

Digitaler Näherungsdetektor mit integriertem Sender Treiber

Digital proximity detector with integrated emitter driver

Lead (Pb) Free Product - RoHS Compliant

SFH 7743

preliminary



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

Anwendungen

- Näherungsdetektor für kurze Entfernungen

Features

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

Applications

- Short range proximity detector

| Typ Type | Bestellnummer Ordering Code |
|-------------|--------------------------------|
| SFH 7743 | Q65110A8870 |

勝特力材料 886-3-5753170
勝特力电子(上海) 86-21-34970699
勝特力电子(深圳) 86-755-83298787
[Http://www.100y.com.tw](http://www.100y.com.tw)

Grenzwerte
Maximum Ratings

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

¹⁾ Der Senderausgangsstrom I_f ist abhängig von V_{dd} und R_{prog} wie folgt:

*The Emitter output current depends on V_{dd} and R_{prog} as in the following formula:

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

Empfohlene Betriebsbedingungen Recommended Operating Conditions

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

¹⁾ Der externe Sender kann durch den SFH 7743 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 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 ($T_a = 25^\circ\text{C}$)

Characteristics

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

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

| Bezeichnung Parameter | Symbol Symbol | Wert Value | | | Einheit Unit |
|---|---------------------------|---------------|------|------|-----------------|
| | | min. | typ. | max. | |
| Maximale Stromaufnahme Maximum current consumption ($R_{\text{Prog}} = 470 \Omega$, $V_{\text{dd}} = 3V$) | $I_{\text{dd, max}}$ | | 50 | 65 | mA |
| Ausgangsleckstrom „high“ Output leakage current „high“ $DV_{\text{dd}} = 2.2V$ | $I_{\text{out, H}}$ | | 5 | 400 | nA |
| Ausgangsspannung „low“ Output voltage „low“ $DV_{\text{dd}} = 2.2V$; $R_{\text{pullup}} = 270 \Omega$ | $V_{\text{out, L}}$ | | 0.1 | 0.5 | V |
| Wellenlänge der max. Fotoempfindlichkeit Wavelength of max. sensitivity | $\lambda_{\text{S, max}}$ | | 880 | | nm |
| Spektraler Bereich der Fotoempfindlichkeit $S = 10\%$ von S_{max} Spectral range of sensitivity $S = 10\%$ of S_{max} | λ | 730 | | 1080 | nm |
| Wellenlänge der Strahlung des Emitters Wavelength at peak emission $I_{\text{F}} = 10 \text{ mA}$ | λ_{peak} | | 850 | | nm |
| Spektrale Bandbreite des Emitters bei 50% von I_{max} Spectral bandwidth of the emitter at 50% of I_{max} $I_{\text{F}} = 10 \text{ mA}$ | $\Delta\lambda$ | | 30 | | 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 $R_{pull\ up} = 10k\Omega \dots 1M\Omega$)

Block diagram (recommended Pull up resistance $R_{pull\ up} = 10k\Omega \dots 1M\Omega$)

