

# DATA SHEET

# NEC

# PHOTOCOUPLER PS2705-1, PS2705-2, PS2705-4

**HIGH ISOLATION VOLTAGE  
AC INPUT RESPONSE TYPE  
SOP MULTI PHOTOCOUPLER**

–NEPOC™ Series–

## DESCRIPTION

The PS2705-1, PS2705-2, PS2705-4 are optically coupled isolators containing two GaAs light emitting diodes and an NPN silicon phototransistor.

These packages are SOP (Small Outline Package) type and have shield effect to cut off ambient light.

They are designed for high density mounting applications.

## FEATURES

- AC input response
- High isolation voltage ( $BV = 3\ 750\ V_{r.m.s.}$ )
- ★ • High current transfer ratio ( $CTR = 100\ \% \text{ TYP.}$ )
- SOP (Small Outline Package) type
- High-speed switching ( $t_r = 3\ \mu s \text{ TYP.}$ ,  $t_f = 5\ \mu s \text{ TYP.}$ )
- Ordering number of taping product (Only-1 type) : PS2705-1-E3, E4, F3, F4
- UL approved: File No. E72422 (S)
- VDE0884 approved (Option)

## ★ APPLICATIONS

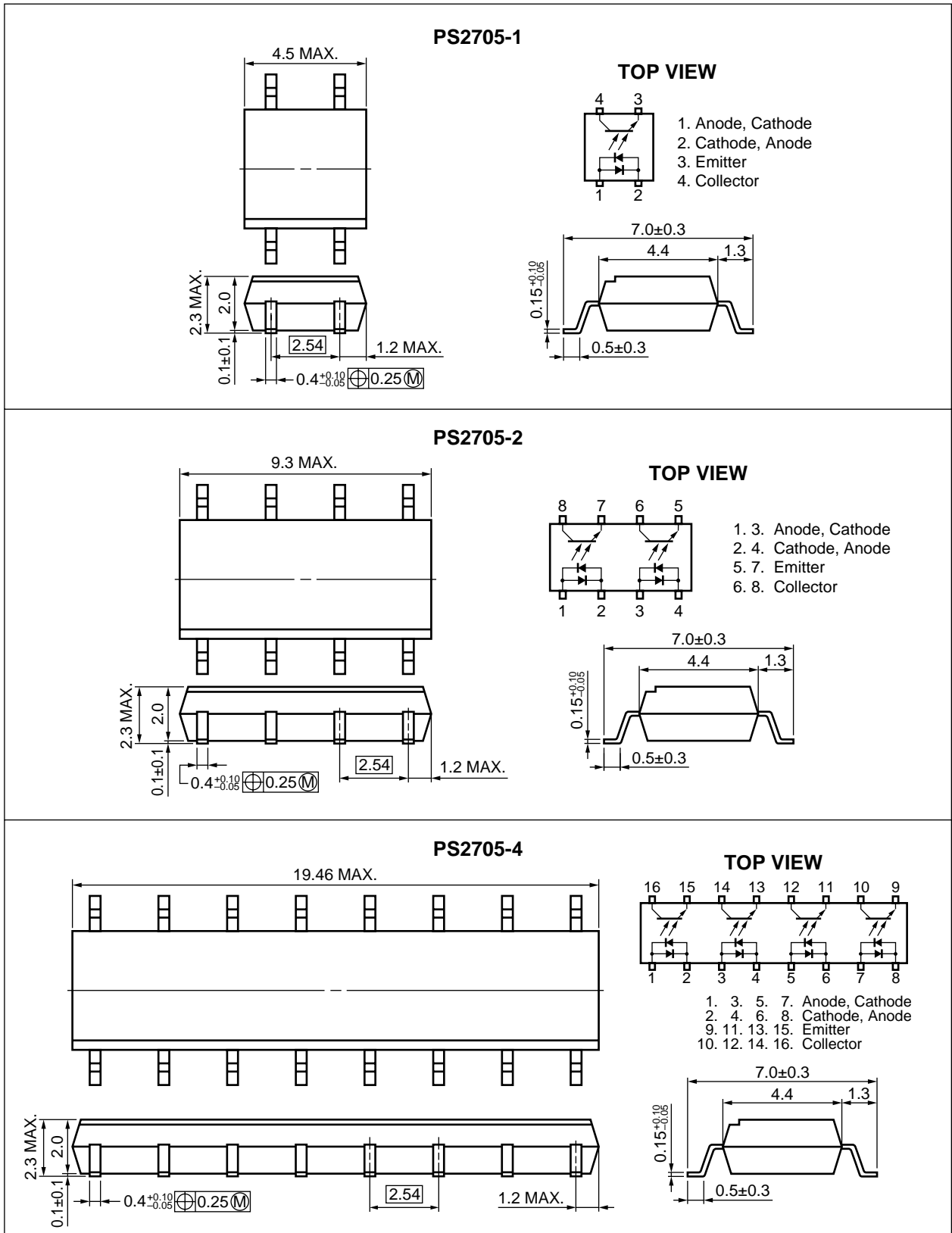
- Hybrid IC
- Telephone/FAX
- FA/OA equipment
- Programmable logic controllers
- Power supply

