

**LONG CREEPAGE TYPE  
HIGH ISOLATION VOLTAGE  
6-PIN PHOTOCOUPLER**

–NEPOC™ Series–

**DESCRIPTION**

The PS2653, PS2654, PS2653L2, PS2654L2 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon darlington-connected phototransistor in a plastic DIP (Dual In-line Package).

The PS2653 has base pin and the PS2654 has no base pin.

Creepage distance and clearance of leads are over 8 millimeters.

The PS2653L2, PS2654L2 are lead bending type (Gull-wing) for surface mount.

**FEATURES**

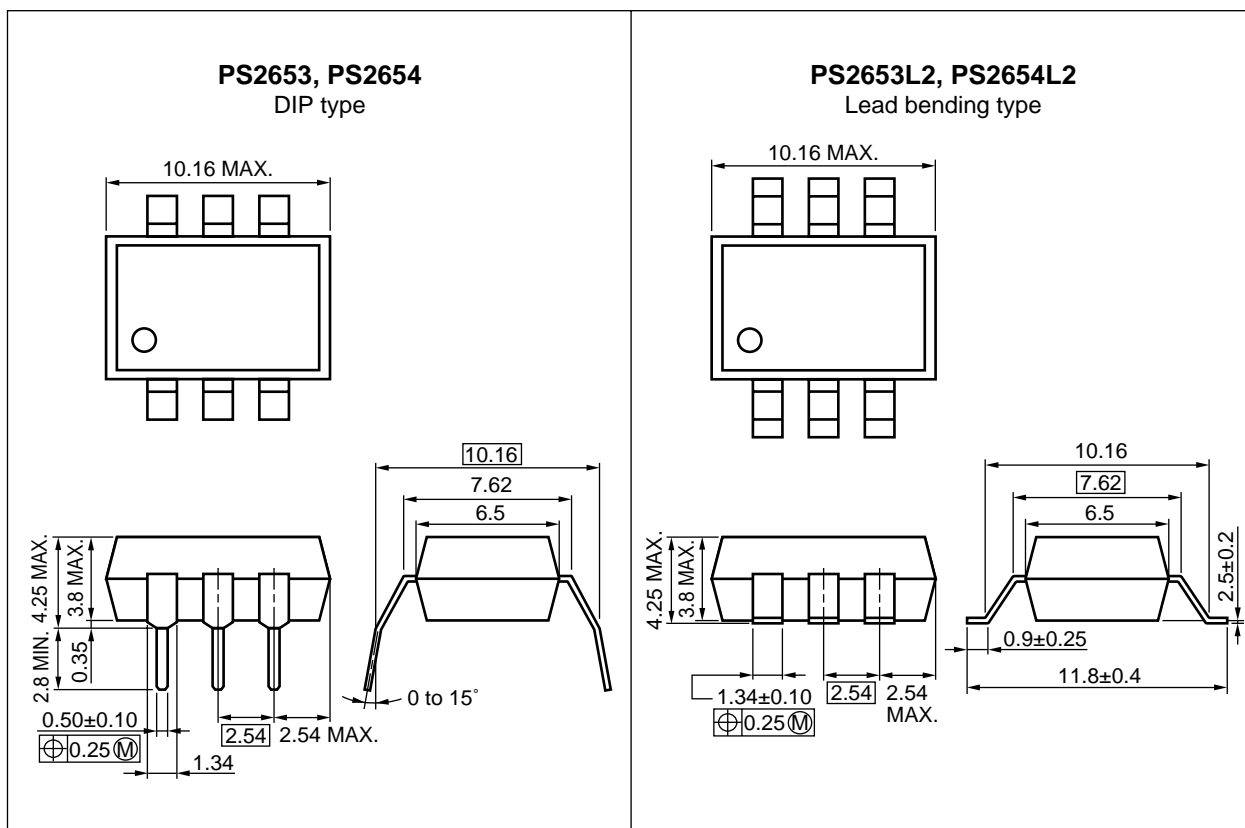
- Long creepage distance (8 mm)
- High Isolation voltage (BV = 5 000 Vr.m.s.)
- High-speed switching ( $t_r, t_f = 100 \mu s$  TYP.)
- High current transfer ratio (CTR = 2 000 % TYP.)
- UL approved: File No. E72422 (S)
- BSI approved (EN 60065/IEC 65, EN 60950/IEC 950) : No. 7250
- SEMKO approved (EN 60065/IEC 60065, EN 60950/IEC 60950) : No. 9317144
- NEMKO approved (EN 60065/IEC 65, EN 60950/IEC 950) : No. A21409
- DEMKO approved (EN 60065/IEC 60665, EN 60950/IEC 950) : No. 300535
- FIMKO approved (EN 60065/IEC 65, EN 60950/IEC 950) : No. 167265-08
- VDE0884 approved (Option)

