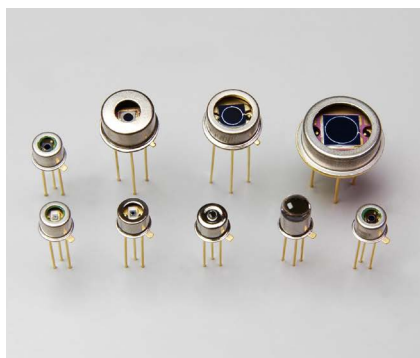


S12023 series, etc.



Low bias operation, for 800 nm band

These are 800 nm band near-infrared Si APDs that can operate at low voltages, 200 V or less. They are suitable for applications such as FSO (free space optics) and optical rangefinders. TE-cooled type S4315 series are also available (see P.6).

Features

- Stable operation at low bias
- High-speed response
- High sensitivity and low noise

Applications

- FSO
- Optical rangefinders

Structure / Absolute maximum ratings

Type no.	Dimensional outline/ Window material*1	Package	Effective photosensitive area size*2 (mm)	Absolute maximum ratings			
				Operating temperature*3 Topr (°C)	Storage temperature*3 Tstg (°C)	Forward current IF max (mA)	Reverse current IR max (μA)
S12023-02	(1)/K	TO-18	φ0.2	-20 to +85	-55 to +125	10	200
S12023-05	(1)/K		φ0.5				
S12051	(2)/L						
S12086	(3)/L						
S12023-10	(1)/K		φ1.0				
S12023-10A*4	(1)/K						
S3884	(4)/K	TO-5	φ1.5				
S2384	(5)/K		φ3.0				
S2385	(6)/K	TO-8	φ5.0				

*1: K=borosilicate glass, L=lens type borosilicate glass

*2: Photosensitive area in which a typical gain can be obtained

*3: No dew condensation. When there is a temperature difference between a product and the surrounding area in high humidity environments, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

*4: This is a variant of the S12023-10 in which the device chip is light-shielded by aluminum layer except for the photosensitive area.

Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

Type no.	Spectral response range λ (nm)	Peak ^{*5} sensitivity wavelength λ_p (nm)	Photo-sensitivity S M=1 $\lambda=800$ nm (A/W)	Quantum efficiency QE M=1 $\lambda=800$ nm (%)	Breakdown voltage V _{BR} I _D =100 μ A		Temp. co-efficient of V _{BR} (V/°C)	Dark ^{*5} current I _D		Cutoff frequency f _c R _L =50 Ω (MHz)	Terminal ^{*5} capacitance C _t (pF)	Excess ^{*5} noise figure x $\lambda=800$ nm	Gain M $\lambda=800$ nm
					Typ.	Max.		Typ.	Max.				
S12023-02	400 to 1000	800	0.5	75	150	200	0.65	0.05	0.5	1000	1	0.3	100
S12023-05								0.1	1	900	2		
S12051								0.2	2	600	6		
S12086								0.5	5	400	10		
S12023-10								1	10	120	40		60
S12023-10A ^{*3}								3	30	40	95		40
S3884													
S2384													
S2385													

*5: The value at the gain listed in "Gain M"

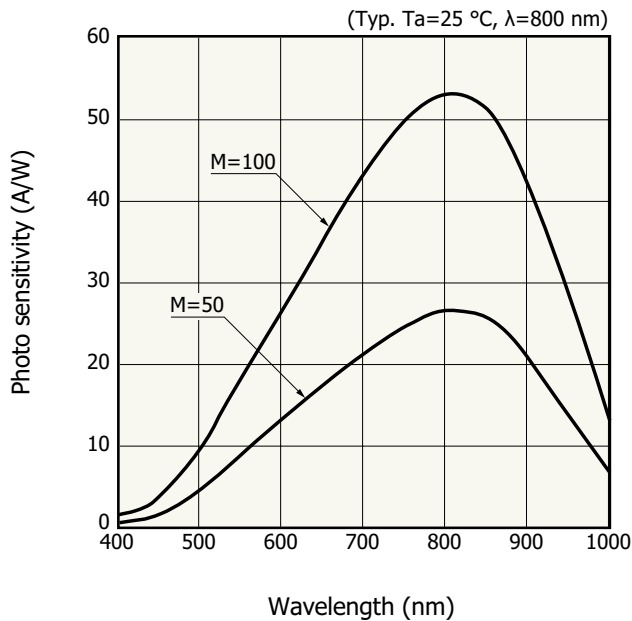
Note: Breakdown voltage can be specified by using the suffix of type number as examples shown below.

