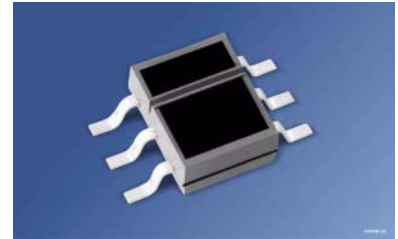


# Reflexlichtschranke mit VCSEL-Sender Reflective Interrupter with VCSEL-Emitter

## 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<br>Type | Bestellnummer<br>Ordering Code | $I_p$ [ $\mu A$ ]<br>( $I_F = 8\text{ mA}$ , $V_R = 5\text{ V}$ , $d = 5\text{ mm}$ ) (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<br>Parameter | Symbol<br>Symbol | Wert<br>Value | Einheit<br>Unit |
|--------------------------|------------------|---------------|-----------------|
|--------------------------|------------------|---------------|-----------------|

**Sender** (GaAs-VCSEL-Diode)

**Emitter** (GaAs VCSEL diode)

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

**Empfänger** (Si-Fotodiode)

**Detector** (silicon photodiode)

|                                            |           |     |    |
|--------------------------------------------|-----------|-----|----|
| Sperrspannung<br>Reverse Voltage           | $V_R$     | 20  | V  |
| Verlustleistung<br>Total power dissipation | $P_{tot}$ | 150 | mW |

**Reflexlichtschranke**
**Reflective Interrupter**

|                                                       |                                         |               |    |
|-------------------------------------------------------|-----------------------------------------|---------------|----|
| Lagertemperatur<br>Storage temperature range          | $T_{stg}$                               | - 40 ... + 85 | °C |
| Betriebstemperatur<br>Operating temperature range     | $T_{op}$                                | - 40 ... + 85 | °C |
| Elektrostatische Entladung<br>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<br>Parameter | Symbol<br>Symbol | Wert<br>Value | Einheit<br>Unit |
|--------------------------|------------------|---------------|-----------------|
|--------------------------|------------------|---------------|-----------------|

**Sender** (GaAs-VCSEL Diode)**Emitter** (GaAs-VCSEL diode)

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

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

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

Kennwerte ( $T_A = 25\text{ °C}$ )

Characteristics (cont'd)

| Bezeichnung<br>Parameter | Symbol<br>Symbol | Wert<br>Value | Einheit<br>Unit |
|--------------------------|------------------|---------------|-----------------|
|--------------------------|------------------|---------------|-----------------|

### Reflexlichtschranke Reflective Interrupter

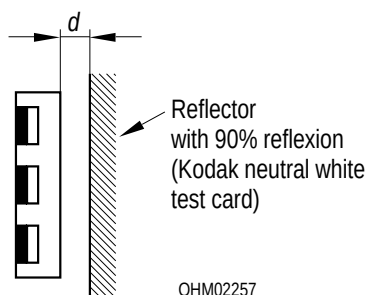
|                                                                                                                                                                           |                     |   |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---|---------------|
| Fotostrom<br>Photocurrent<br>Kodak neutral white test card, 90% Reflexion<br>$I_F = 8\text{ mA}$ ; $V_R = 5\text{ V}$ ; $d = 5\text{ mm}$<br>(see note on <b>page 5</b> ) | $I_{P\text{ min.}}$ | 1 | $\mu\text{A}$ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---|---------------|

1) Der VCSEL emittiert nur bei Flussströmen größer als  $I_{th}$

1) VCSEL only emits at forward currents higher than  $I_{th}$

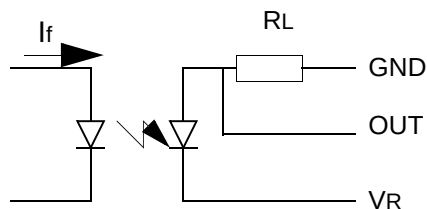
2) Montage auf PC-Board mit  $> 5\text{ mm}^2$  Padgröße

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<br>Parameter  | Symbol<br>Symbol | Wert<br>Value | Einheit<br>Unit |
|---------------------------|------------------|---------------|-----------------|
| Anstiegszeit<br>Rise time | $t_r$            | 10            | ns              |
| Abfallzeit<br>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 ( $d$ )

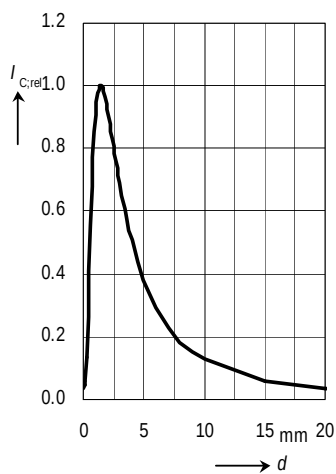
<sup>1)</sup>  $I_P$  as a function of the forward current of the emitting diode, the degree of reflection and the distance between reflector and component ( $d$ )