Figure 1a Blockdiagramm Option 1
Block diagram option 1

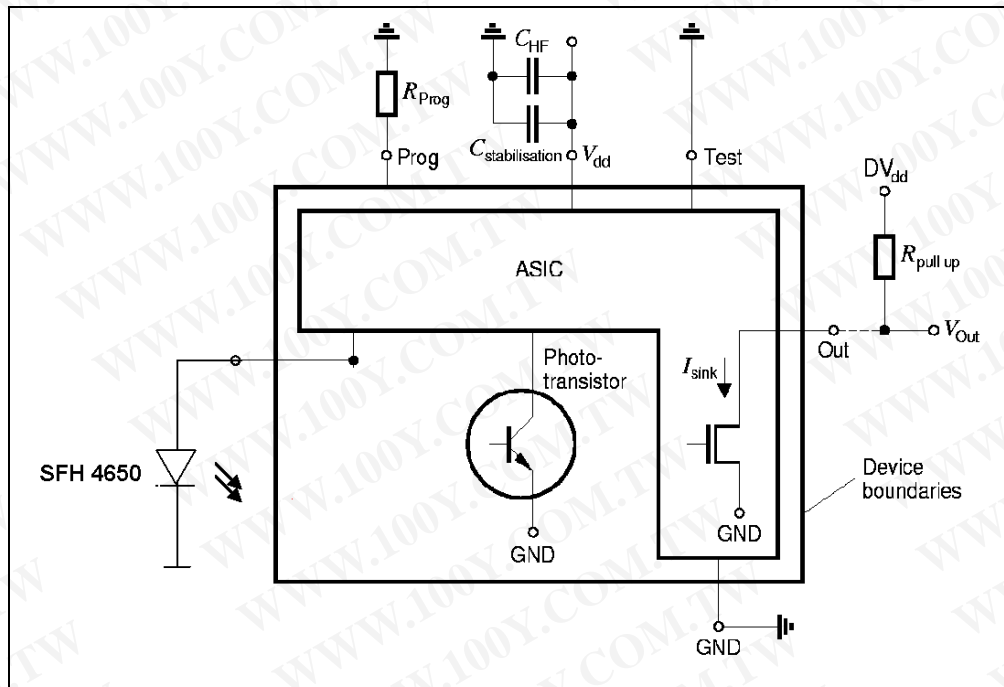
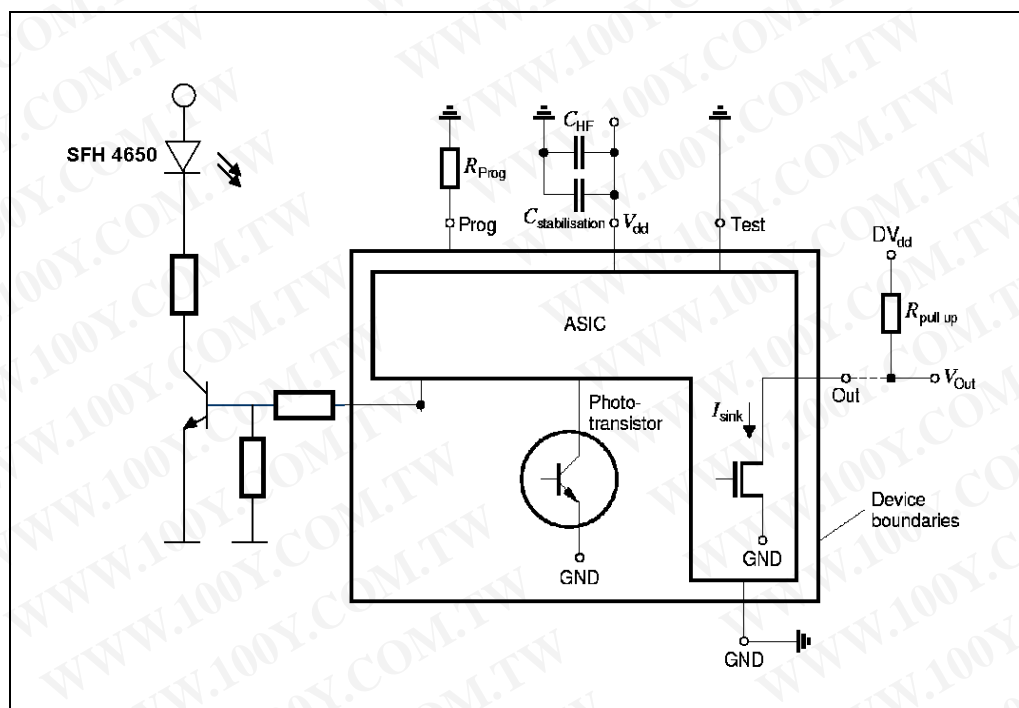
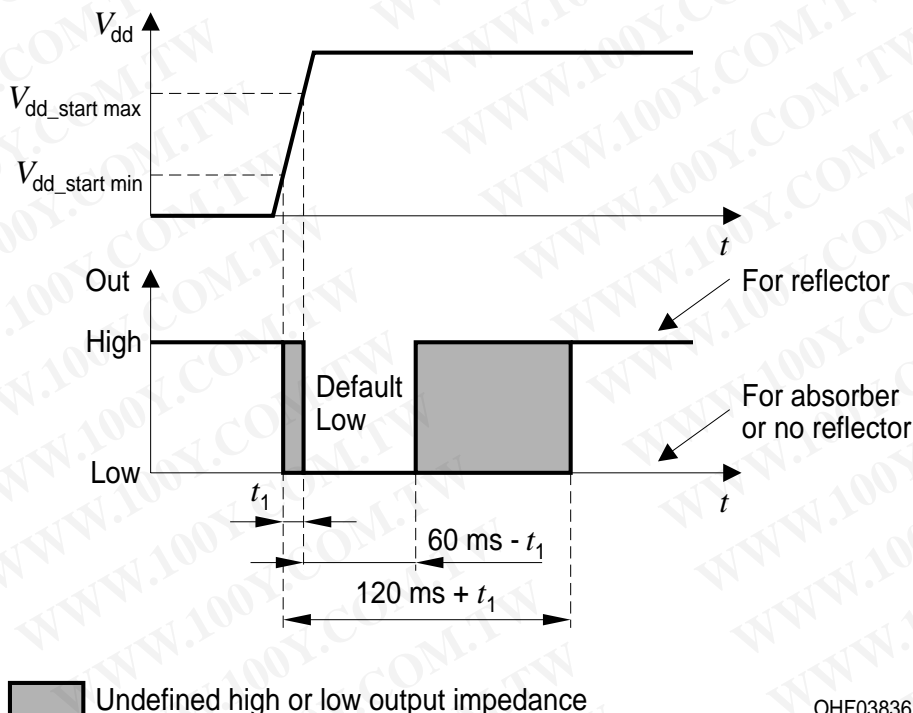