**★ APPLICATIONS**

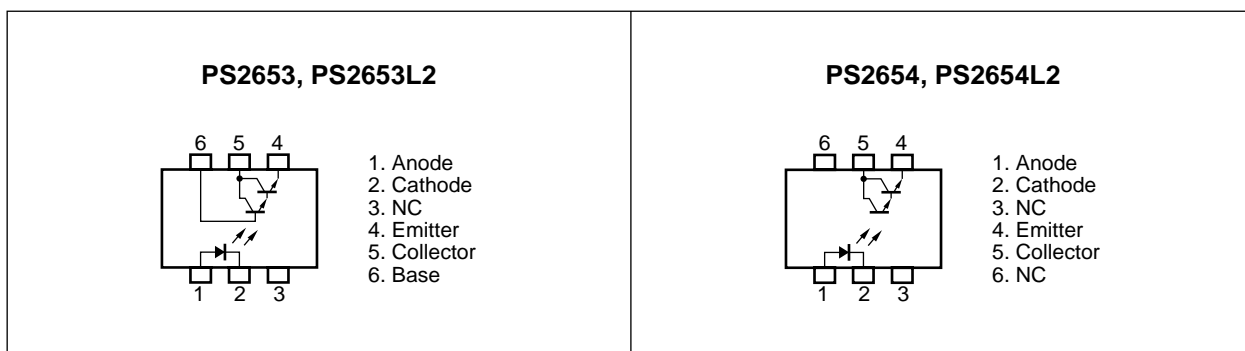
- Power supply
- Telephone, FAX
- FA/OA equipment

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

★ PACKAGE DIMENSIONS (in millimeters)



PIN CONNECTIONS (TOP VIEW)



**★ ORDERING INFORMATION**

Part Number	Package	Safety Standard Approval	Application Part Number <sup>*1</sup>
PS2653, PS2654	6-pin DIP	Standard products	PS2653
PS2653L2, PS2654L2	6-pin DIP (lead bending surface mount)	<ul style="list-style-type: none"> <li>• UL approved</li> <li>• SEMKO approved</li> <li>• DEMKO approved</li> <li>• BSI approved</li> <li>• NEMKO approved</li> <li>• FIMKO approved</li> </ul>	PS2654
PS2653-V, PS2654-V	6-pin DIP	VDE0884 approved products (Option)	
PS2653L2-V, PS2654L2-V	6-pin DIP (lead bending surface mount)	<ul style="list-style-type: none"> <li>• VDE approved</li> <li>• BSI approved</li> <li>• NEMKO approved</li> <li>• FIMKO approved</li> <li>• UL approved</li> <li>• SEMKO approved</li> <li>• DEMKO approved</li> </ul>	

\*1 As applying to Safety Standard, following part number should be used.

**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)**

Parameter		Symbol	Ratings	Unit
Diode	Forward Current (DC)	$I_F$	80	mA
	Reverse Voltage	$V_R$	6	V
	Power Dissipation Derating	$\Delta P_D/^{\circ}\text{C}$	1.5	mW/ $^{\circ}\text{C}$
	Power Dissipation	$P_D$	150	mW
	Peak Forward Current <sup>*1</sup>	$I_{FP}$	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	$\Delta P_C/^{\circ}\text{C}$	2.0	mW/ $^{\circ}\text{C}$
	Power Dissipation	$P_C$	200	mW
Isolation Voltage <sup>*2</sup>		BV	5 000	Vr.m.s.
Operating Ambient Temperature		$T_A$	-55 to +100	$^{\circ}\text{C}$
Storage Temperature		$T_{stg}$	-55 to +150	$^{\circ}\text{C}$