**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.

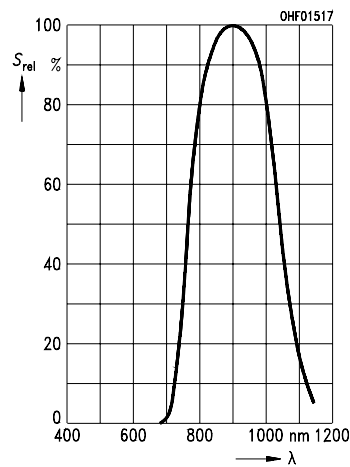
Von einem Einsatz der Lichtschranke mit glänzenden oder gar spiegelnden Oberflächen wird abgeraten. Die Abstrahlcharakteristik des Senders ändert sich sowohl über die Temperatur als auch mit dem Flußstrom stärker als bei Standardemittern und führt somit ebenfalls zur Erhöhung des Streubereichs beim Koppelfaktor. 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.

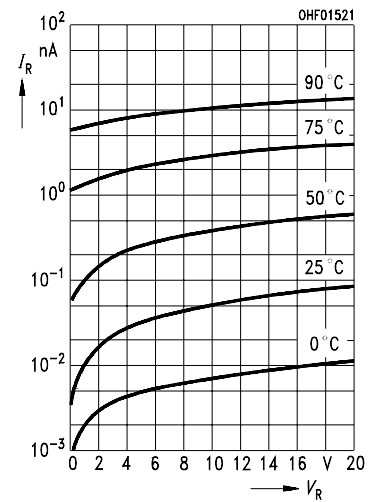
**Photocurrent**  $\frac{I_p}{I_{pmax}} = f(d)$   
Kodak 90%



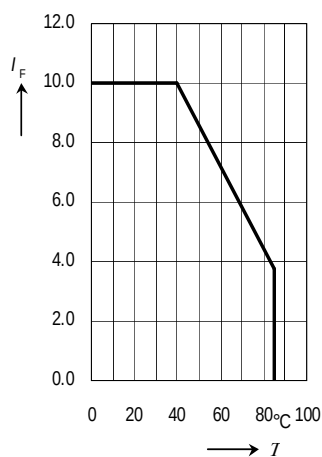
**Relative Spectral Sensitivity**



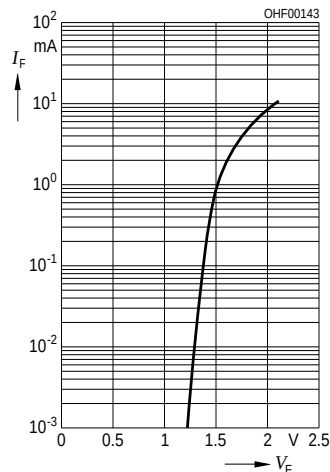
**Dark Current**



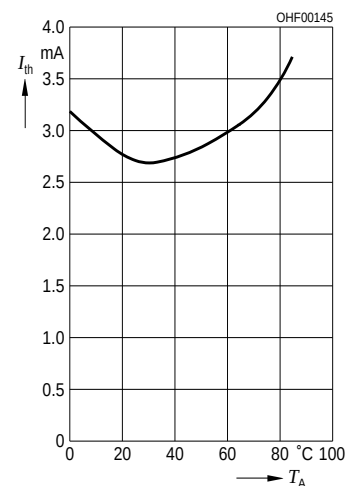
**Max. Permissible Forward Current**  
 $I_F = f(T_A)$