S12023-02-01: 80 to 120 V

S12023-02-02: 120 to 160 V

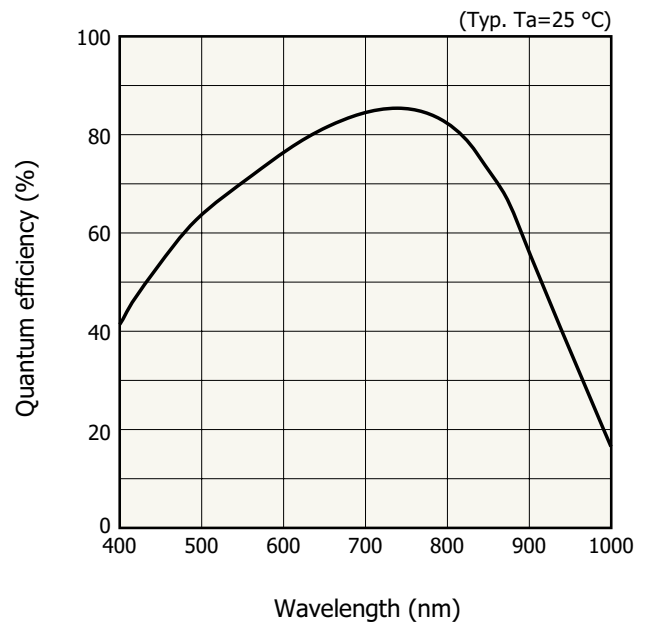
S12023-02-03: 160 to 200 V

Spectral response



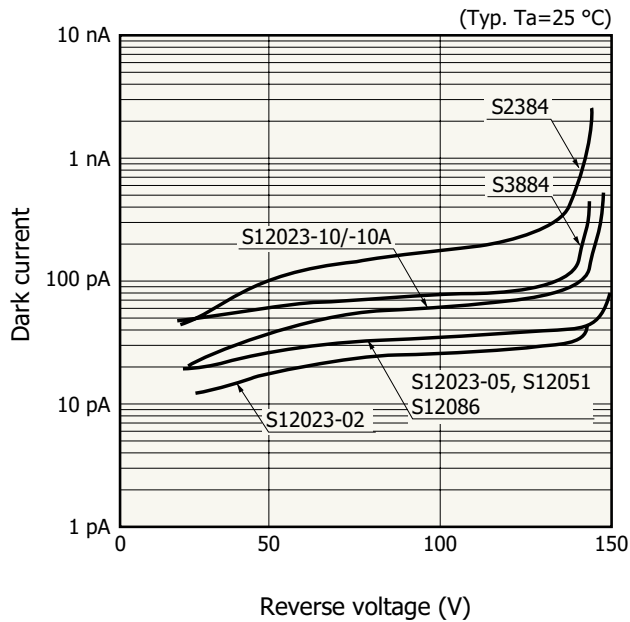
KAPDB0020ED

Quantum efficiency vs. wavelength (typical example)

