# Digitaler Näherungsdetektor mit integriertem Sender Treiber
# Digital proximity detector with integrated emitter driver

**Lead (Pb) Free Product - RoHS Compliant**

## SFH 7743

### Wesentliche Merkmale

- Typ. Arbeitsabstand mit externem Sender SFH 4650: 40 mm
- Optohybrid mit Schmitt-Trigger Ausgang, open drain
- Extrem niedriger Stromverbrauch
- Sehr kleines SMD Gehäuse
- Hohe Umgebungslicht Unterdrückung

### Features

- Typ. Working distance with external emitter SFH 4650: 40 mm
- Opto hybrid with Schmitt trigger output, open drain
- Extremly low power consumption
- Very small SMD package
- High ambient light suppression

### Anwendungen

- Näherungsdetektor für kurze Entfernungen

### Applications

- Short range proximity detector

| Typ<br>Type | Bestellnummer<br>Ordering Code |
|---|---|
| SFH 7743 | Q65110A8870 |

**Grenzwerte**
**Maximum Ratings**

| Bezeichnung<br>Parameter | Symbol<br>Symbol | Wert<br>Value | Einheit<br>Unit |
|---|---|---|---|
| Lagertemperatur<br>Storage temperature | $T_{stg}$ | min: – 40<br>max: + 85 | °C |
| Versorgungsspannung<br>Supply voltage | $V_{dd}$ | 0 - 6 | V |
| Externe Spannung an Pin<br>External voltage at pin<br>Out<br>Prog<br>Test<br>Anode LED | $V_{out}$ | <br><br>0 - 4.5<br>0 - 4.5<br>0 - 4.5<br>0 - 1.5 | V |
| Sink current durch den Ausgangstransistor<br>Sink current through output transistor<br>(please see figure 1) | $I_{sink}$ | 10 | mA |
| Treiberstrom[1)]<br>Driver current<br>(for directly connected LED (figure 1a)<br>or transistor base current (figure 1b) page 6) | $I_d$ | 60 | mA |
| Elektrostatische Entladung<br>Electrostatic discharge<br>- Human Body Model<br>(according to: JESD22-A114E; Class2)<br>- Machine Model<br>(according to: JESD22-A115A; Class B) | $ESD$ | <br><br>2<br><br>200 | <br><br>kV<br><br>V |
| latch up protection<br>latch up protection<br>(according to: EIA/JESD78 Class 1) | | 20 | mA |

1) Der Treiberstrom $I_d$ ist abhängig von $V_{dd}$ und $R_{prog}$ wie folgt:
The driver current $I_d$ depends on $V_{dd}$ and $R_{prog}$ as in the following formula:

$$I_d = 10mA + \left(\frac{V_{dd} \times 6}{R_{prog}}\right)$$

**Empfohlene Betriebsbedingungen**
**Recommended Operating Conditions**

| Bezeichnung<br>Parameter | Symbol<br>Symbol | Wert<br>Value | | | Einheit<br>Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| Betriebstemperatur<br>Operating temperature | $T_{op}$ | – 20 | | + 85 | °C |
| Versorgungsspannung<br>Supply voltage | $V_{dd}$ | 2.4 | | 3.6 | V |
| Ausgangsspannung<br>Output voltage<br>(please see figure 1) | $DV_{dd}$ | 1.7 | | 3.6 | V |
| Rauschen der Versorgungsspannung[1)]<br>Supply voltage ripple<br>frequency range 0...20kHz | $dV_{dd}$ | | | 200 | mV |
| Pull-up Widerstand<br>Pull-up resistor<br>(please see figure 1) | $R_{pull\text{-}up}$ | 10 | | 1000 | kΩ |
| Abblock Kondensatoren<br>Bypass capacitors<br>(please see figure 1) | $C_{bypass}$<br>- stabilisation<br>- *HF* | | <br>>1<br>10 - 100 | | <br>µF<br>nF |
| Max. Umgebungslicht<br>Max. ambient light<br>Normlicht / Standard light A | $E_V$<br>Vdd < 3V<br>Vdd > 3V | | <br>1000<br>2000 | | lux |

[1)] Der externe Sender kann durch den SFH 7743 direkt mit 10mA bis 60mA gepulst betrieben werden; das bedeutet, dass jeder Widerstand in Serie zu $V_{dd}$ einen Spannungsabfall in der Versorgungsleitung verursacht. Es wird empfohlen, diesen Serienwiderstand so klein zu halten, dass max $dV_{dd}$ nicht überschritten und min $V_{dd}$ nicht unterschritten wird. Beim Betrieb des SFH 7743 im Labor ist vom Einsatz geregelter Spannungsversorgungen abzusehen. Durch das Einschalten der IRED wird die Quelle kurzzeitig belastet. Diese Belastung kann zu Spannungsschwankungen der Quelle führen, die wiederum die Funktion des SFH 7743 beeinträchtigen können. Im Normalbetrieb (Akku, Batterie, stabilisierte Netzteile) tritt dieser Effekt nicht auf.

The external emitter can be driven directly with 10 mA to 60 mA in pulsed mode; this means, that any series resistance on the $V_{dd}$ line causes a voltage drop at the power pin. It is recommended to keep the series resistance low, so that max $dV_{dd}$ is not exceeded. When testing the SFH 7743 sensor in the lab, please do not use regulated voltage supplies. The IR emitter pulse is a high, short load for the power supply. This load can influence the stability of the output voltage; this instability will influence the operation of the SFH 7743. This effect does not occur during normal operation of the sensor with batteries, storage batteries, or stabilized voltage supplies.