<sup>\*1</sup> PW = 100  $\mu\text{s}$ , Duty Cycle = 1 %

<sup>\*2</sup> AC voltage for 1 minute at  $T_A = 25\text{ }^{\circ}\text{C}$ , 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> = 10 mA		1.1	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		30		pF
Transistor	Collector to Emitter Dark Current	I <sub>CEO</sub>	V <sub>CE</sub> = 40 V, I <sub>F</sub> = 0 mA			400	nA
	DC Current Gain <sup>*1</sup>	h <sub>FE</sub>	I <sub>C</sub> = 5 mA, V <sub>CE</sub> = 2 V		180		
Coupled	Current Transfer Ratio <sup>*2</sup>	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> = 1.0 kV <sub>DC</sub>	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1.0 MHz		0.6		pF
	Rise Time <sup>*3</sup>	t <sub>r</sub>	V <sub>CC</sub> = 5 V, I <sub>C</sub> = 10 mA, R <sub>L</sub> = 100 Ω		100		μs
	Fall Time <sup>*3</sup>	t <sub>f</sub>			100		

**\*1** Second stage transistor (PS2653, PS2653L2 only)

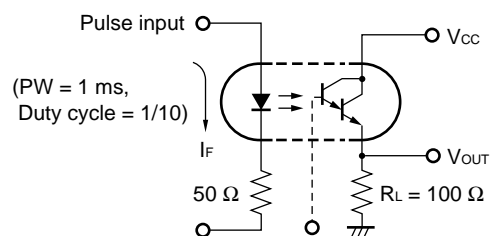
**\*2** CTR rank

K : 2 300 to (%)