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

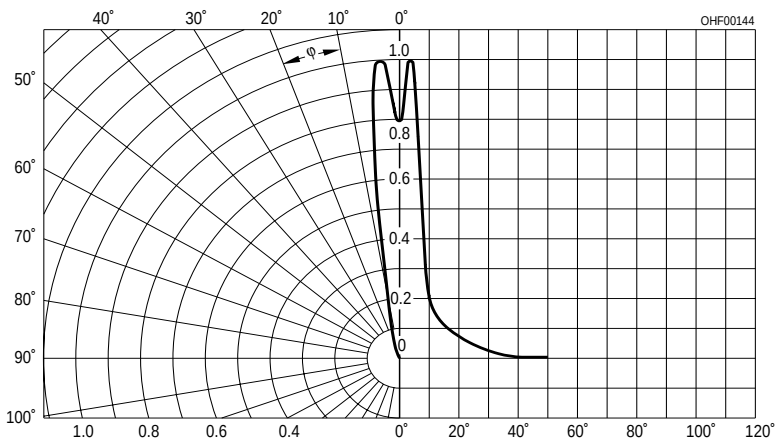


**Threshold Current**  $I_{th} = f(T_A)$



**Target Radiation characteristics**

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



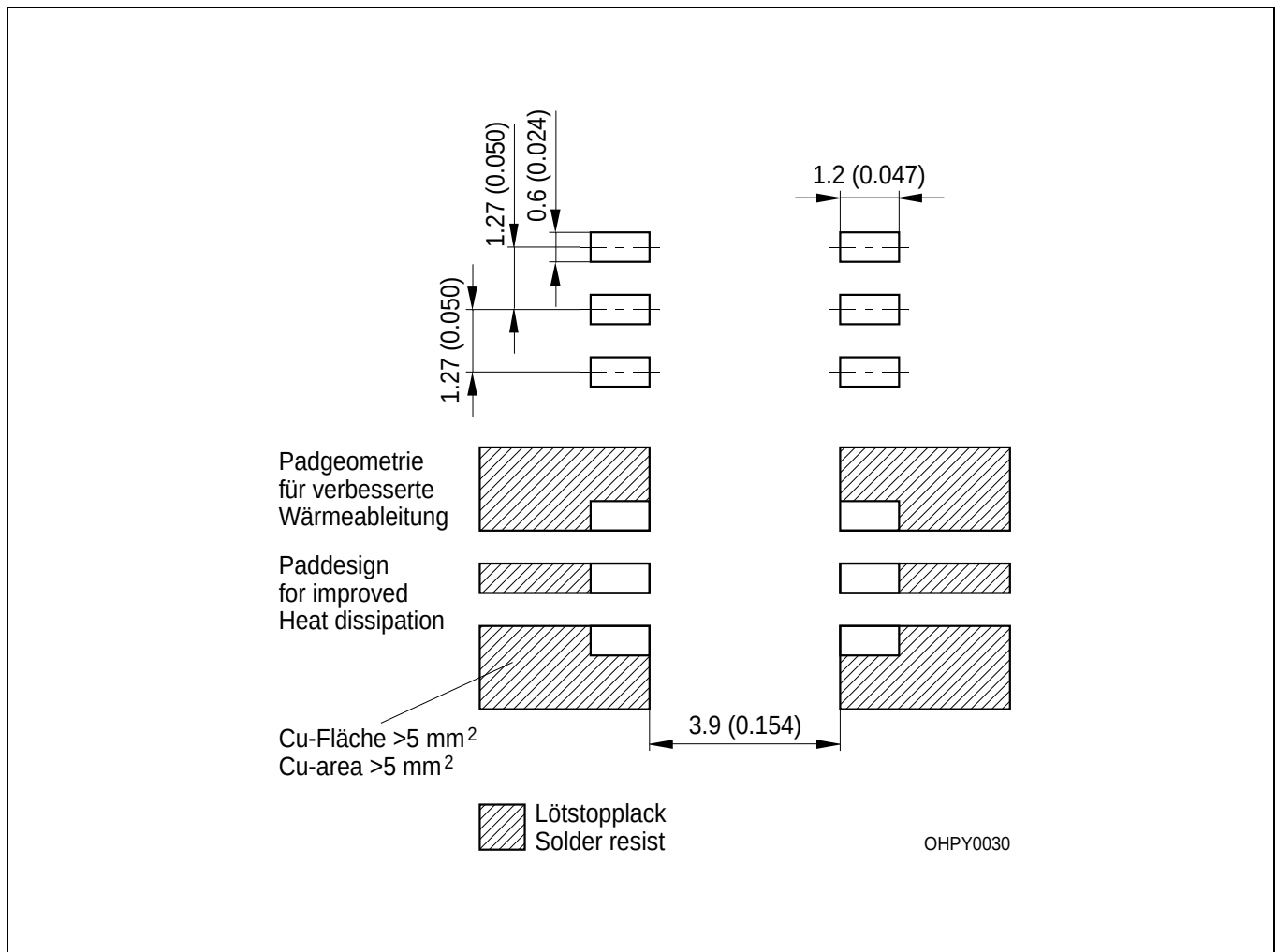


| Type     | 1        | 2 | 3        | 4          | 5 | 6          |
|----------|----------|---|----------|------------|---|------------|
| SFH 9221 | Anode(E) | – | Anode(S) | Cathode(S) | – | Cathode(E) |

