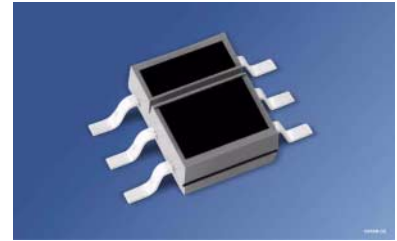


# Reflexlichtschranke mit VCSEL-Sender Reflective Interrupter with VCSEL-Emitter

SFH 9221



## Wesentliche Merkmale

- Großer Arbeitsabstand (2-10mm)
- IR-GaAs-VCSEL (Vertical Cavity Surface Emitting Laser) in Kombination mit einer Si-Fotodiode
- Enge Strahlverteilung des Senders
- Tageslichtsperrfilter

## Anwendungen

- Positionssensor
- Endabschaltung
- Drehzahlüberwachung, -regelung
- Bewegungssensor
- Strichcodeleser

## Features

- Long operating distance (2-10mm)
- IR-GaAs-VCSEL (Vertical Cavity Surface Emitting Laser) in combination with a Silicon photodiode
- Narrow beam characteristics of the emitter
- Daylight cut-off filter

## Applications

- Position sensor
- End position switch
- Speed monitoring and regulating
- Motion sensor
- Bar Code reading

Typ Type	Bestellnummer Ordering Code	$I_p$ [ $\mu A$ ] ( $I_F = 8 \text{ mA}$ , $V_R = 5 \text{ V}$ , $d = 5 \text{ mm}$ )	(see note on page 5)
SFH 9221	Q62702-P5468	1 <	

Beim Betrieb dieses Bauteils sind die Sicherheitsvorschriften für die Laserklasse 1M nach IEC 60825-1 Am. 2 zu beachten.

Operating this device the safety instructions for laser class 1M according to IEC 60825-1 Am. 2 have to be observed.



ATTENTION - Observe Precautions For Handling - Electrostatic Sensitive Device

**Grenzwerte**  
**Maximum Ratings**

Bezeichnung Parameter	Symbol Symbol	Wert Value	Einheit Unit
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**Sender (GaAs-VCSEL-Diode)**
**Emitter (GaAs VCSEL diode)**

Sperrspannung Reverse voltage	$V_R$	3	V
Vorwärtsgleichstrom Forward current	$I_F$	10	mA
Verlustleistung Power dissipation	$P_{tot}$	25	mW

**Empfänger (Si-Fotodiode)**
**Detector (silicon photodiode)**

Sperrspannung Reverse Voltage	$V_R$	20	V
Verlustleistung Total power dissipation	$P_{tot}$	150	mW

**Reflexlichtschranke**
**Reflective Interrupter**

Lagertemperatur Storage temperature range	$T_{stg}$	- 40 ... + 85	°C
Betriebstemperatur Operating temperature range	$T_{op}$	- 40 ... + 85	°C
Elektrostatische Entladung Electrostatic discharge	ESD	400	V
Umweltbedingungen / Environment conditions	3 K3 acc. to EN 60721-3-3 (IEC 721-3-3)		

Kennwerte ( $T_A = 25\text{ °C}$ )**Characteristics**

Bezeichnung Parameter	Symbol Symbol	Wert Value	Einheit Unit
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**Sender** (GaAs-VCSEL Diode)**Emitter** (GaAs-VCSEL diode)

Wellenlänge der Strahlung Wavelength at peak emission $I_F = 8\text{ mA}$ , $t_p = 20\text{ ms}$	$\lambda_{\text{peak}}$	850	nm
Spektrale Bandbreite bei 50% von $I_{\text{max}}$ Spectral bandwidth at 50% of $I_{\text{max}}$ $I_F = 8\text{ mA}$	$\Delta\lambda$	1	nm
Abstrahlwinkel Half angle $I_F = 10\text{ mA}$	$\varphi$	$\pm 15$	Grad deg.
Schwellenstrom <sup>1)</sup> Threshold current <sup>1)</sup>	$I_{\text{th}}$	2.6 (<5)	mA
Durchlaßspannung Forward voltage $I_F = 10\text{ mA}$	$V_F$	1.8 ( $\leq 2.3$ )	V
Sperrstrom Reverse current $V_R = 3\text{ V}$	$I_R$	0.01 ( $\leq 1$ )	$\mu\text{A}$
Kapazität Capacitance $V_R = 0\text{ V}$ , $f = 1\text{ MHz}$	$C_O$	25	pF
Wärmewiderstand <sup>2)</sup> Thermal resistance <sup>2)</sup>	$R_{\text{thJA}}$	1500	K/W