## ORDERING INFORMATION

Part Number	Package	Safety Standard Approval
PS2705-1	4-pin SOP	Standard products • UL approved
PS2705-2	8-pin SOP	
PS2705-4	16-pin SOP	
PS2705-1-V	4-pin SOP	VDE0884 approved products (Option)
PS2705-2-V	8-pin SOP	
PS2705-4-V	16-pin SOP	

The information in this document is subject to change without notice.

PACKAGE DIMENSIONS (in millimeters)



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

Parameter		Symbol	Ratings		Unit
			PS2705-1	PS2705-2, PS2705-4	
Diode	Forward Current (DC)	I <sub>F</sub>	± 50		mA
	Power Dissipation Derating	ΔP <sub>D</sub> /°C	0.8		mW/°C
	Power Dissipation	P <sub>D</sub>	80		mW/ch
	Peak Forward Current <sup>*1</sup>	I <sub>FP</sub>	± 1		A
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>	80		mA/ch
	Power Dissipation Derating	ΔP <sub>C</sub> /°C	1.5	1.2	mW/°C
	Power Dissipation	P <sub>C</sub>	150	120	mW/ch
Isolation Voltage <sup>*2</sup>		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

\*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

**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> = ± 5 mA		1.1	1.4	V
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1 MHz		60		pF
Transistor	Collector to Emitter Current	I <sub>CEO</sub>	I <sub>F</sub> = 0 mA, V <sub>CE</sub> = 40 V			100	nA
Coupled	Current Transfer Ratio (I <sub>c</sub> /I <sub>F</sub> ) <sup>*1</sup>	CTR	I <sub>F</sub> = ± 5 mA, V <sub>CE</sub> = 5 V	50	100	300	%
	CTR Ratio	CTR <sub>1</sub> /CTR <sub>2</sub>	I <sub>F</sub> = ± 5 mA, V <sub>CE</sub> = 5 V	0.3	1.0	3.0	
	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 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 <sup>*2</sup>	t <sub>r</sub>	V <sub>CC</sub> = 5 V, I <sub>c</sub> = 2 mA, R <sub>L</sub> = 100 Ω		3		μs
	Fall Time <sup>*2</sup>	t <sub>f</sub>			5		

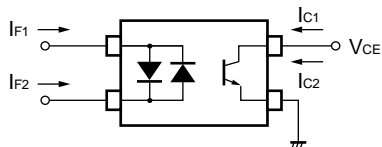
★ \*1 CTR rank (only PS2705-1)

M: 50 to 150 (%)

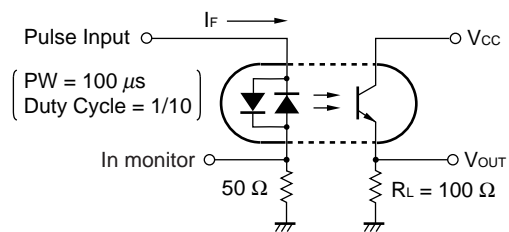
L: 100 to 300 (%)