**Kennwerte** (Ta = 25°C)
**Characteristics**

| **Bezeichnung**<br>**Parameter** | **Symbol**<br>**Symbol** | **Wert**<br>**Value** | | | **Einheit**<br>**Unit** |
|---|---|---|---|---|---|
| | | **min.** | **typ.** | **max.** | |
| Minimale Betriebsspannung für Startphase<br>Minimum required supply voltage for start-up<br>(please see figure 2) | $V_{dd,\ start}$ | 0.8 | | 2.0 | V |
| Länge der Startphase<br>Start-up time<br>(please see figure 2) | $t_{start}$ | 60 | 90 | 120 | ms |
| Mess-Wiederholzeit<br>Measurement refresh time<br>(please see figure 3) | $t_{refresh}$ | 60 | 90 | 120 | ms |
| LED „An“ Zeit<br>LED „ON“ Time<br>(please see figure 3) | $t_{pulse}$ | 30 | 45 | 60 | µs |
| Schaltschwelle „Low“ --> „High“<br>Switching threshold „Low“ --> „High“ | $Ee$ | 145 | | | µW/cm² |
| Schaltabstand mit externem Sender SFH 4650<br>Operating distance with external emitter SFH 4650<br>($R_{Prog}$ = 470 Ω, $V_{dd}$ = 3V,<br>KODAK White Paper R=90%)<br>(please see figure 1a, Option 1) | $d$ | | 40 | | mm |
| Schaltabstand mit externem Sender SFH 4650<br>Operating distance with external emitter SFH 4650<br>(SFH 4650 driven with 1A via external transistor,<br>KODAK White Paper R=90%)<br>(please see figure 1b, Option 2) | $d$ | | 150 | | mm |
| Durchschnittliche Stromaufnahme[1)]<br>Mean current consumption[1)]<br>($R_{Prog}$ = h, $V_{dd} = 3V$) | $I_{dd,\ mean}$ | | 25 | 50 | µA |
| Maximale Stromaufnahme<br>Maximum current consumption<br>($R_{Prog}$ = h, $V_{dd} = 3V$) | $I_{dd,\ max}$ | | 10 | 20 | mA |
| Durchschnittliche Stromaufnahme[1)]<br>Mean current consumption[1)]<br>($R_{Prog}$ = 470 Ω, $V_{dd} = 3V$) | $I_{dd,\ mean}$ | | 45 | 75 | µA |

**Kennwerte** (Ta = 25°C)
**Characteristics**

| **Bezeichnung**<br>**Parameter** | **Symbol**<br>**Symbol** | **Wert**<br>**Value** | | | **Einheit**<br>**Unit** |
|---|---|---|---|---|---|
| | | **min.** | **typ.** | **max.** | |
| Maximale Stromaufnahme<br>Maximum current consumption<br>($R_{Prog}$ = 470 Ω, $V_{dd} = 3V$) | $I_{dd, max}$ | | 50 | 65 | mA |
| Ausgangsleckstrom „high“<br>Output leakage current „high“<br>$DV_{dd}$ = 2.2V | $I_{out, H}$ | | 5 | 400 | nA |
| Ausgangsspannung „low“<br>Output voltage „low“<br>$DV_{dd}$ = 2.2V; $R_{pullup}$ = 270 Ω | $V_{out, L}$ | | 0.1 | 0.5 | V |
| Wellenlänge der max. Fotoempfindlichkeit<br>Wavelength of max. sensitivity | $\lambda_{S, max}$ | | 880 | | nm |
| Spektraler Bereich der Fotoempfindlichkeit<br>$S$ = 10% von $S_{max}$<br>Spectral range of sensitivity<br>$S$ = 10% of $S_{max}$ | λ | 730 | | 1080 | nm |

[1] gepulster Betrieb: Dauer LED an: ~44µs / Dauer LED aus: ~90ms
pulsed operating mode: LED on time: ~44µs / LED off time: ~90ms

Blockdiagramm (empfohlener Pull-Up-Widerstand $R_{pull\ up}$ = 10kOhm...1MOhm)

Block diagram (recommended Pull up resistance $R_{pull\ up}$ = 10kOhm...1MOhm)

