NEC

PHOTOCOUPLER
PS9701

HIGH SPEED DIGITAL OUTPUT TYPE 5-PIN SOP PHOTOCOUPLER

–NEPOC Series–

DESCRIPTION

The PS9701 is an optically coupled isolator containing a GaAlAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

This is SOP (Small Outline Package) type for high-density applications.

FEATURES

- High isolation voltage (BV = 2 500 Vr.m.s.)
- Small and thin package (5-pin SOP)
- High-speed response (t_{PHL} = 36 ns TYP., t_{PLH} = 60 ns TYP.)
- Low threshold input current (I_{FHL} = 2.5 mA TYP.)
- Open collector type
- ★ Ordering number of taping product: PS9701-F3, F4: 3 500 pcs/reel
- Safety standards
  - UL approved: File No. E72422 (S)
  - ★ BSI approved (BS415, BS7002) : No. 8387
  - VDE0884 approved (Option)

APPLICATIONS

- Computer and peripheral manufactures
- Measurement equipment
- Audio-Visual

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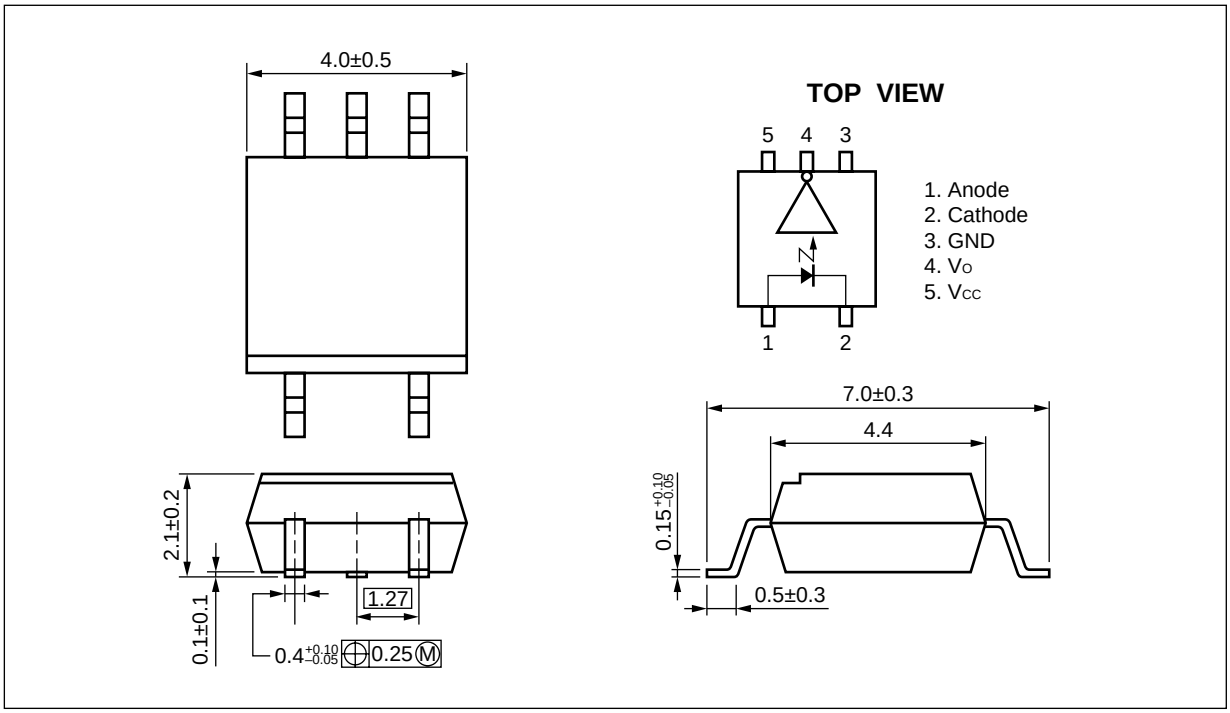
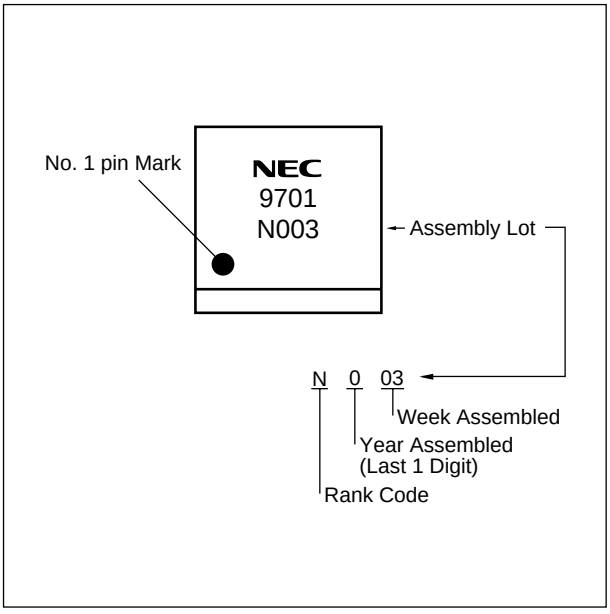
Printed in Japan