N: 50 to 300 (%)

\*2 CTR<sub>1</sub> = I<sub>c1</sub>/I<sub>F1</sub>, CTR<sub>2</sub> = I<sub>c2</sub>/I<sub>F2</sub>

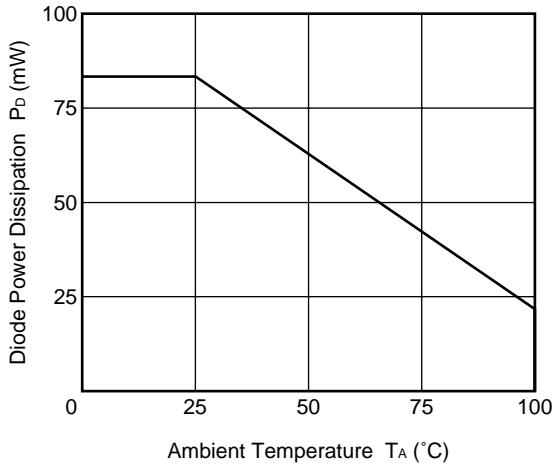


★ \*3 Test circuit for switching time

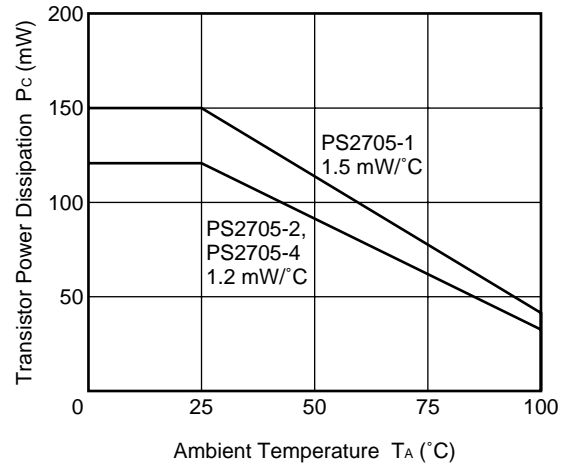


★ TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

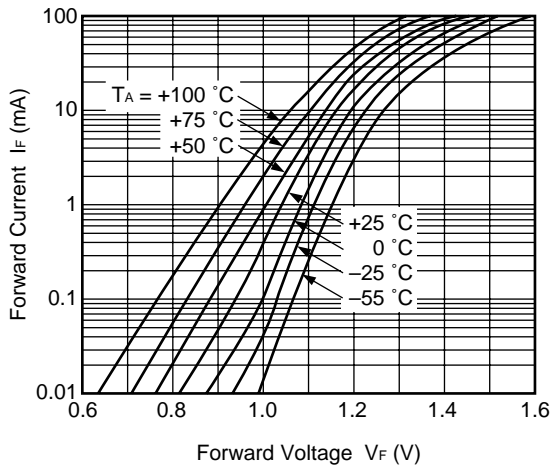
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



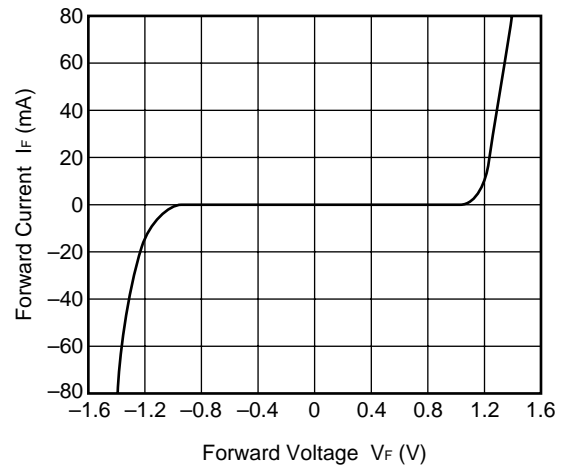
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