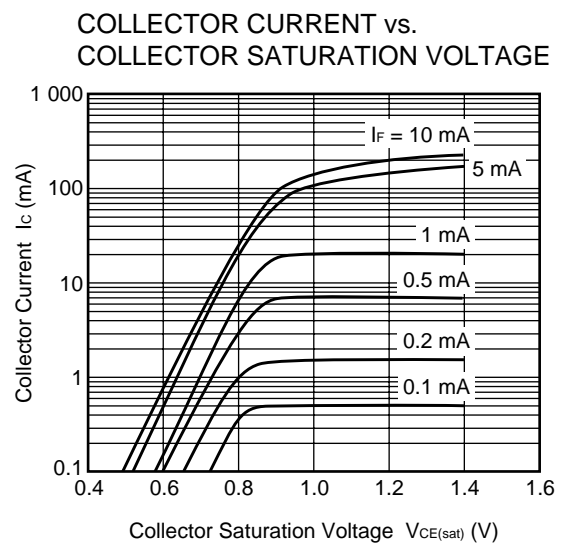
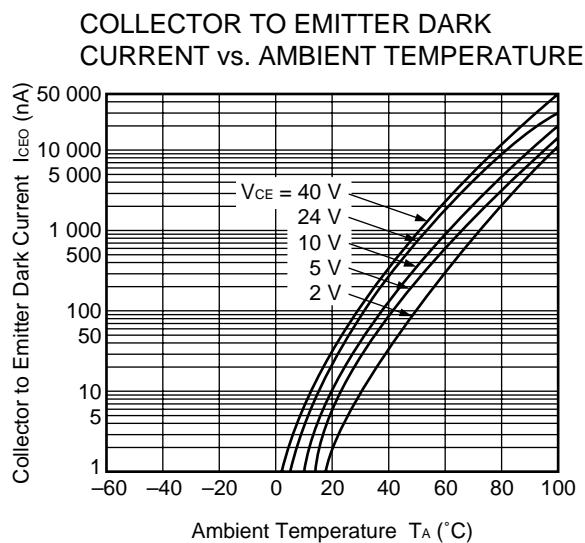
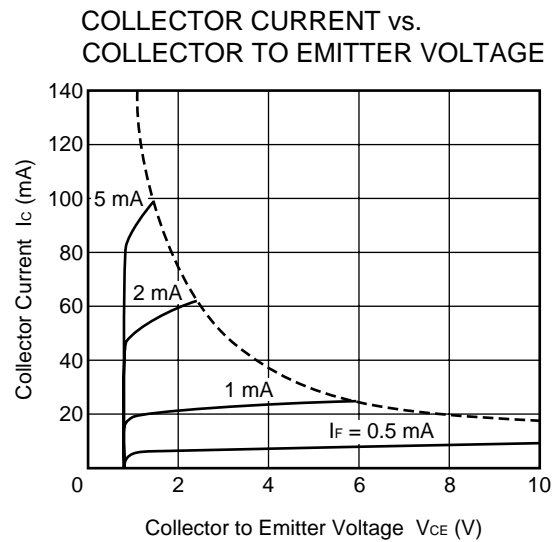
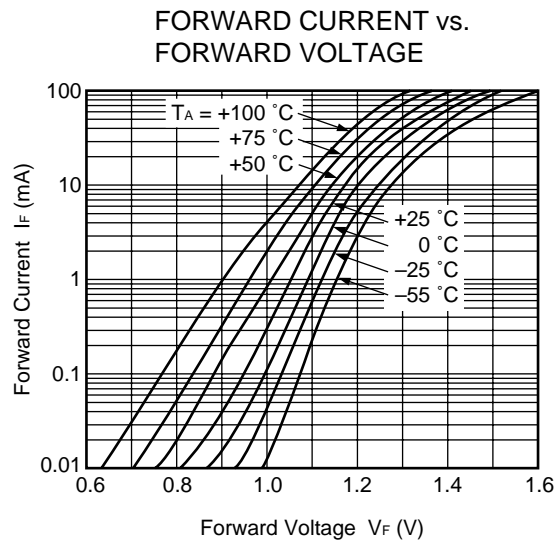
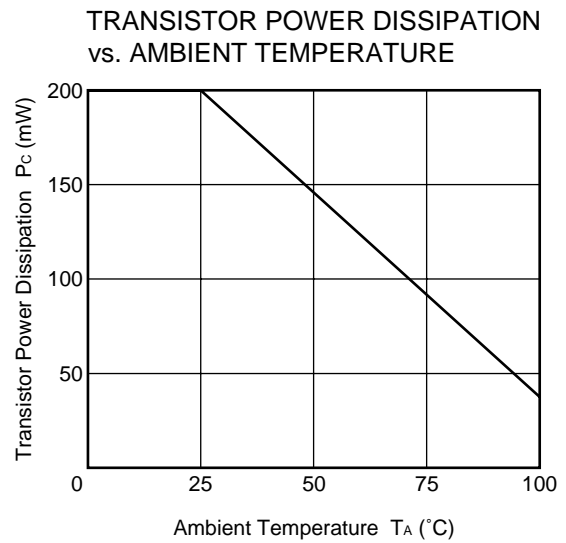
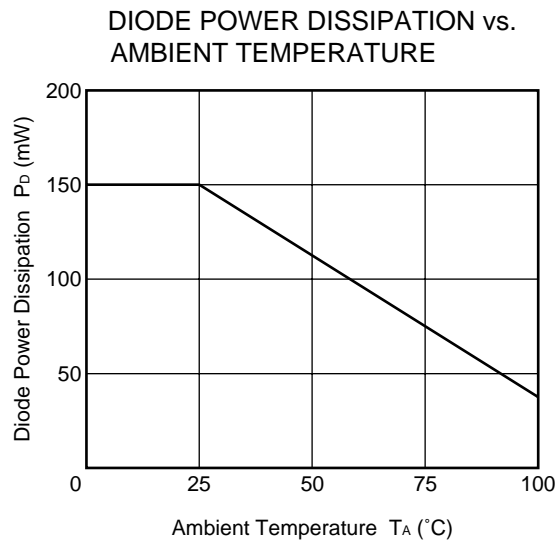
L : 700 to 3 400 (%)

M : 200 to 1 000 (%)