Figure 1b Blockdiagramm Option 2
Block diagram option 2



**Figure 2 Startverhalten
Start-up sequence**

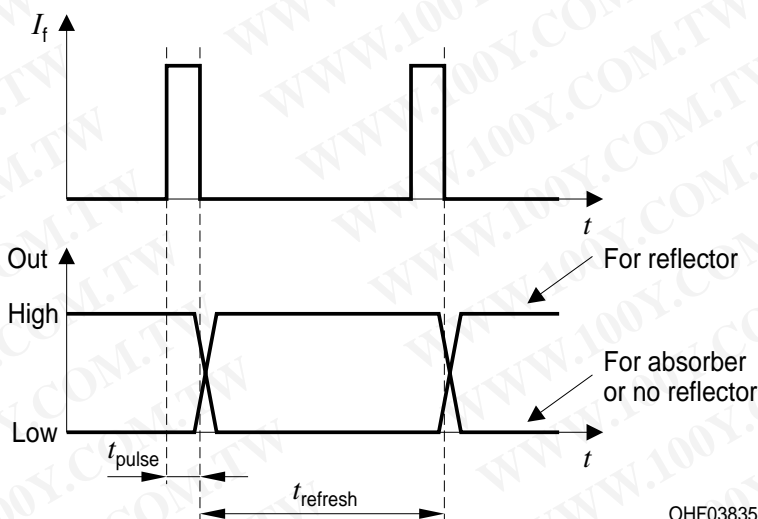


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Der Ausgang ist immer hochohmig, wenn an V_{dd} keine Spannung angeschlossen ist. Wenn die Versorgungsspannung V_{dd_start} erreicht, bleibt der Ausgang für $60\ ms < t_{start} < 120\ ms$ auf „low“. Anschließend findet etwa alle 90ms eine Messung des reflektierten Signals statt und der Ausgang wird entsprechend geschaltet (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 $60\ ms < t_{start} < 120\ ms$. Subsequently approx. every 90ms the reflected signal is measured and the output is set accordingly (Figure 3).