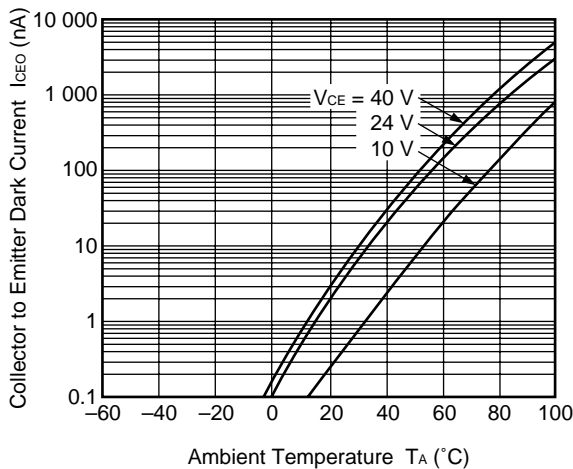
FORWARD CURRENT vs. FORWARD VOLTAGE



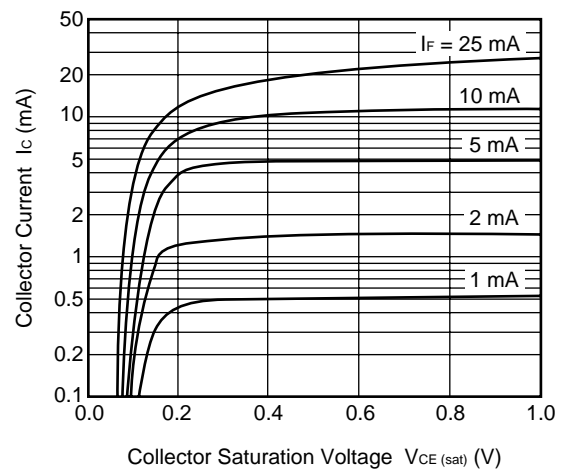
FORWARD CURRENT vs. FORWARD VOLTAGE



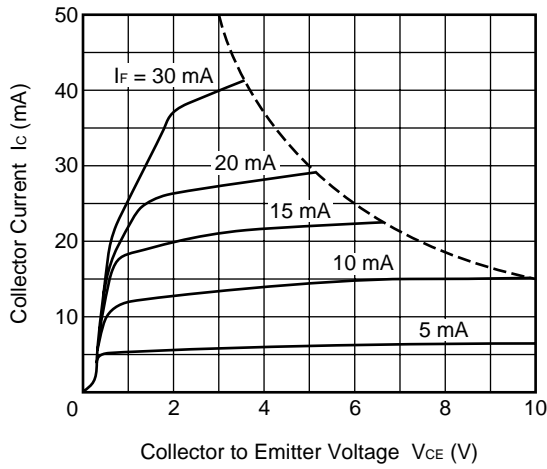
COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE



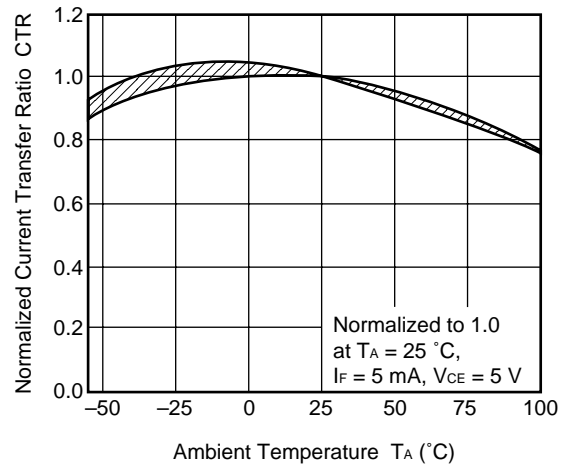
COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE



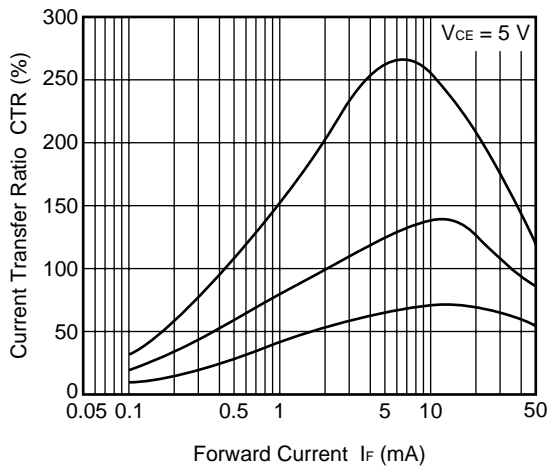
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