**Empfänger** (Si-Fotodiode)**Detector** (silicon photodiode)

Wellenlänge der max. Fotoempfindlichkeit Wavelength of max. sensitivity	$\lambda_{\text{S max}}$	900	nm
Dunkelstrom, $V_R = 10\text{ V}$ Dark current	$I_R$	50 ( $\leq 5000$ )	pA
Kapazität, $V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ , $E = 0$ Capacitance	$C_O$	13	pF

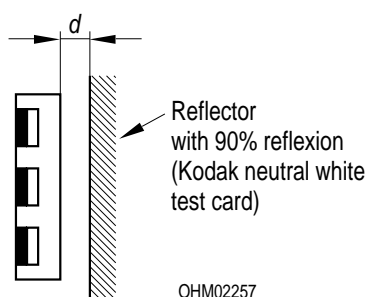
**Kennwerte** ( $T_A = 25\text{ °C}$ )  
**Characteristics** (cont'd)

Bezeichnung Parameter	Symbol Symbol	Wert Value	Einheit Unit
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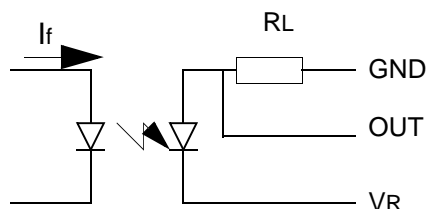
**Reflexlichtschranke**  
**Reflective Interrupter**

Fotostrom Photocurrent Kodak neutral white test card, 90% Reflexion $I_F = 8\text{ mA}$ ; $V_R = 5\text{ V}$ ; $d = 5\text{ mm}$ (see note on <b>page 5</b> )	$I_{P\text{ min.}}$	1	$\mu\text{A}$
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- 1) Der VCSEL emittiert nur bei Flusstströmen größer als  $I_{th}$
- 1) VCSEL only emits at forward currents higher than  $I_{th}$
- 2) Montage auf PC-Board mit  $> 5\text{ mm}^2$  Padgröße
- 2) Mounting on pcb with  $> 5\text{ mm}^2$  pad size



**Schaltzeiten** ( $T_A = 25\text{ °C}$ ,  $V_R = 5\text{ V}$ ,  $I_P = 1.5\text{ }\mu\text{A}^{1)}$ ,  $R_L = 50\text{ }\Omega$ )  
**Switching Times**



Bezeichnung Parameter	Symbol Symbol	Wert Value	Einheit Unit
Anstiegszeit Rise time	$t_r$	10	ns
Abfallzeit Fall time	$t_f$	10	ns

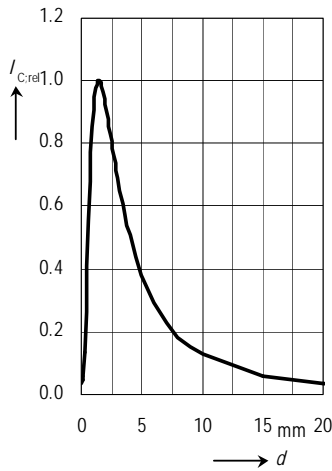
- <sup>1)</sup>  $I_P$  eingestellt über den Durchlaßstrom der Sendediode, den Reflexionsgrad und den Abstand des Reflektors vom Bauteil ( $d$ )
- <sup>1)</sup>  $I_P$  as a function of the forward current of the emitting diode, the degree of reflection and the distance between reflector and component ( $d$ )

**Anm.:** Es wird empfohlen die Lichtschranke bei dem spezifizierten Arbeitspunkt von ca. 8mA für den Emitter einzusetzen, weil andere Betriebsströme zu einem größeren Streubereich beim Koppelfaktor führen. Der Abgleich erfolgt über den Arbeitswiderstand am Detektor.

