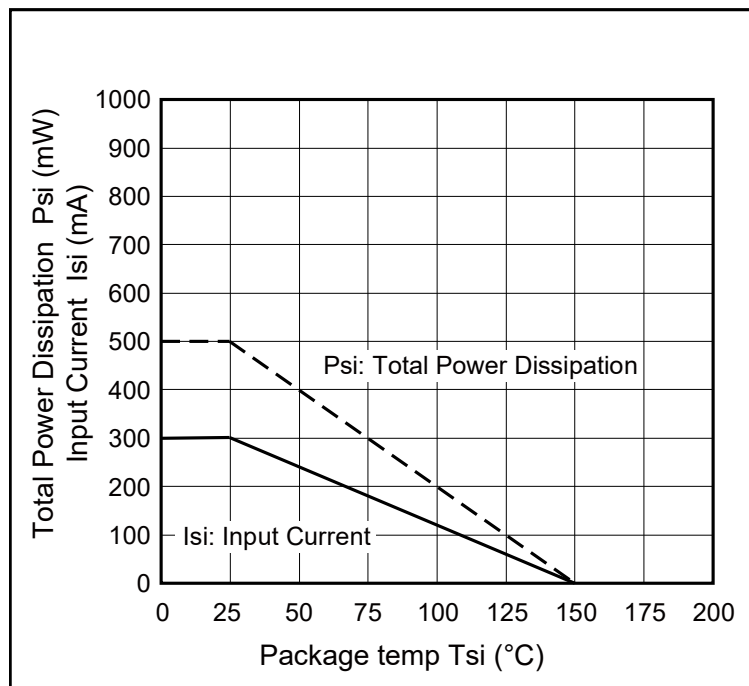
USAGE CAUTIONS

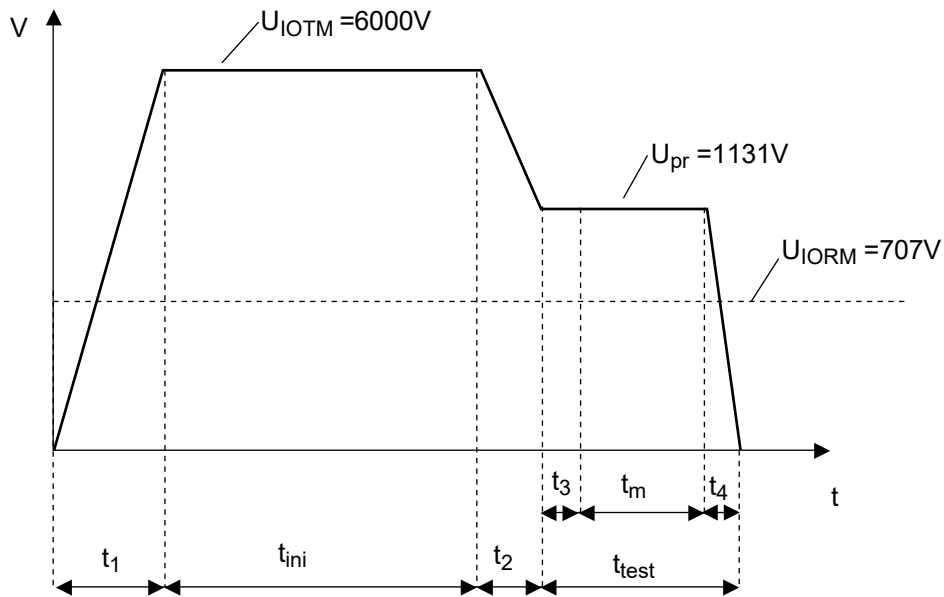
1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.
3. Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
4. Do not use fixing agents or coatings containing halogen-based substances.

SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

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) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$	U_{IORM} U_{pr}	707 1 131	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}	1 325	V_{peak}
Highest permissible overvoltage	U_{IOTM}	6 000	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 +100	°C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	$R_{is \text{ MIN.}}$ $R_{is \text{ MIN.}}$	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 , $\Psi_i = 0$) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	T_{si} I_{si} Ψ_i $R_{is \text{ MIN.}}$	150 300 500 10^9	°C mA mW Ω

Dependence of maximum safety ratings with package temperature



Method a) Destructive Test, Type and Sample Test

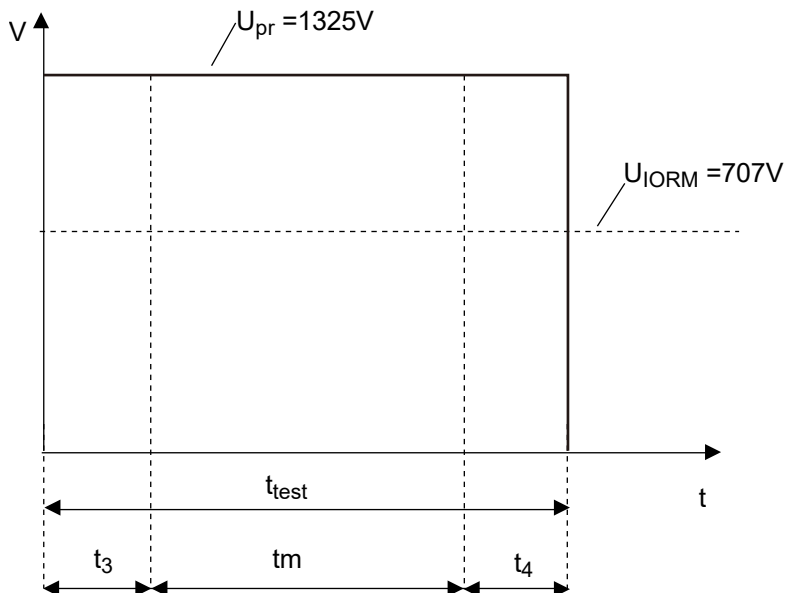
$t_1, t_2 = 1 \text{ to } 10 \text{ sec}$

$t_3, t_4 = 1 \text{ sec}$

$t_m(\text{PARTIAL DISCHARGE}) = 10 \text{ sec}$

$t_{test} = 12 \text{ sec}$

$t_{ini} = 60 \text{ sec}$

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

$t_3, t_4 = 0.1 \text{ sec}$

$t_m(\text{PARTIAL DISCHARGE}) = 1.0 \text{ sec}$

$t_{test} = 1.2 \text{ sec}$

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 in any way allow it to enter the mouth.

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