**Figure 1a Blockdiagramm Option 1**
**Block diagram option 1**

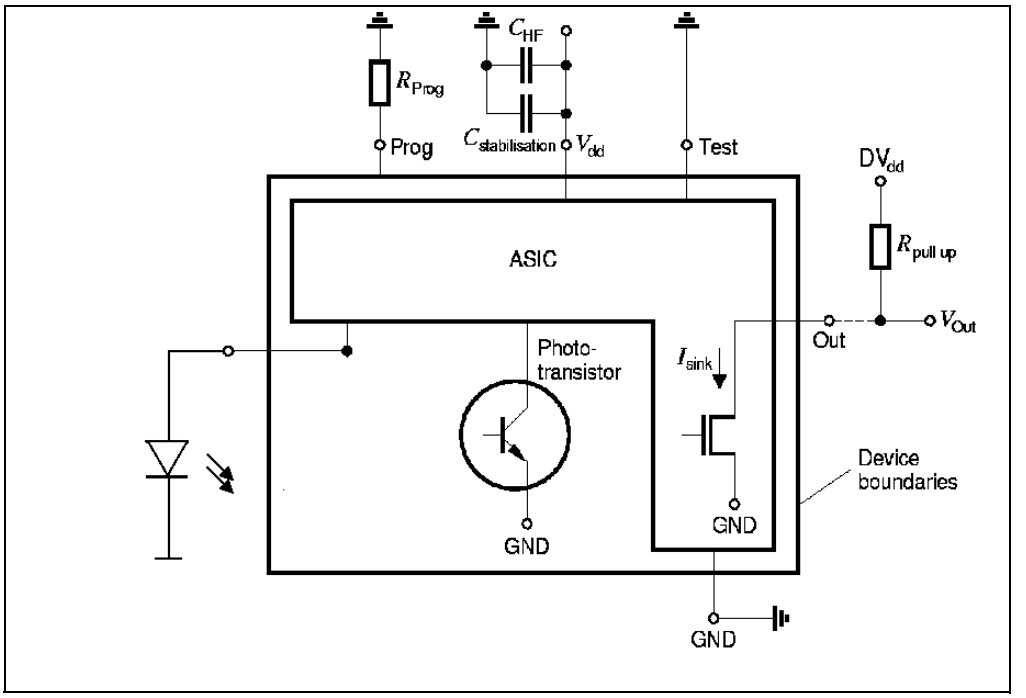



**Figure 1b Blockdiagramm Option 2**
**Block diagram option 2**

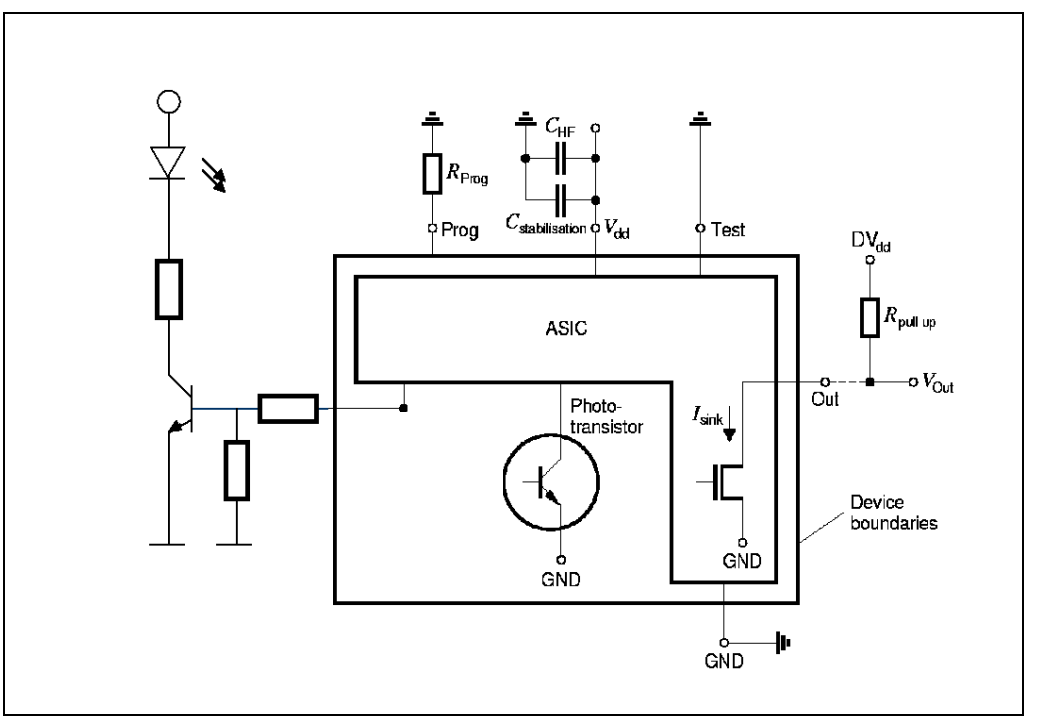
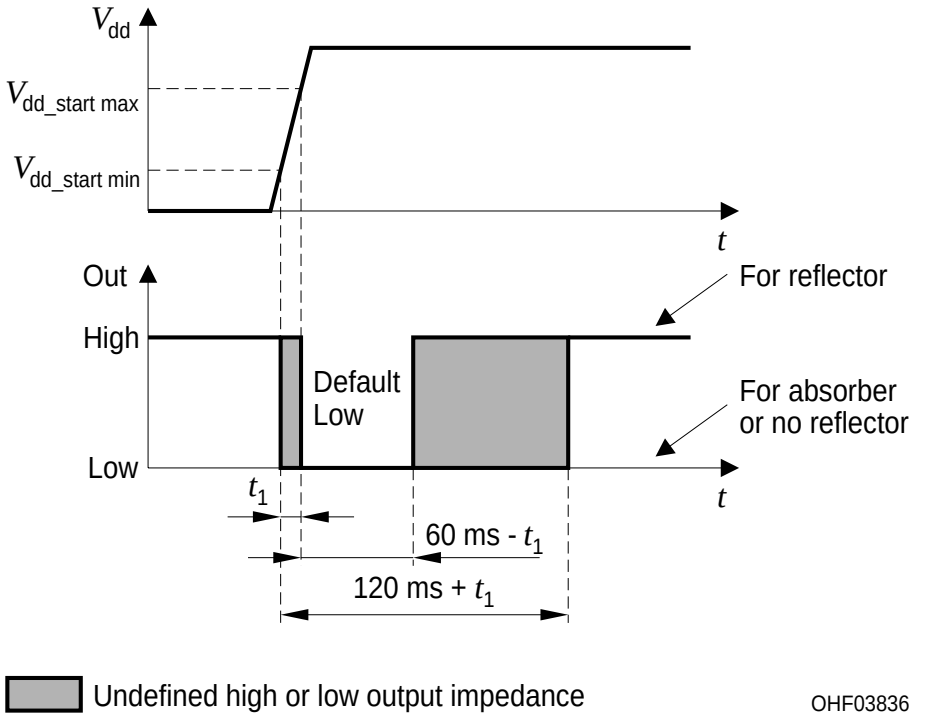