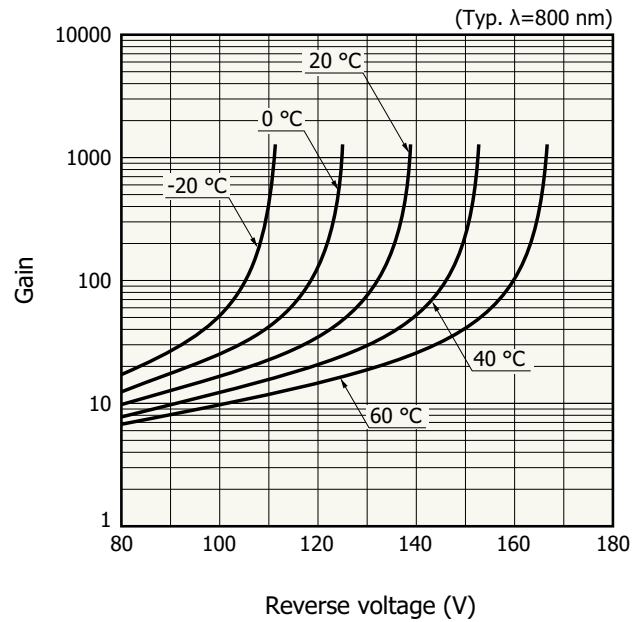


KAPDB0021EC

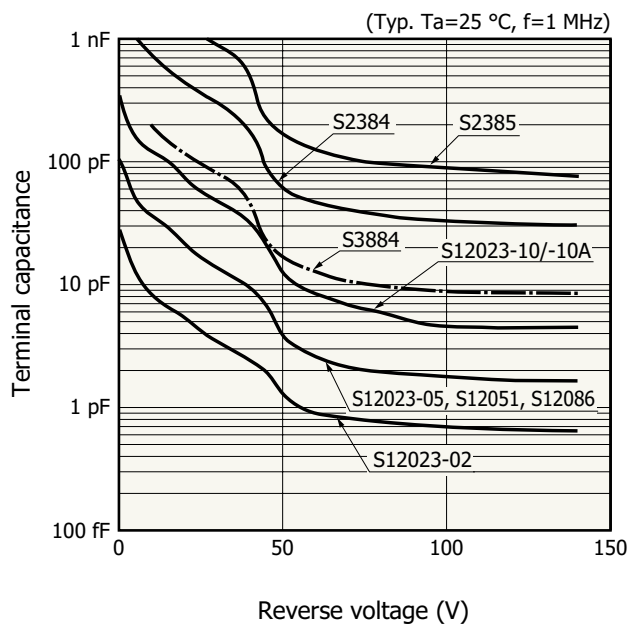
Dark current vs. reverse voltage



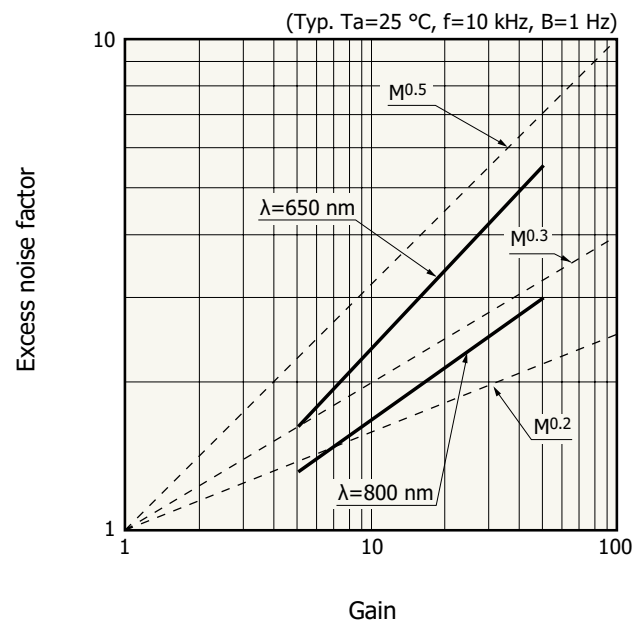
Gain vs. reverse voltage



Terminal capacitance vs. reverse voltage

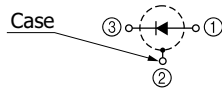
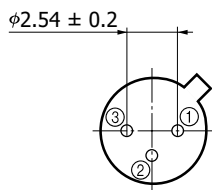
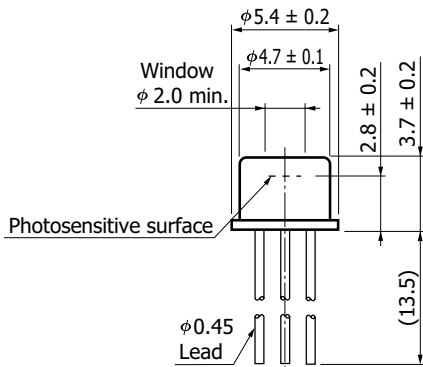


Excess noise factor vs. gain



Dimensional outlines (unit: mm)