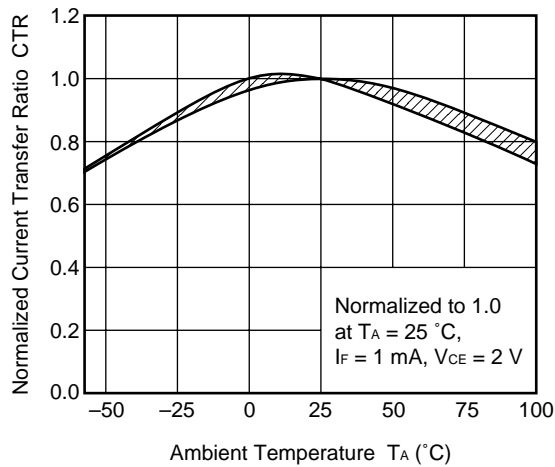
**\*3** Test circuit for switching time



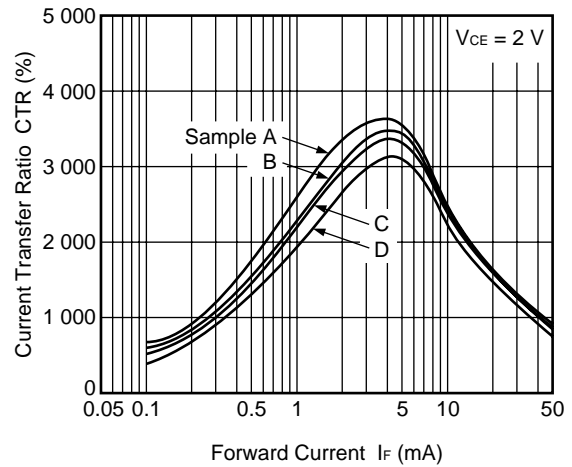
TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)



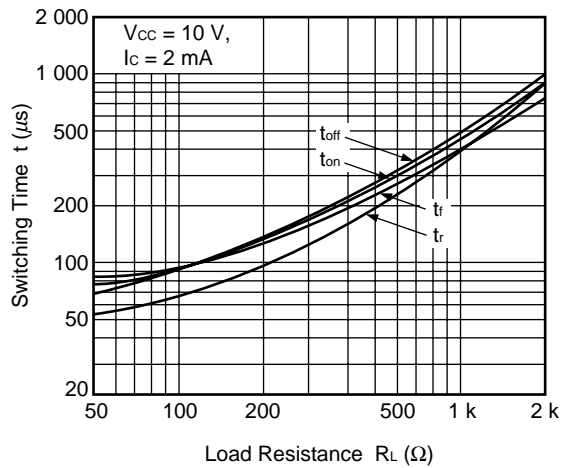
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



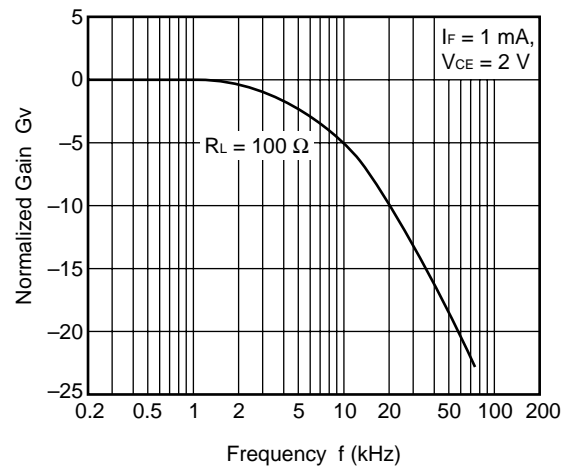
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