The mark ★ shows major revised points.

★ **PACKAGE DIMENSIONS (UNIT: mm)**



★ **MARKING EXAMPLE**



★ ORDERING INFORMATION

Part Number		Package	Packing Style	Application Part Number[*1]
Standard Products	VDE0884 Approved Products (Option)			
PS9701	PS9701-V	5-pin SOP	Magazine case 100 pcs	PS9701
PS9701-F3	PS9701-V-F3		Embossed tape 3 500 pcs/reel	
PS9701-F4	PS9701-V-F4			

***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	I_F	30	mA
	Reverse Voltage	V_R	5	V
Detector	Supply Voltage	V_{CC}	7	V
	Output Voltage	V_O	7	V
	Output Current	I_O	50	mA
	Power Dissipation	P_C	85	mW
Isolation Voltage[*1]		BV	2 500	Vr.m.s.
Operating Ambient Temperature		T_A	–40 to +85	°C
Storage Temperature		T_{stg}	–55 to +125	°C

***1** AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

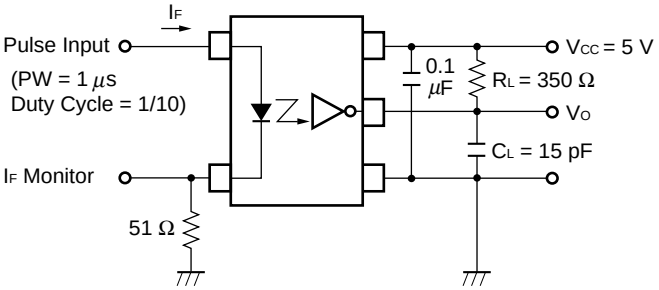
RECOMMENDED OPERATING CONDITIONS

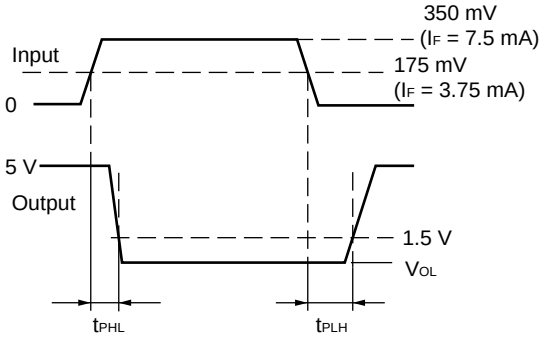
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
High Level Input Current	I_{FH}	5	7.5	15	mA
Low Level Input Current	I_{FL}	0		250	μA
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
Operating Ambient Temperature	T_A	0	25	70	°C

ELECTRICAL CHARACTERISTICS (T_A = 0 to +70°C, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C	1.4	1.65	1.9	V
	Reverse Current	I_R	V_R = 5 V, T_A = 25°C			10	μA
	Terminal Capacitance	C_t	V = 0 V, f = 1 MHz, T_A = 25°C		60		pF
Detector	High Level Output Current	I_{OH}	V_{CC} = V_O = 5.5 V, I_F = 250 μA		2	250	μA
★	Low Level Output Voltage	V_{OL}	V_{CC} = 5.5 V, I_F = 7.5 mA, I_{OL} = 13 mA		0.3	0.6	V
	High Level Supply Current	I_{CCH}	V_{CC} = 5.5 V, I_F = 0 mA	4	6	8	mA
	Low Level Supply Current	I_{CCL}	V_{CC} = 5.5 V, I_F = 10 mA	9	12	15	mA
Coupled	Threshold Input Current (H → L)	I_{FHL}	T_A = 25°C	0.5	2.5	5.0	mA
			V_{CC} = 5 V, V_O = 0.8 V, R_L = 350 Ω			7	
	Isolation Resistance	R_{I-O}	V_{I-O} = 1 kVDC, RH = 40 to 60%, T_A = 25°C	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V = 0 V, f = 1 MHz, T_A = 25°C		0.6		pF
	Propagation Delay Time (H → L)*1	t_{PHL}	V_{CC} = 5 V, I_F = 7.5 mA, R_L = 350 Ω, C_L = 15 pF, T_A = 25°C		36	75	ns
	Propagation Delay Time (L → H)*1	t_{PLH}			60	75	
	Rise Time	t_r			20		
	Fall Time	t_f			10		