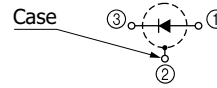
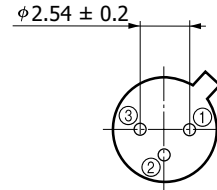
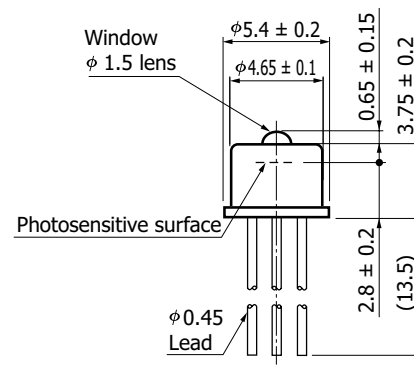
(1) S12023-02/-05/-10/-10A



Distance from photosensitive area center to cap center
 $-0.2 \leq X \leq +0.2$
 $-0.2 \leq Y \leq +0.2$

KAPDA0136EC

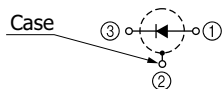
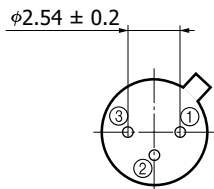
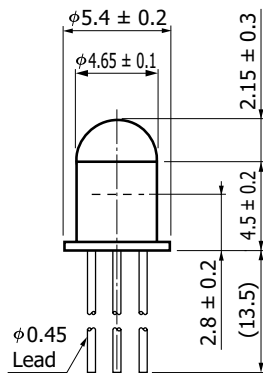
(2) S12051



Distance from photosensitive area center to cap center
 $-0.2 \leq X \leq +0.2$
 $-0.2 \leq Y \leq +0.2$

KAPDA0018EC

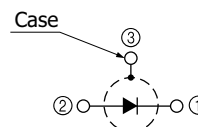
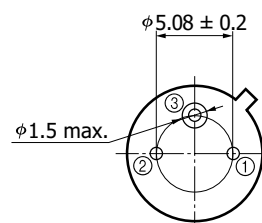
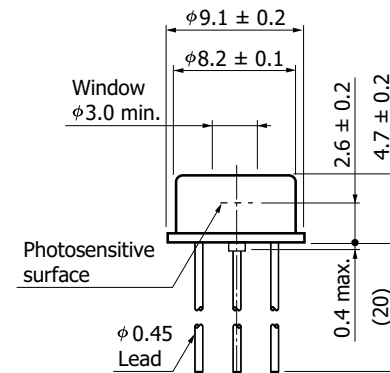
(3) S12086



Distance from photosensitive area center to cap center
 $-0.2 \leq X \leq +0.2$
 $-0.2 \leq Y \leq +0.2$

KAPDA0031EC

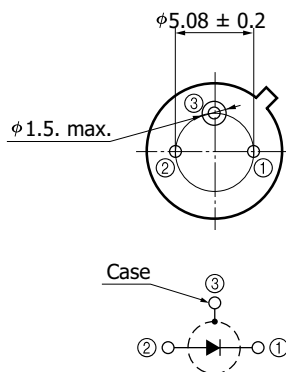
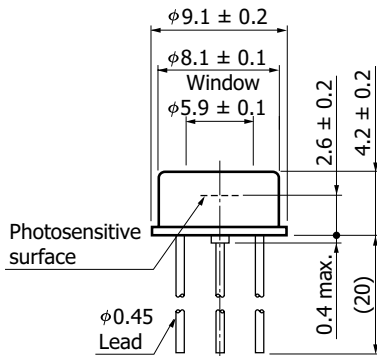
(4) S3884



Distance from photosensitive area center to cap center
 $-0.3 \leq X \leq +0.3$
 $-0.3 \leq Y \leq +0.3$

KAPDA0011EC

(5) S2384

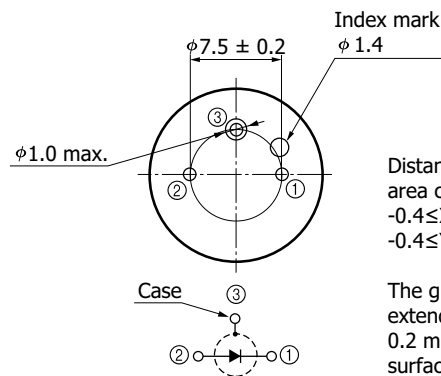
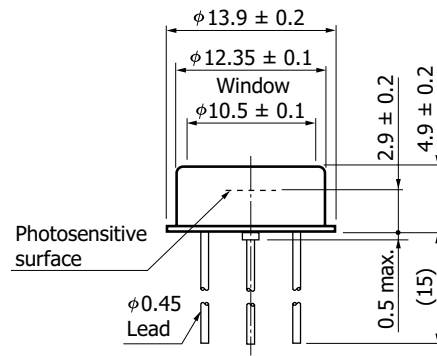