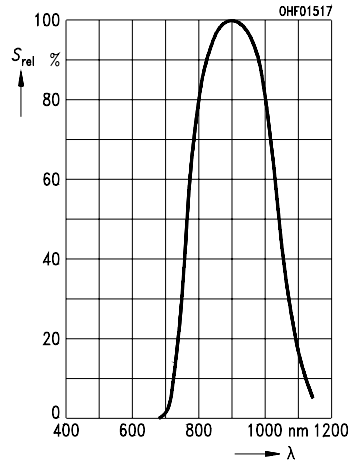
Von einem Einsatz der Lichtschranke mit glänzenden oder gar spiegelnden Oberflächen wird abgeraten. Die Abstrahlcharakteristik des Senders ändert sich sowohl über die Temperatur als auch mit dem Flußstrom stärker als bei Standardemittern und führt somit ebenfalls zur Erhöhung des Streubereichs beim Koppelfaktor. Bei diffuser Streuung ist dieser Einfluß jedoch gering, und kann für die meisten Anwendungen vernachlässigt werden.

**Note:** It is recommended to use the interrupter at the specified emitter current of about 8mA, as other operating currents lead to a larger coupling factor variation. The tuning is done using the operating resistor on the detector side. It is not recommended to use the interrupter in combination with shiny or mirror like surfaces. Changes in temperatures and operating current are having a bigger influence on the radiation characteristic as it is the case for standard emitters. This means a higher variance of the coupling factor. For diffuse surfaces the mentioned influence is low, and can be neglected for most of the applications.

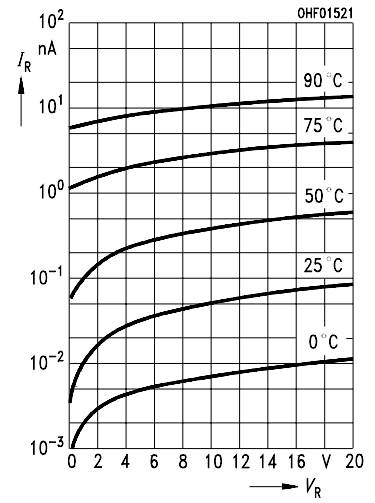
**Photocurrent**  $\frac{I_p}{I_{pmax}} = f(d)$   
 Kodak 90%



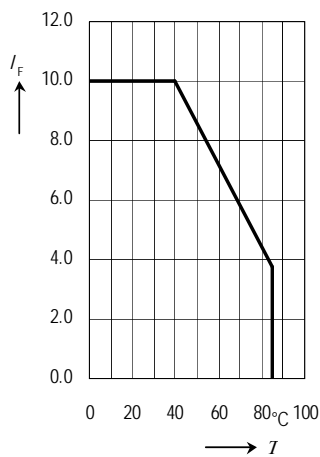
**Relative Spectral Sensitivity**



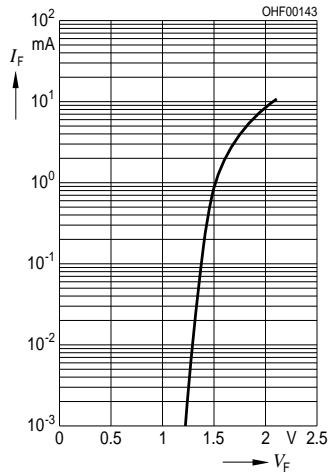
**Dark Current**



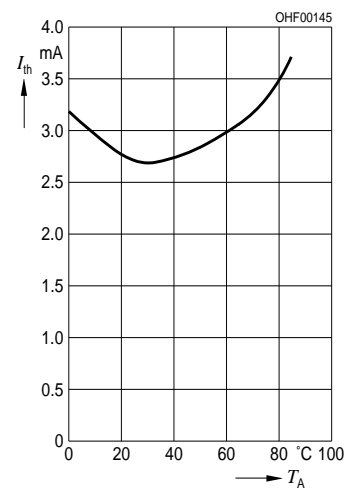
**Max. Permissible Forward Current**  
 $I_F = f(T_A)$