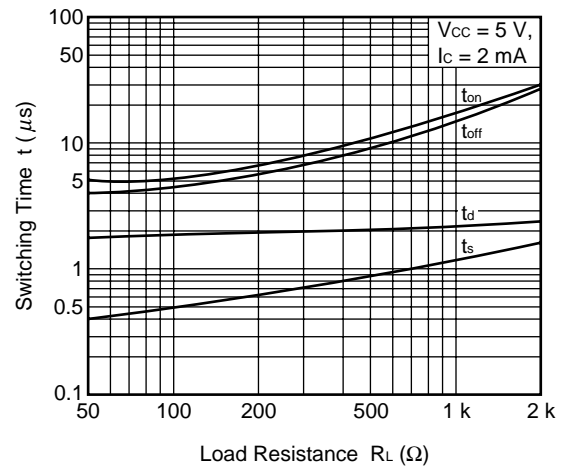
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



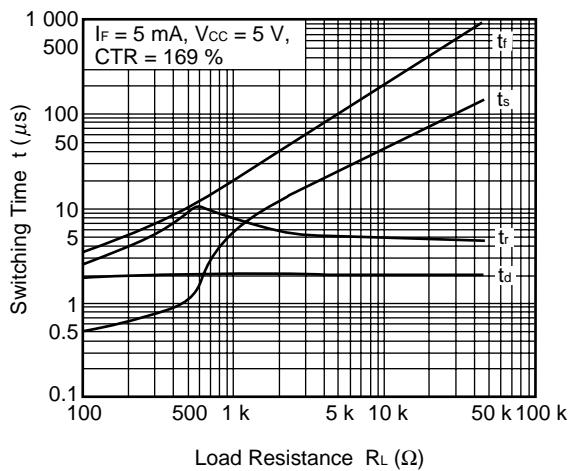
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