★ ***1** Test circuit for propagation delay time





C_L includes probe and stray wiring capacitance.

★ **CAUTIONS REGARDING NOISE**

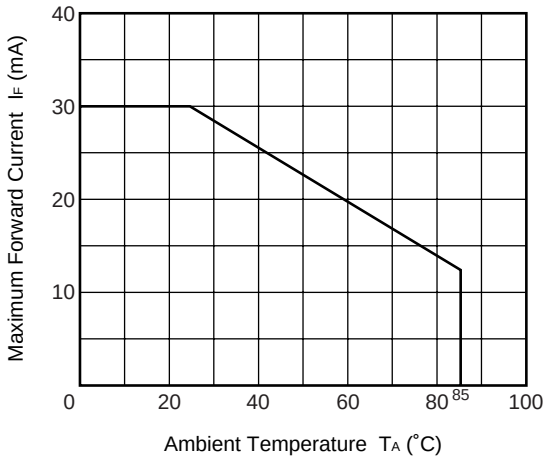
Be aware that when voltage is applied suddenly between the photocoupler's input and output at startup, the output side may enter the on state, even if the voltage is within the absolute maximum ratings.

★ **USAGE CAUTIONS**

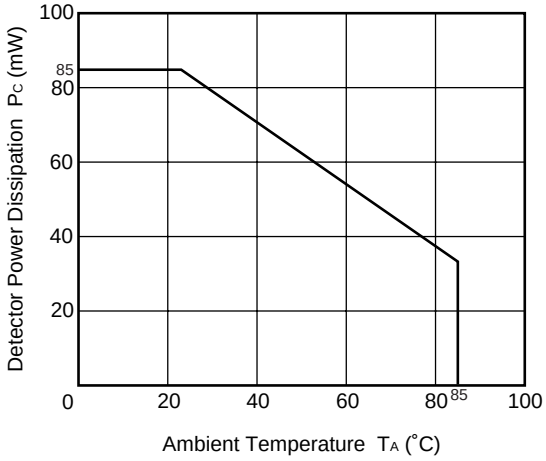
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than 0.1 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.

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

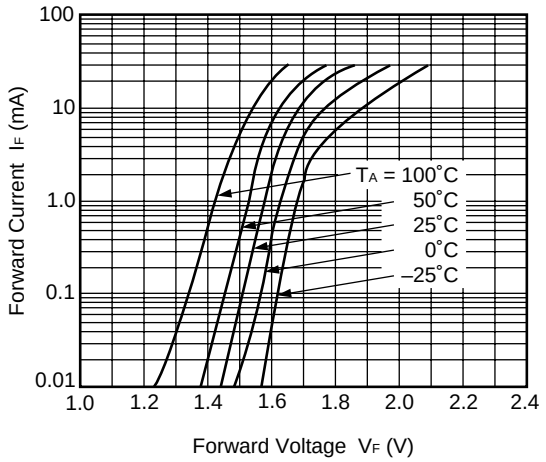
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



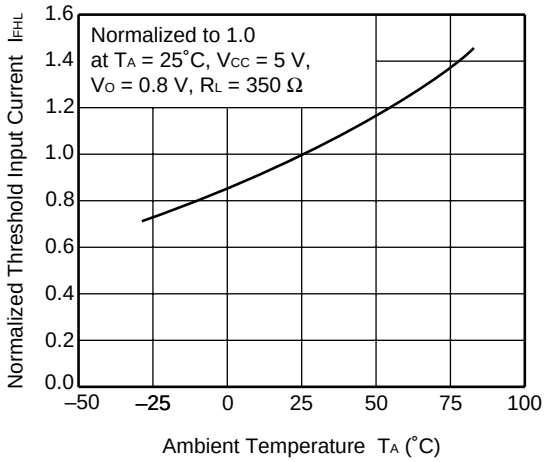
DETECTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