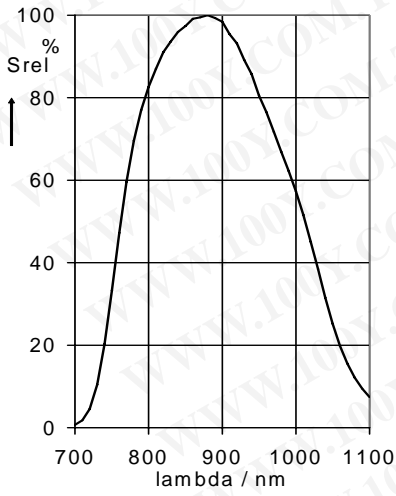
Figure 3 Timing diagram



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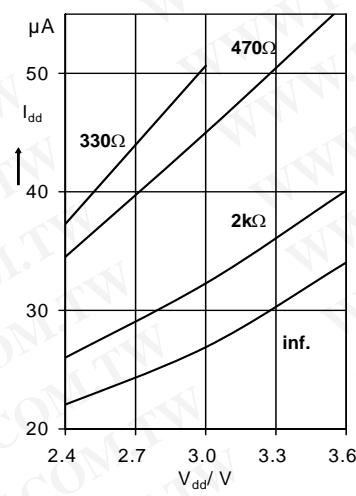
**Phototransistor
Relative Spectral Sensitivity**