Distance from photosensitive area center to cap center
 $-0.3 \leq X \leq +0.3$
 $-0.3 \leq Y \leq +0.3$

The glass window may extend a maximum of 0.2 mm above the upper surface of the cap.

KAPDA0012EC

(6) S2385



Distance from photosensitive area center to cap center
 $-0.4 \leq X \leq +0.4$
 $-0.4 \leq Y \leq +0.4$

The glass window may extend a maximum of 0.2 mm above the upper surface of the cap.

KAPDA0013EE

Recommended soldering conditions

Solder temperature: 260 °C (10 s or less, once)

Solder the leads at a point at least 1 mm away from the package body.

Note: When you set soldering conditions, check that problems do not occur in the product by testing out the conditions in advance.

Related products

TE-cooled Si APD S4315 series

(Typ. $T_a=25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Type no.	APD used	Spectral response range λ (nm)	Peak sensitivity wavelength λ_p (nm)	TE-cooler allowable current I_{TE} max. (A)	TE-cooler allowable voltage V_{TE} max. (V)	Thermistor resistance R_{th} typ. (k Ω)	Thermistor power dissipation P_{d_th} max. (mW)	Operating temperature* ⁶ T_{opr} (°C)	Storage temperature* ⁶ T_{stg} (°C)
S4315	S12023-02	400 to 1000	800* ⁷	1.5	1.0	9.0	0.2	-20 to +85* ⁹	-40 to +85
S4315-01	S12023-05								
S4315-02	S12023-10								
S4315-04	S2384		800* ⁸						

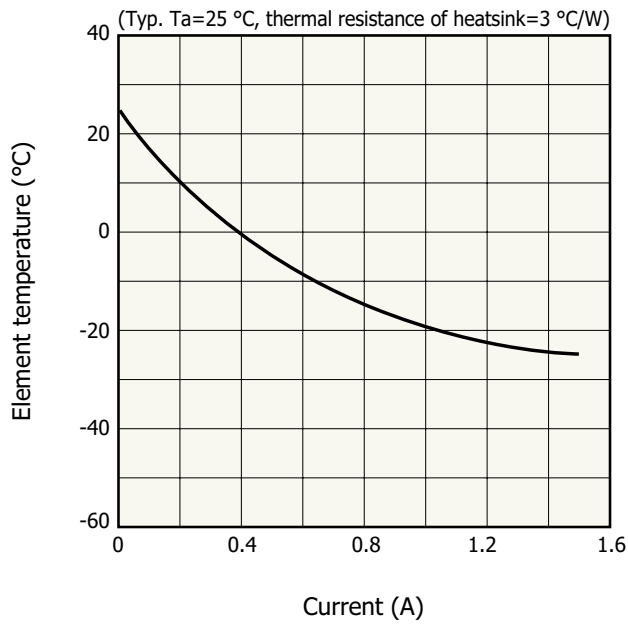
*6: No dew condensation. When there is a temperature difference between a product and the surrounding area in high humidity environments, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