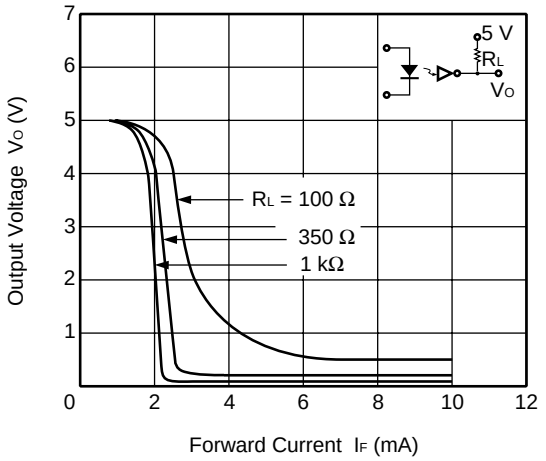
FORWARD CURRENT vs. FORWARD VOLTAGE



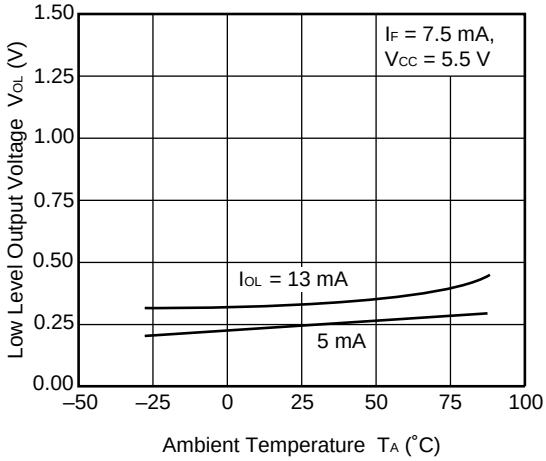
NORMALIZED THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



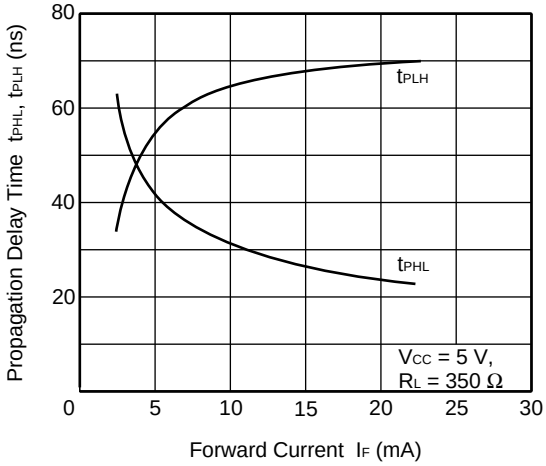
OUTPUT VOLTAGE vs. FORWARD CURRENT



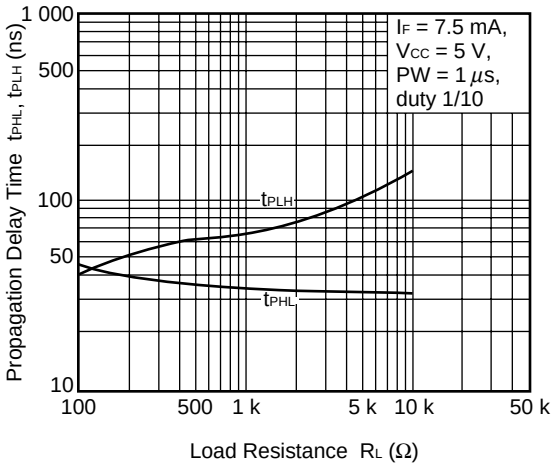
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