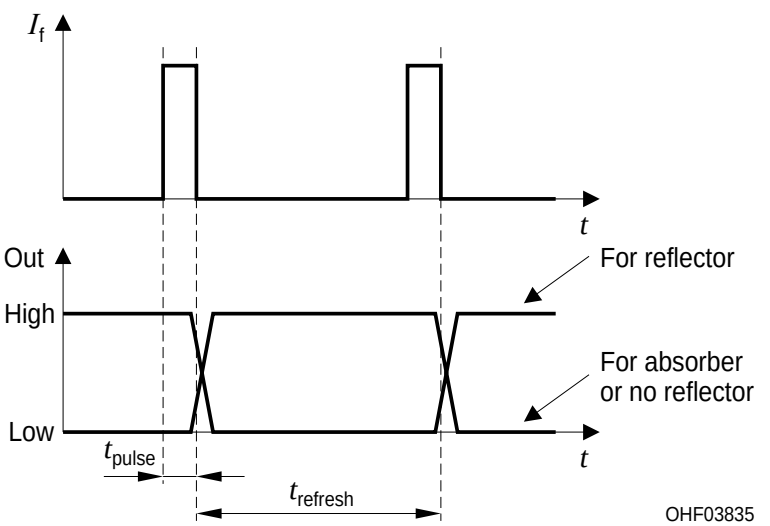
**Figure 2 Startverhalten**
**Start-up sequence**



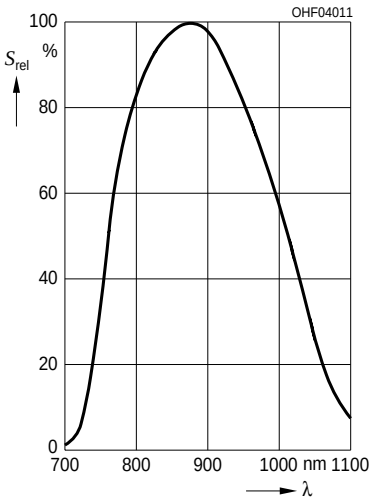

Der Ausgang ist immer hochohmig, wenn an $V_{dd}$ keine Spannung angeschlossen ist. Wenn die Versorgungsspannung $V_{dd,\ start}$ erreicht, bleibt der Ausgang für 60ms < $t_{start}$ <120ms auf „low“. Anschließend findet etwa alle 90ms eine Messung des reflektierten Signals statt und der Ausgang wird entprechend geschalten (Figure 3).

If the supply voltage at $V_{dd}$ is not connected, the output is always high ohmic. When supply voltage reaches $V_{dd,\ start}$ , the sensor output stays low for 60ms < $t_{start}$ <120ms. Subsequently approx. every 90ms the reflected signal is measured and the output is set accordingly (Figure 3).

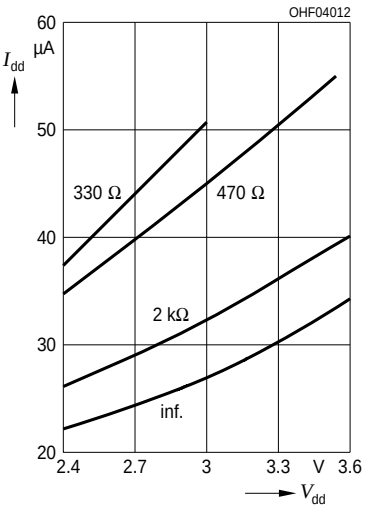
**Figure 3 Timing diagram**



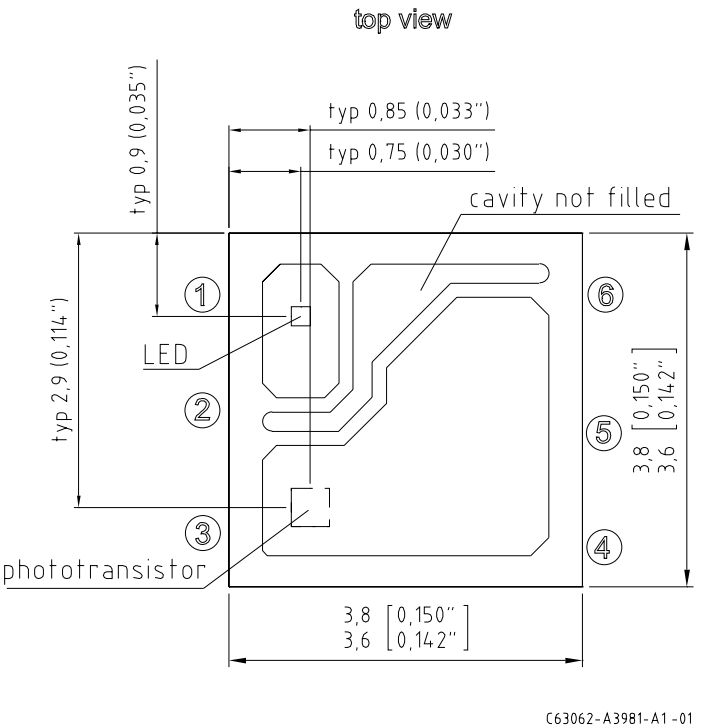
**Phototransistor**
**Relative Spectral Sensitivity**
$S_{rel} = f(\lambda)$; $T_A = 25°C$