**Forward Current**  
 $I_F = f(V_F)$

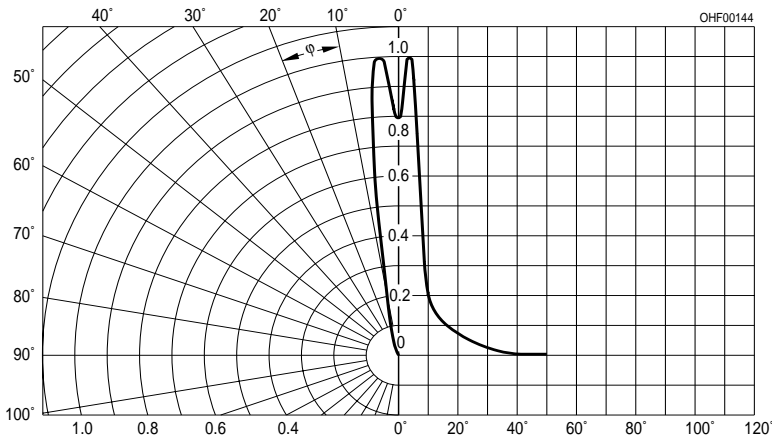


**Threshold Current**  $I_{th} = f(T_A)$

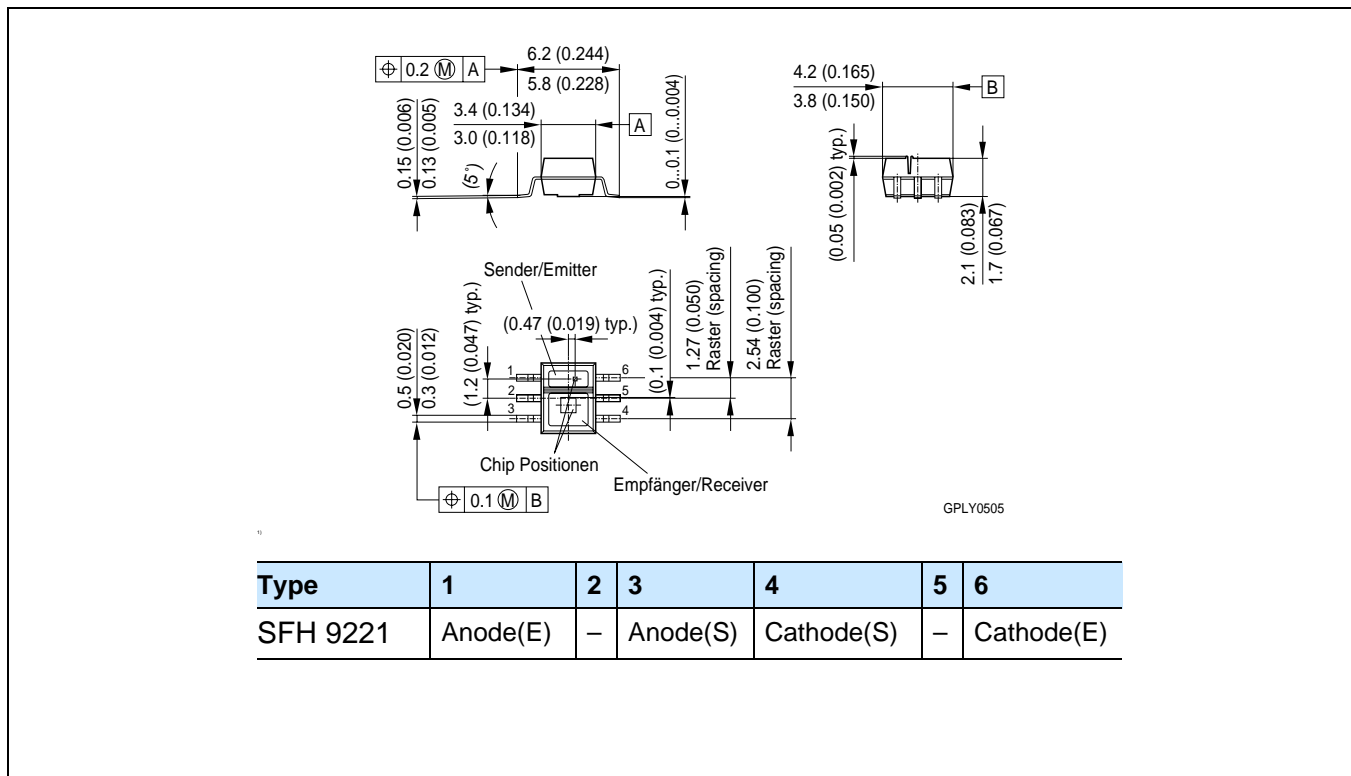


**Target Radiation characteristics**

$I_{rel} = f(\varphi)$   $I_F = 10\text{mA}$



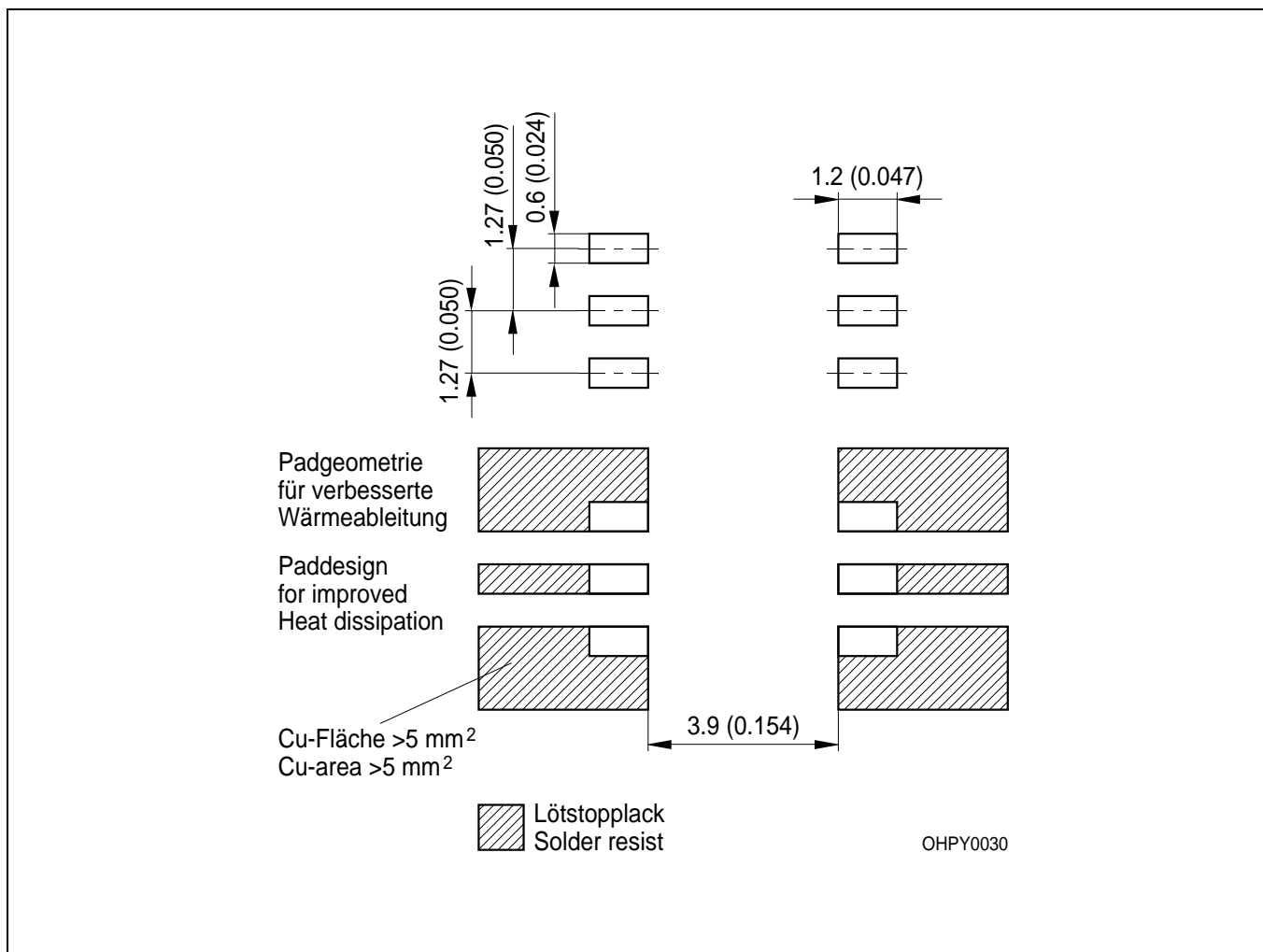
Maßzeichnung  
Package Outlines



Maße werden wie folgt angegeben: mm (inch) / Dimensions are specified as follows: mm (inch).

**Empfohlenes Lötpad Design**  
**Recommended Solder Pad**

**IR-Reflow Lötten**  
**IR REflow Soldering**



Maße werden wie folgt angegeben: mm (inch) / Dimensions are specified as follows: mm (inch).