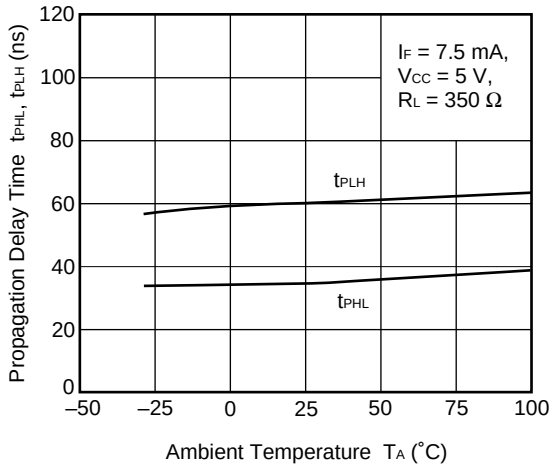
PROPAGATION DELAY TIME vs.
FORWARD CURRENT



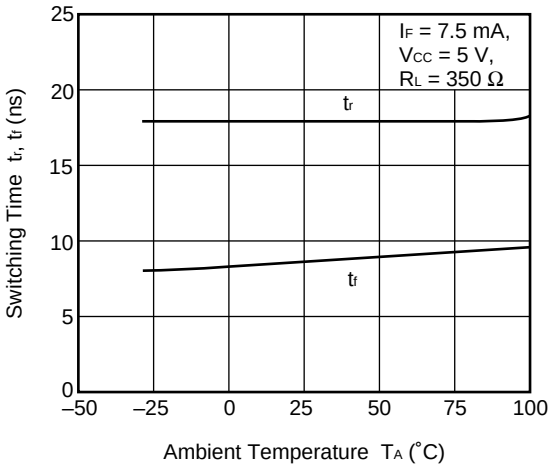
PROPAGATION DELAY TIME vs.
LOAD RESISTANCE



PROPAGATION DELAY TIME vs.
AMBIENT TEMPERATURE



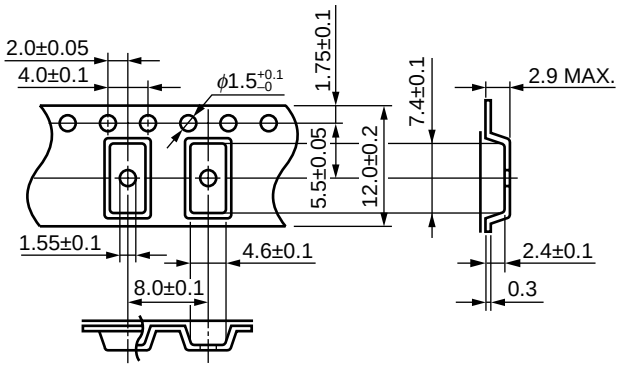
SWITCHING TIME vs.
AMBIENT TEMPERATURE



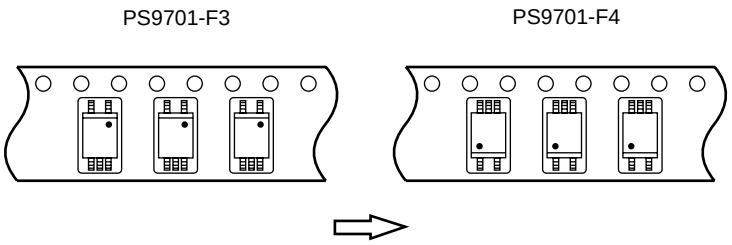
Remark The graphs indicate nominal characteristics.

★ **TAPING SPECIFICATIONS (UNIT: mm)**

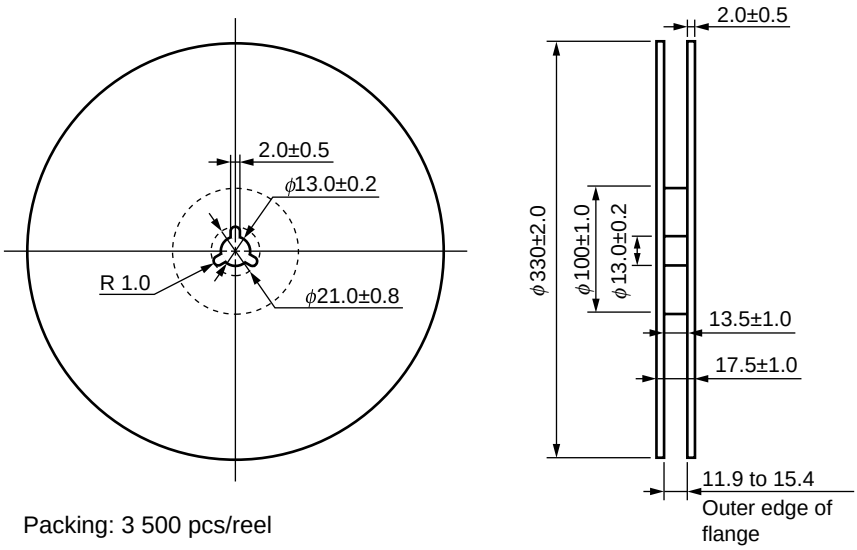
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