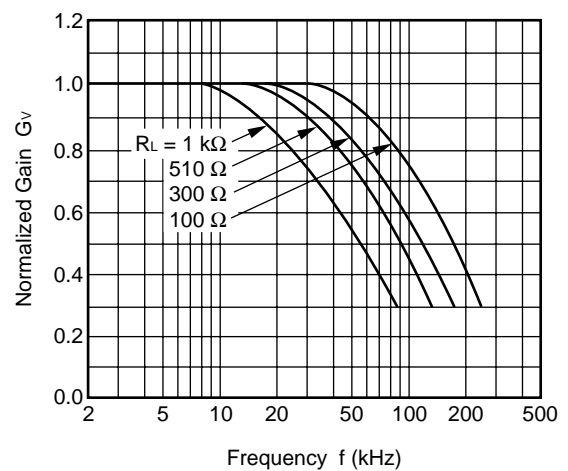
SWITCHING TIME vs. LOAD RESISTANCE

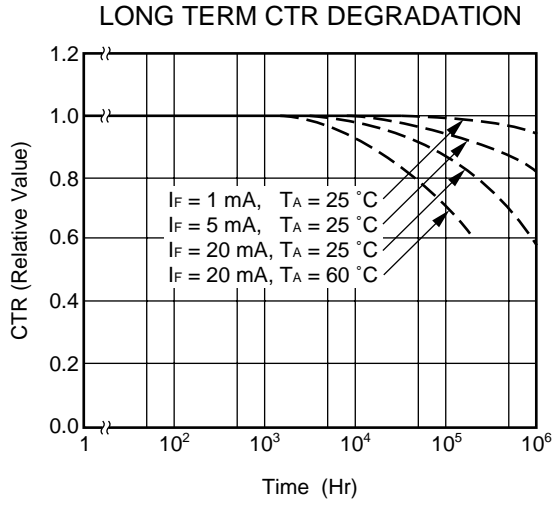


SWITCHING TIME vs. LOAD RESISTANCE



FREQUENCY RESPONSE

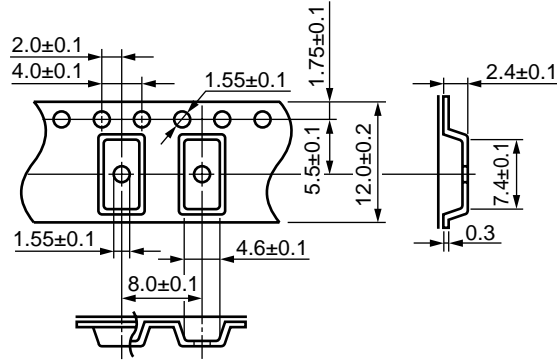




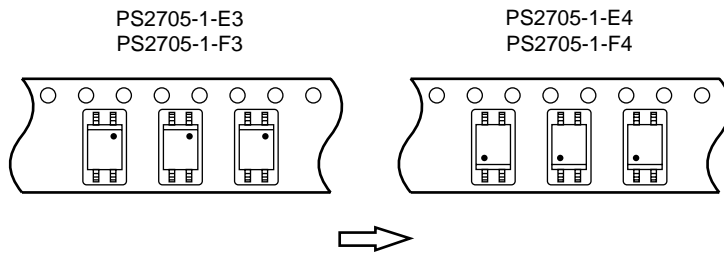
**Remark** The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (in millimeters)

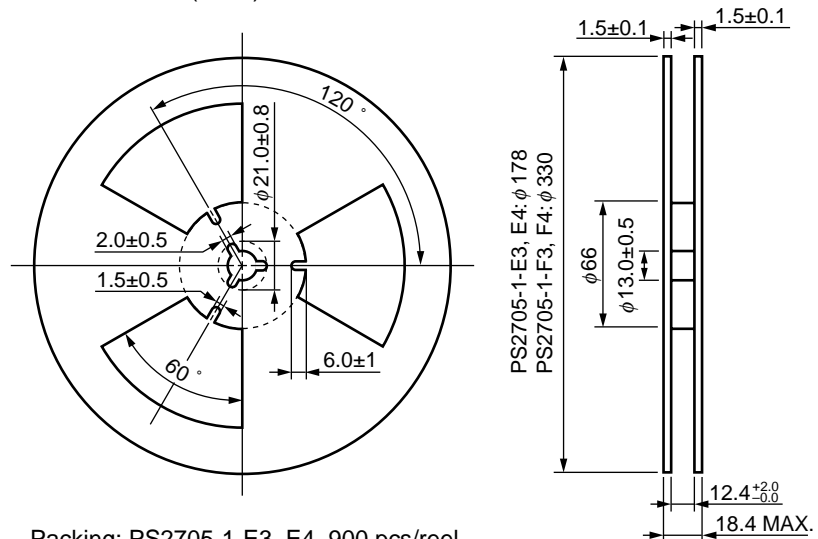
Outline and Dimensions (Tape)



Taping Direction



Outline and Dimensions (Reel)