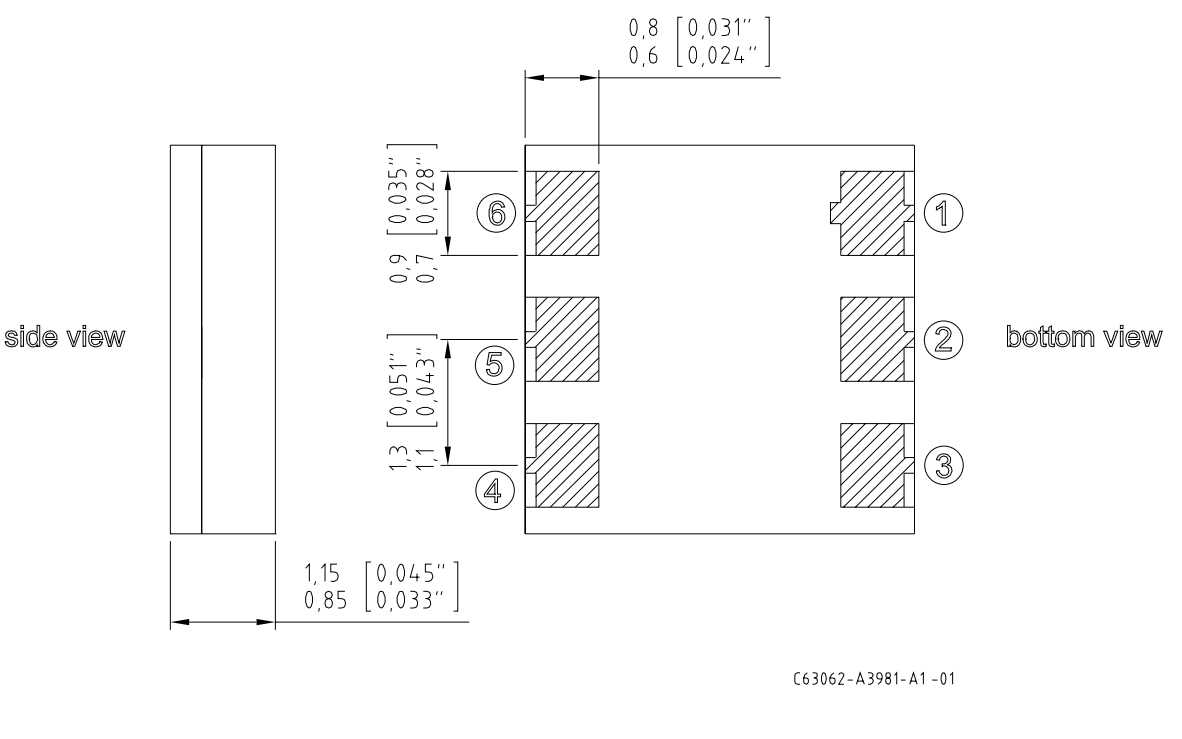



**SFH 7743:**
**Mean current consumption**
$I_{dd} = f(V_{dd})$; $R_{prog}$; $T_A = 25°C$



## Maßzeichnung
## Package Outlines




Maße in mm (inch) / Dimensions in mm (inch)