2004-08-30

**Empfohlenes Lötpaddesign**  
**Recommended Solder Pad**

IR-Reflow Löten  
 IR REflow Soldering



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



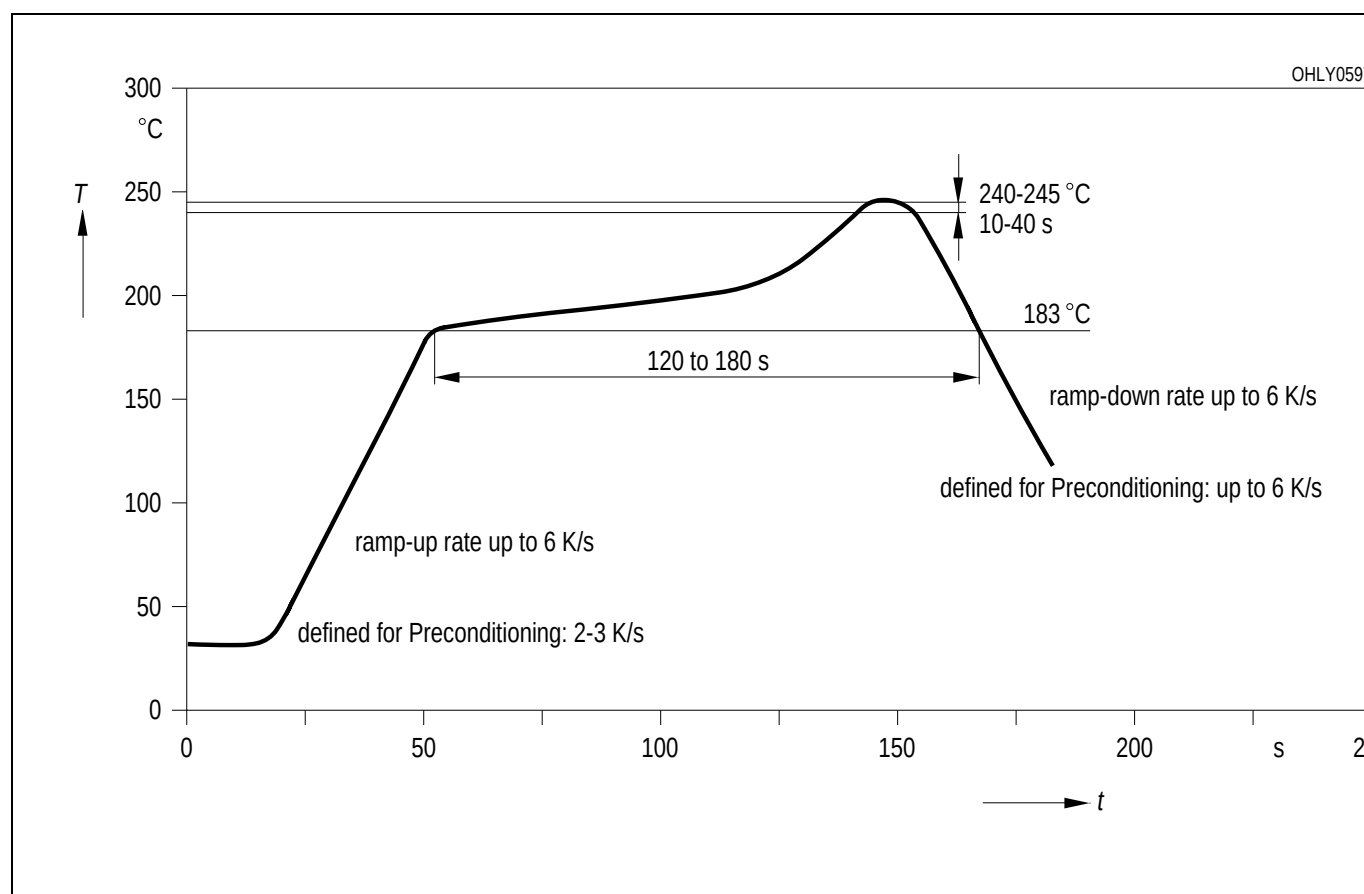
## Löthinweise Soldering Conditions

| Bauform<br>Type | Drypack<br>Level acc.<br>to<br>IPS-stand.<br>020 | Tauch-, Schwalllötung<br>Dip, Wave Soldering |                           | Reflowlötung<br>Reflow Soldering |                              | Kolbenlötung<br>Iron Soldering<br>(Iron temp.) |
|-----------------|--------------------------------------------------|----------------------------------------------|---------------------------|----------------------------------|------------------------------|------------------------------------------------|
|                 |                                                  | Peak Temp.<br>(solderbath)                   | Max. Time in<br>Peak Zone | Peak Temp.<br>(package<br>temp.) | Max. Time<br>in Peak<br>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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