*7: $M=100$

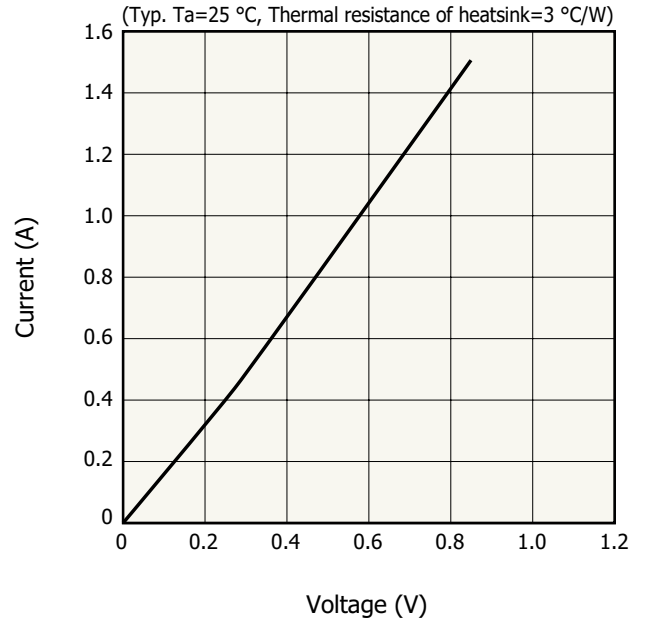
*8: $M=60$

*9: Chip temperature and package temperature

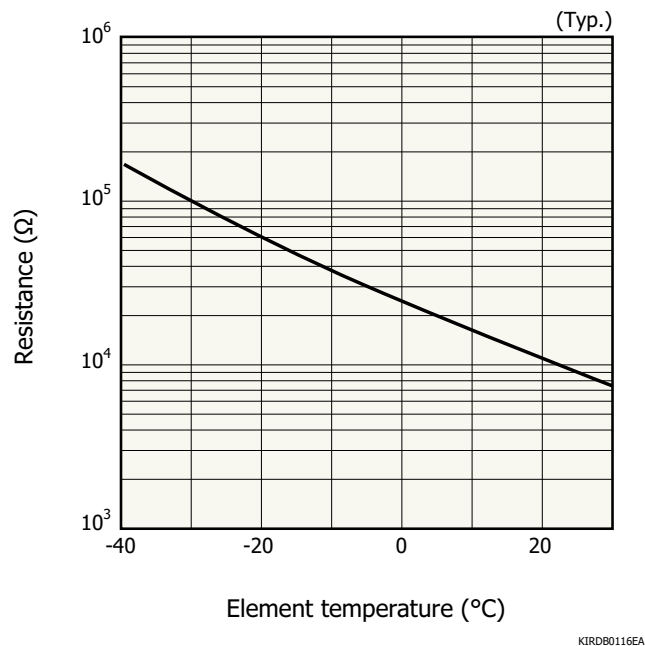
Cooling characteristic of TE-cooler



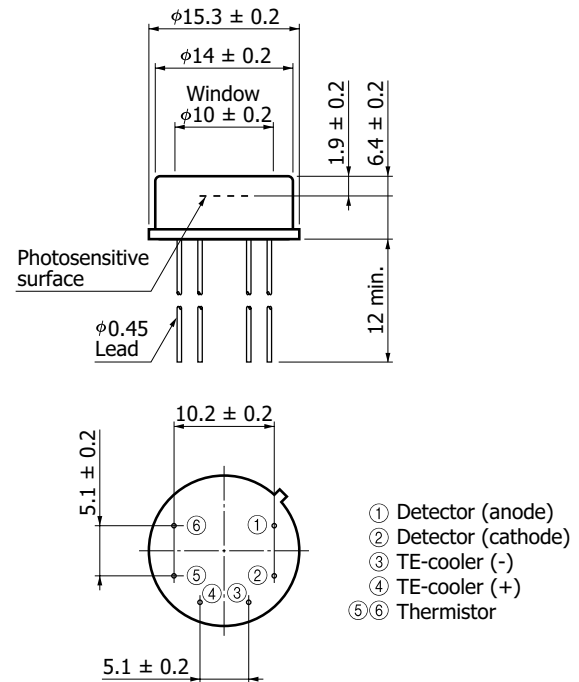
Current vs. voltage characteristic of TE-cooler



Thermistor temperature characteristic



Dimensional outline (unit: mm)



Recommended soldering conditions

Solder temperature: 260 °C (10 s or less, once)

Solder the leads at a point at least 1 mm away from the package body.

Related information

www.hamamatsu.com/sp/ssd/doc_en.html

■ Precautions

- Disclaimer
- Precautions / Metal, ceramic, plastic package products

■ Catalogs

- Technical note / Si APD

Information described in this material is current as of February 2026.

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The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use. Copying or reprinting the contents described in this material in whole or in part is prohibited without our prior permission.