**Anschlußbelegung**
**Pin configuration**

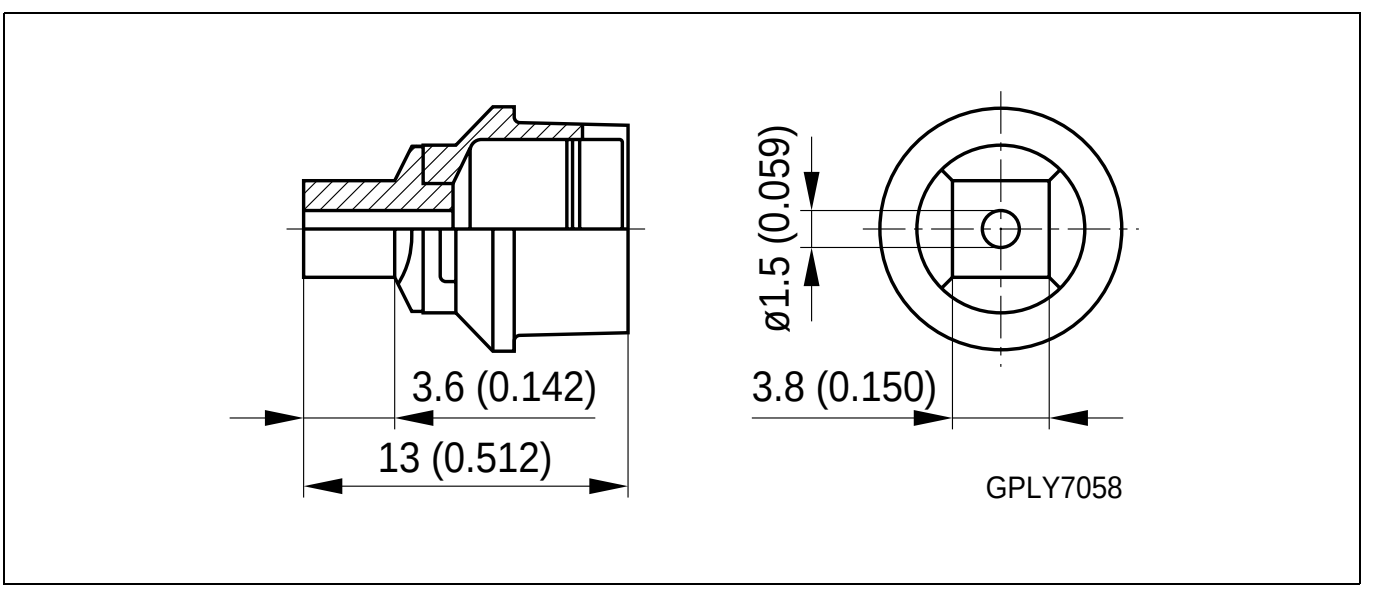
| Pin # | Description |
|---|---|
| 1 | external LED (anode pin) or $I_d$ for driver circuit |
| 2 | GND |
| 3 | Out |
| 4 | Test (must be connected to GND) |
| 5 | $V_{dd}$ |
| 6 | Prog |

**Bauteilaufnahme**
**device pickup**

Vakuum Pipette sollte das Bauteil am rechteckigen Außenrahmen fassen.

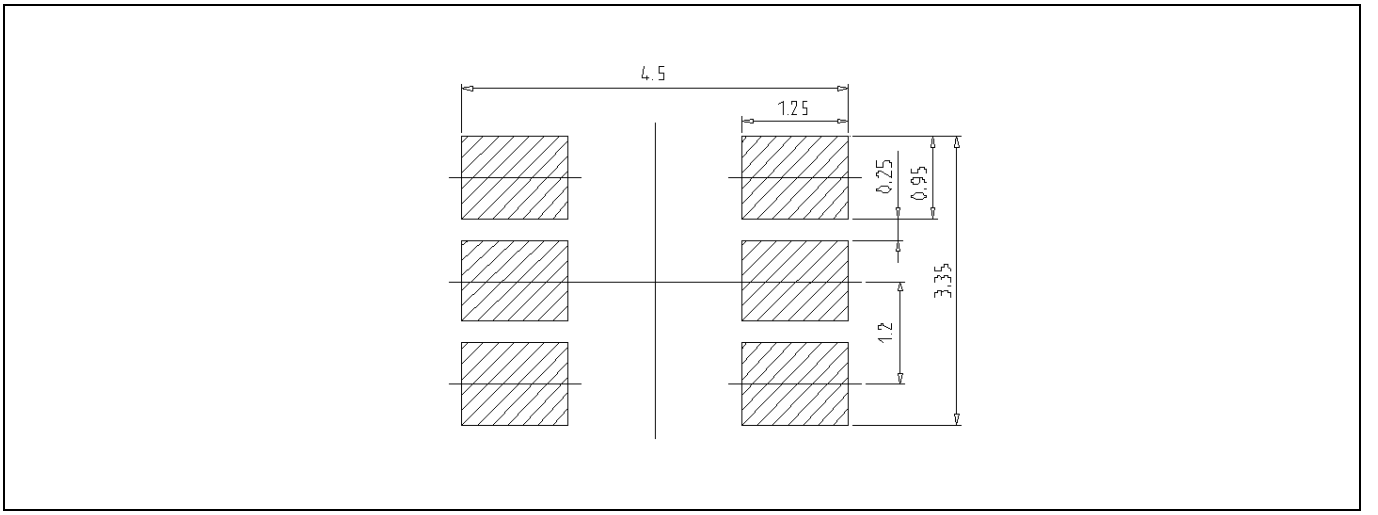
Laminar vacuum pickup nozzle should use the rectangular outer wall of the device for handling.