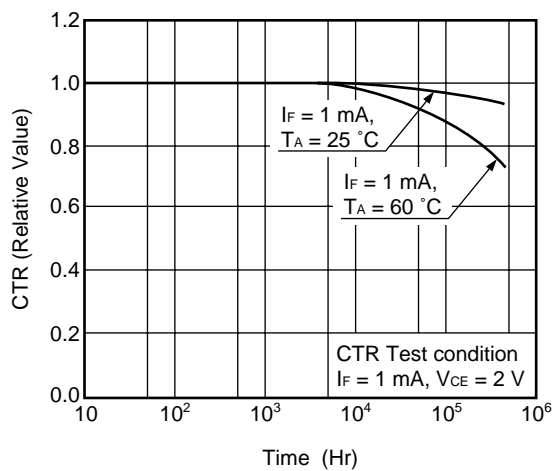
SWITCHING TIME vs. LOAD RESISTANCE



FREQUENCY RESPONSE



LONG TERM CTR DEGRADATION



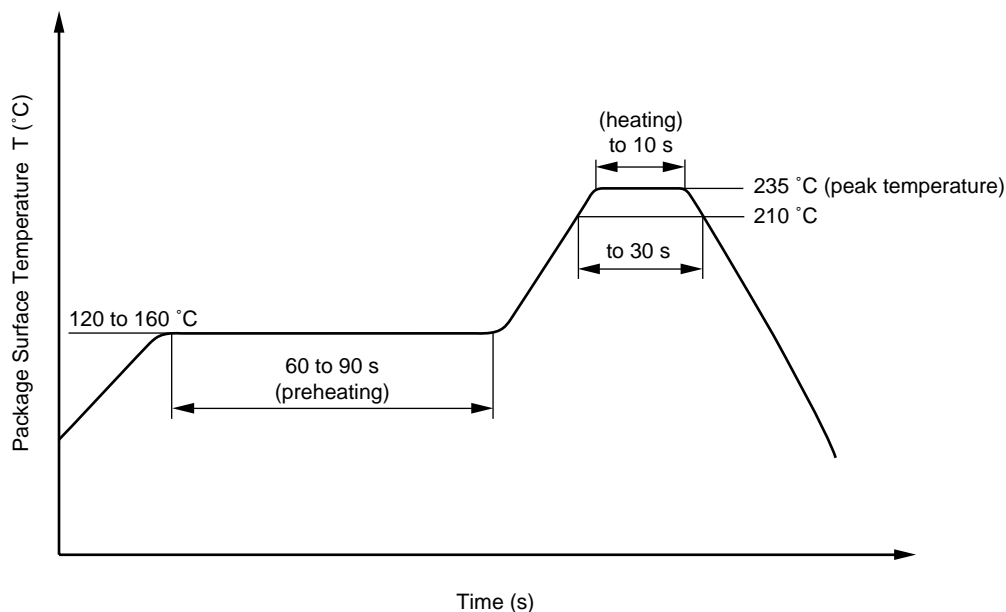
**Remark** The measurement of TYPICAL CHARACTERISTICS are only for reference, not guaranteed.

## RECOMMENDED SOLDERING CONDITIONS

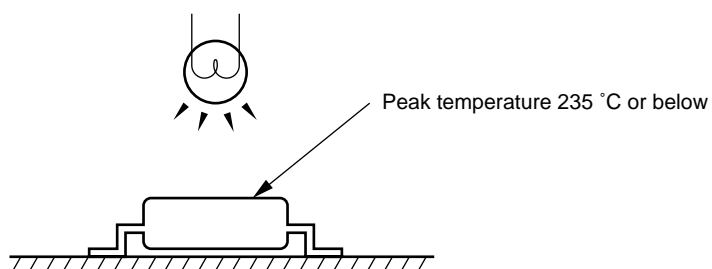
### (1) Infrared reflow soldering

- 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



**Caution** Please avoid to removed the residual flux by water after the first reflow processes.



### (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	$U_{IORM}$ $U_{pr}$	890 1 068	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for random test) $U_{pr} = 1.6 \times U_{IORM}$ , $P_d < 5$ pC	$U_{pr}$	1 424	$V_{peak}$
Highest permissible overvoltage	$U_{TR}$	8 000	$V_{peak}$
Degree of pollution (DIN VDE 0109)		2	
Clearance distance		> 8.0	mm
Creepage distance		> 8.0	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.	175 400 700 $10^9$	°C mA mW $\Omega$

[MEMO]

[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.**

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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.

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Anti-radioactive design is not implemented in this product.