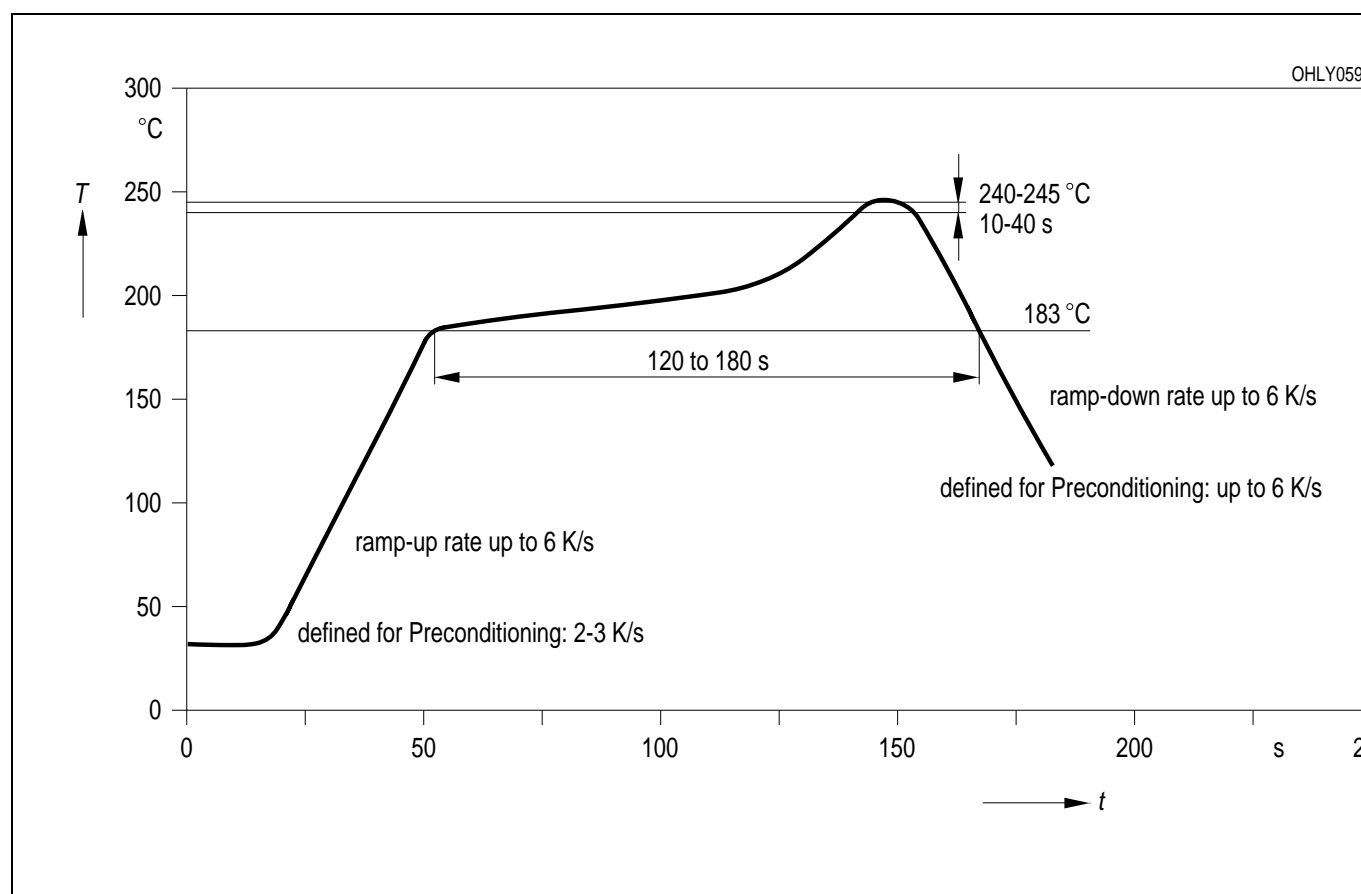


**Löthinweise**  
**Soldering Conditions**

Bauform Type	Drypack Level acc. to IPS-stand. 020	Tauch-, Schwallötung Dip, Wave Soldering		Reflowlötung Reflow Soldering		Kolbenlötung Iron Soldering (Iron temp.)
		Peak Temp. (solderbath)	Max. Time in Peak Zone	Peak Temp. (package temp.)	Max. Time in Peak Zone	
SFH 9221	4	n. a.	–	245 °C	10 sec.	n.a.

Bitte Verarbeitungshinweise für SMT-Bauelemente beachten!  
Please observe the handling guidelines for SMT devices!

**IR-Reflow Lötprofil** (nach IPC 9501)  
**IR Reflow Soldering Profile** (acc. to IPC 9501)



**Gurtung / Polarität und Lage**

siehe Dokument: Short Form Katalog: Gurtung und  
Verpackung - SMT-Bauelemente - Gehäuse:SMT RLS

**Methode of Taping / Polarity and Orientation**

see document: Short Form Catalog: Tape and Reel -  
SMT-Components - Package: SMT-RLS

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