**Empfohlene Pipette**
**Recommended pickup nozzle**



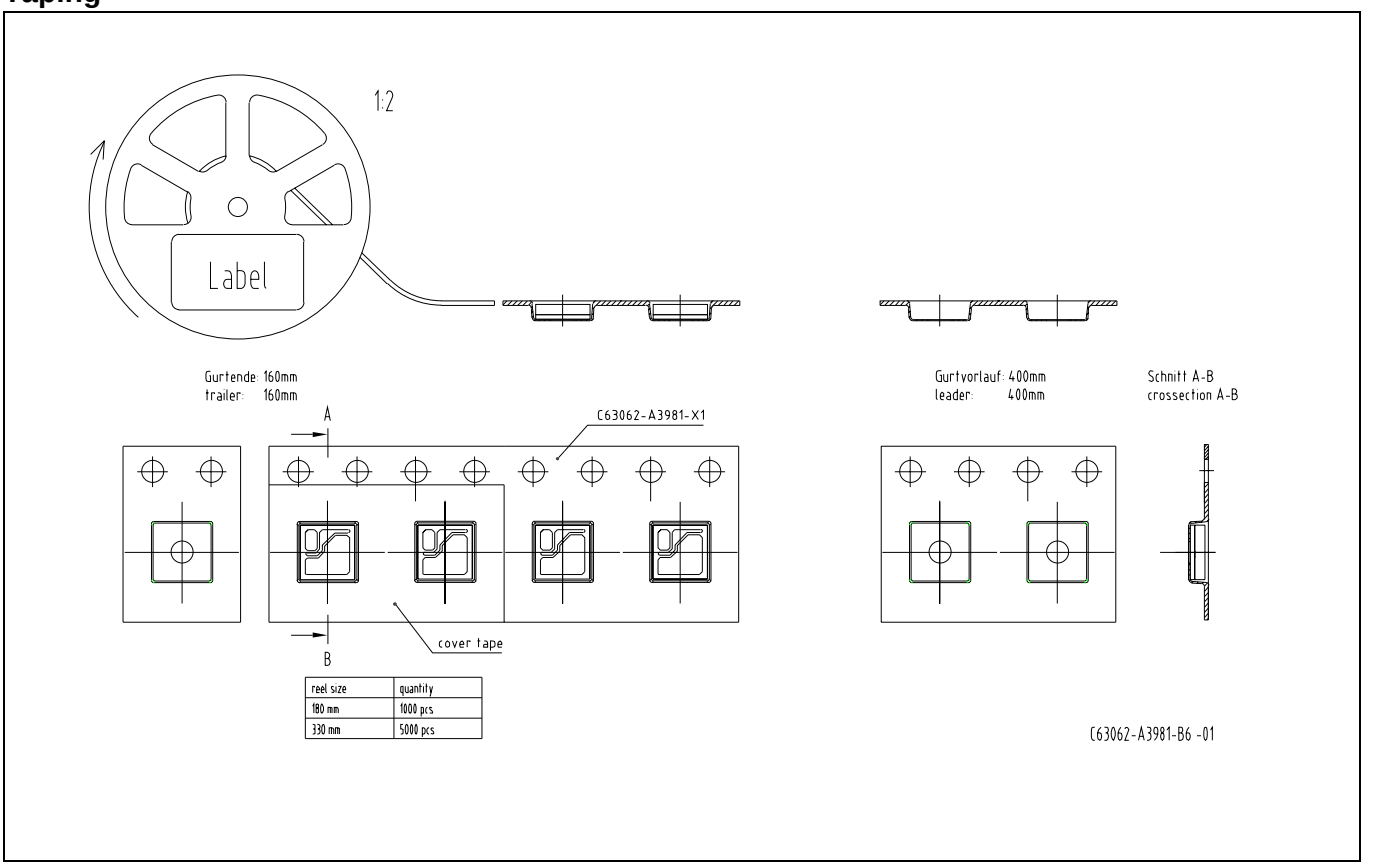

Maße in mm/ Dimensions in mm

## Empfohlenes Lötpaddesign
## Recommended Solderpad Design

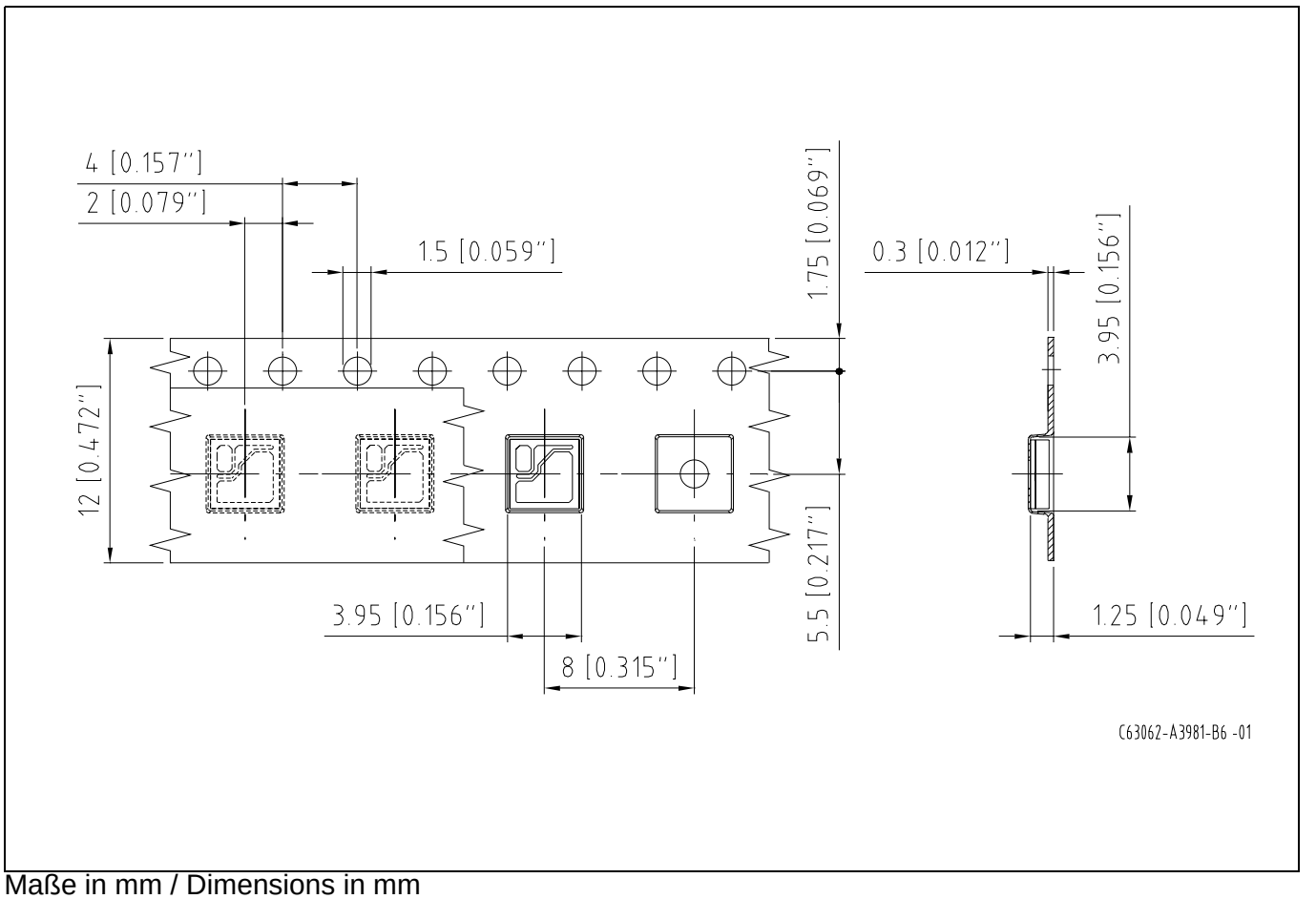



Maße in mm / Dimensions in mm

## Gurtverpackung
## Taping



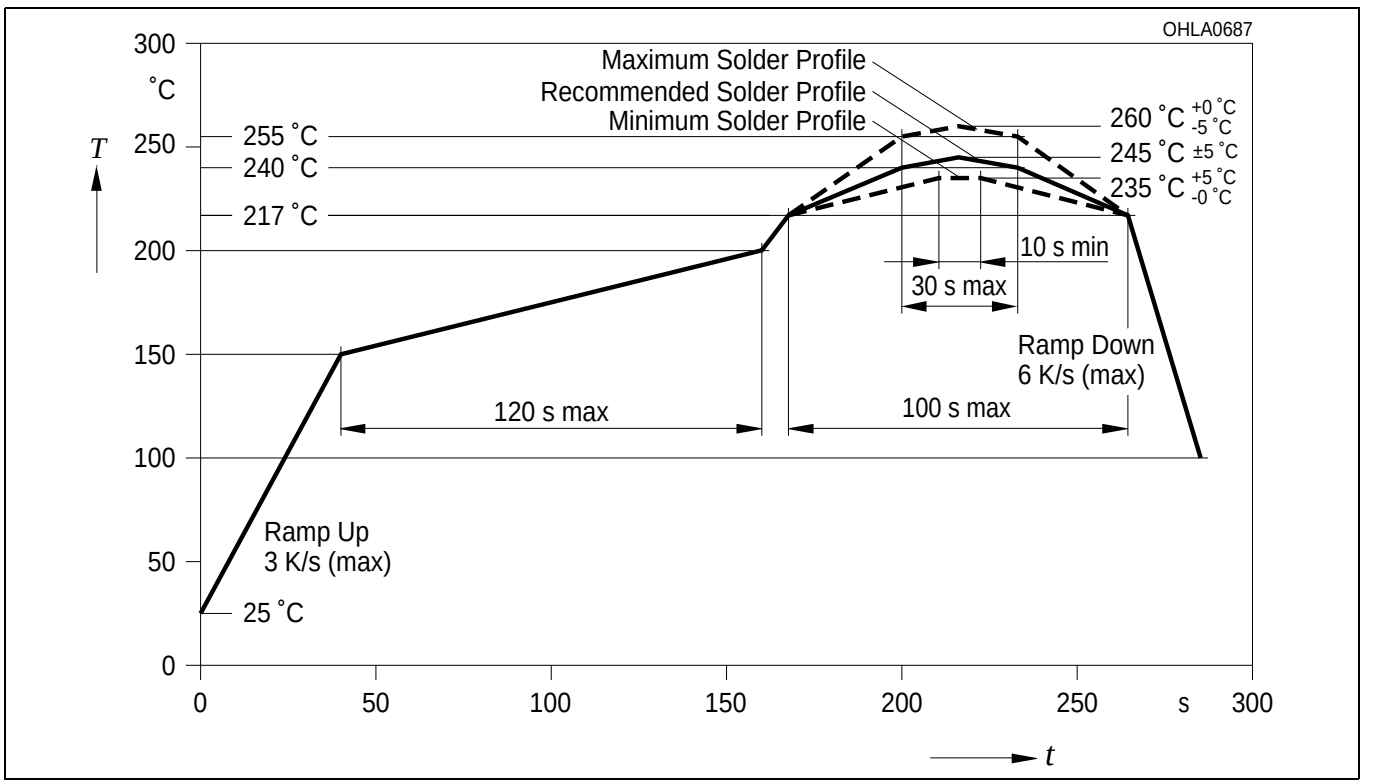

Maße in mm / Dimensions in mm




Maße in mm / Dimensions in mm

**Lötbedingungen**
**Soldering Conditions**
**Reflow Lötprofil für bleifreies Löten**
**Reflow Soldering Profile for lead free soldering**

Vorbehandlung nach JEDEC Level 4
Preconditioning acc. to JEDEC Level 4
(nach J-STD-020C)
(acc. to J-STD-020C)

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