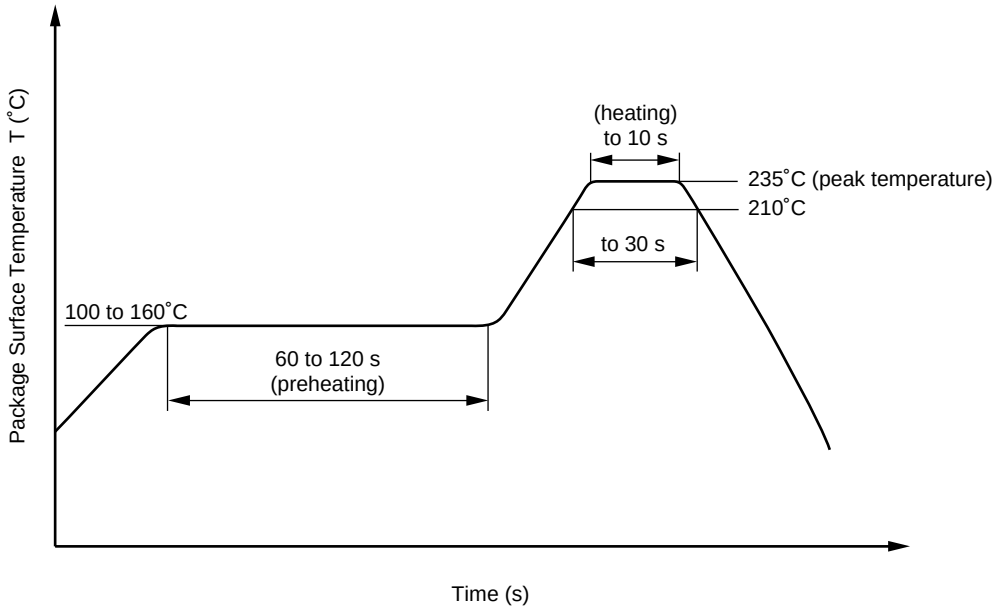
Packing: 3 500 pcs/reel

★ RECOMMENDED SOLDERING CONDITIONS

(1) Infrared reflow soldering

• Peak reflow temperature	235°C or below (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) Cautions

• Fluxes

Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.

SPECIFICATION OF VDE MARKS LICENSE DOCUMENT (VDE0884)

Parameter	Symbol	Speck	Unit
Application classification (DIN VDE 0109)			
for rated line voltages ≤ 300 Vr.m.s.		IV	
for rated line voltages ≤ 600 Vr.m.s.		III	
Climatic test class (DIN IEC 68 Teil 1/09.80)		40/085/21	
Dielectric strength maximum operating isolation voltage.			
Test voltage (partial discharge test procedure a for type test and random test)	U_{IORM}	710	V_{peak}
$U_{pr} = 1.2 \times U_{IORM}$, $P_d < 5$ pC	U_{pr}	850	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}	4 000	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 +125	°C
Operating temperature range	T_A	–40 to +85	°C
Isolation resistance, minimum value			
V_{IO} = 500 V dc at T_A = 25°C	Ris MIN.	10^{12}	Ω
V_{IO} = 500 V dc at T_A MAX. at least 100°C	Ris MIN.	10^{11}	Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)			
Package temperature	Tsi	150	°C
Current (input current I_F, Psi = 0)	Isi	200	mA
Power (output or total power dissipation)	Psi	300	mW
Isolation resistance			
V_{IO} = 500 V dc at T_A = 175°C (Tsi)	Ris MIN.	10^9	Ω

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M8E 00.4-0110

SAFETY INFORMATION ON THIS PRODUCT

Caution GaAs Products	The product contains gallium arsenide, GaAs. GaAs vapor and powder are hazardous to human health if inhaled or ingested. • Do not destroy or burn the product. • Do not cut or cleave off any part of the product. • Do not crush or chemically dissolve the product. • Do not put the product in the mouth. Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.

▶**Business issue**

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▶**Technical issue**

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