Packing: PS2705-1-E3, E4 900 pcs/reel  
 PS2705-1-F3, F4 3 500 pcs/reel

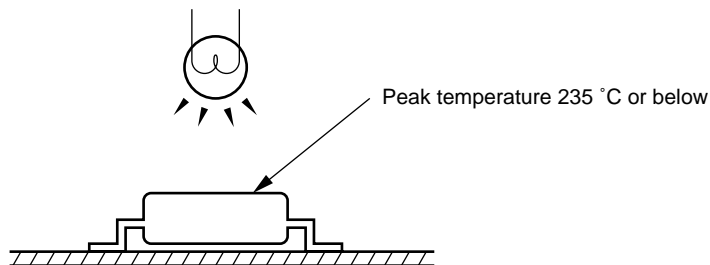
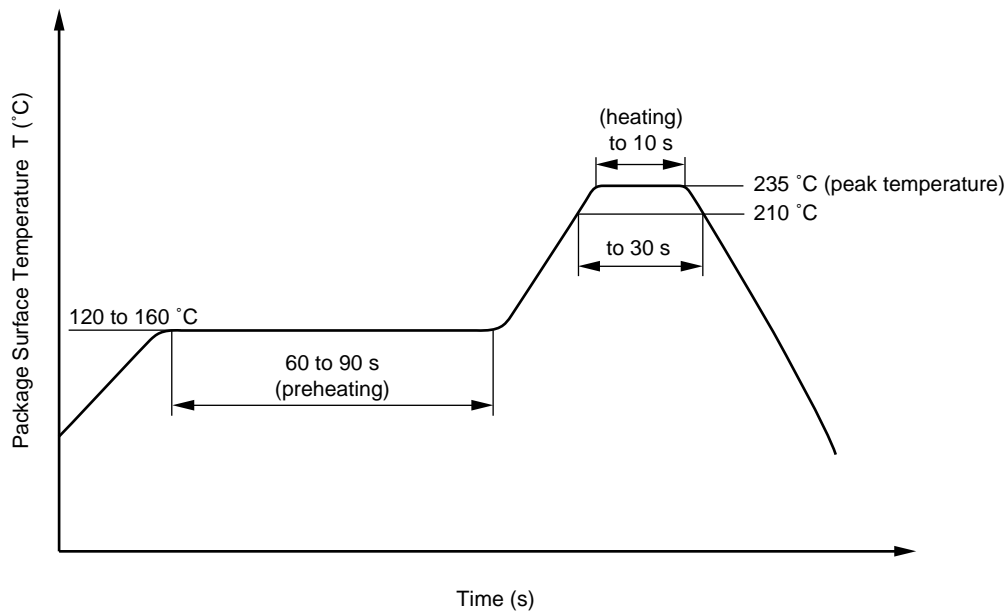


**RECOMMENDED SOLDERING CONDITIONS**

**(1) Infrared reflow soldering**

- Peak reflow temperature 235 °C (package surface temperature)
- Time of temperature higher than 210 °C 30 seconds or less
- 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) Dip soldering**

- Temperature 260 °C or below (molten solder temperature)
- Time 10 seconds or less
- Number of times One
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt % is recommended.)

SPECIFICATION OF VDE MARKS LICENSE DOCUMENT (VDE0884)

Parameter	Symbol	Speck	Unit
Application classification (DIN VDE 0109) for rated line voltages $\leq 300$ Vr.m.s. for rated line voltages $\leq 600$ Vr.m.s.		IV III	
Climatic test class (DIN IEC 68 Teil 1/09.80)		55/100/21	
Dielectric strength Maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.2 \times U_{IORM}, P_d < 5$ pC	$U_{IORM}$ $U_{pr}$	710 850	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for random test) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5$ pC	$U_{pr}$	1 140	$V_{peak}$
Highest permissible overvoltage	$U_{TR}$	6 000	$V_{peak}$
Degree of pollution (DIN VDE 0109)		2	
Clearance distance		> 5	mm
Creepage distance		> 5	mm
Comparative tracking index (DIN IEC 112/VDE 0303 part 1)	CTI	175	
Material group (DIN VDE 0109)		III a	
Storage temperature range	$T_{stg}$	-55 to +150	°C
Operating temperature range	$T_A$	-55 to +100	°C
Isolation resistance, minimum value $V_{IO} = 500$ V dc at $T_A = 25$ °C $V_{IO} = 500$ V dc at $T_A$ MAX. at least 100 °C	Ris MIN. Ris MIN.	$10^{12}$ $10^{11}$	$\Omega$ $\Omega$
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 $V_{IO} = 500$ V dc at $T_A = 175$ °C ( $T_{si}$ )	$T_{si}$ $I_{si}$ $P_{si}$ Ris MIN.	150 200 300 $10^9$	°C mA mW $\Omega$

[MEMO]

**CAUTION**

**Within this device there exists GaAs (Gallium Arsenide) material which is a harmful substance if ingested. Please do not under any circumstances break the hermetic seal.**

**NEPOC is a trademark of NEC Corporation.**

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.