$S_{rel} = f(\lambda); T_A = 25^\circ\text{C}$

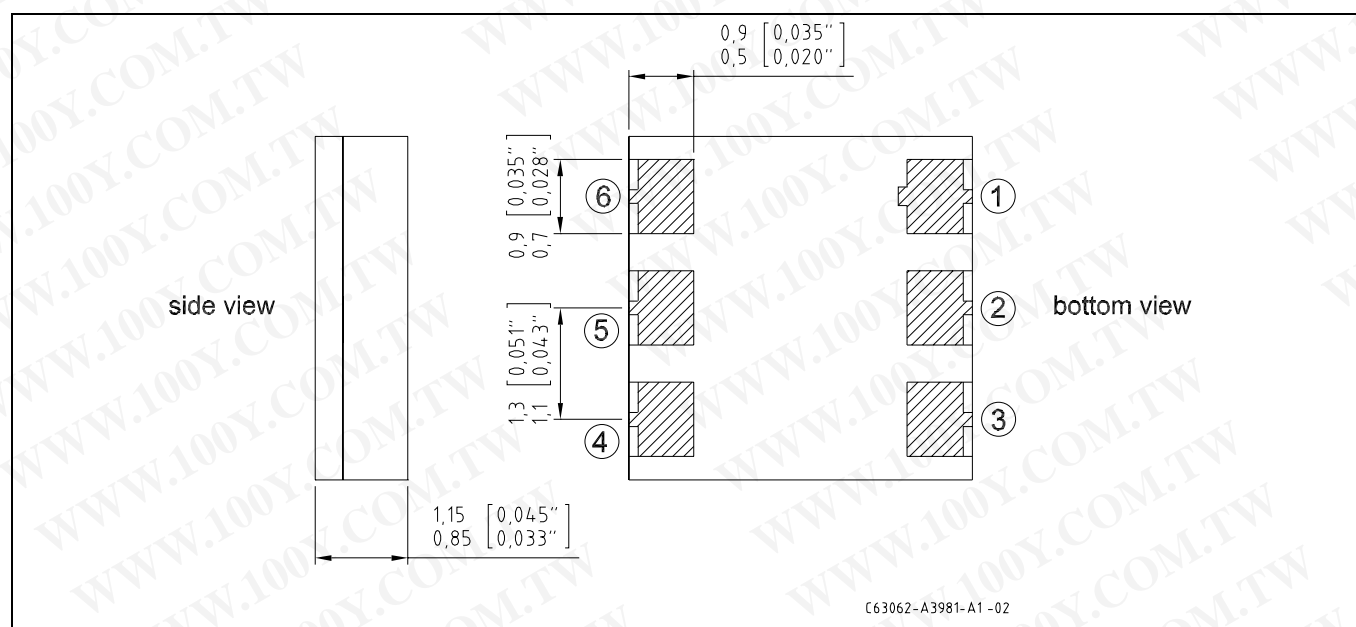
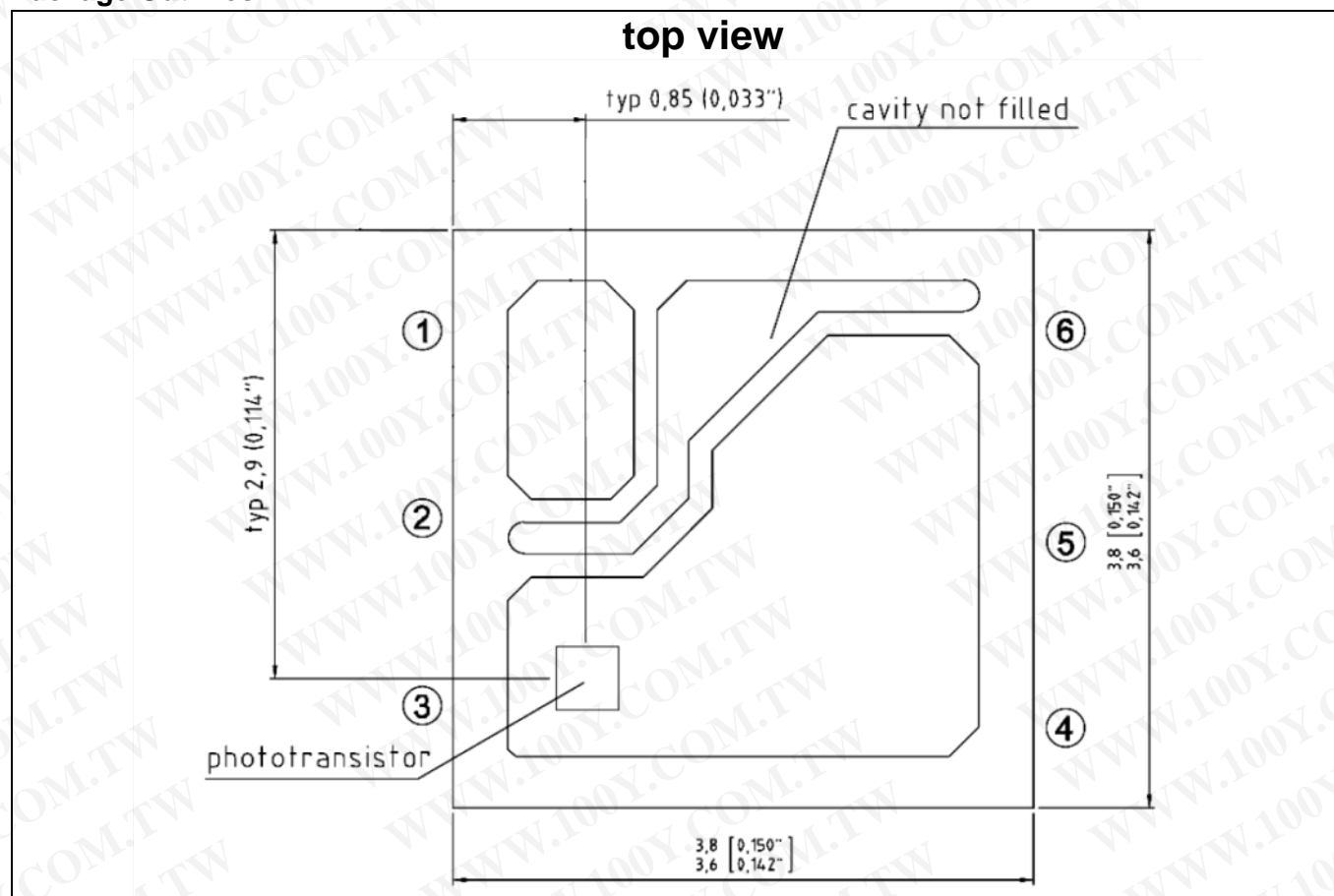


**SFH 7741:
Mean current consumption**

$I_{dd} = f(V_{dd}); R_{prog}; T_A = 25^\circ\text{C}$



Maßzeichnung
Package Outlines



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

Anschlußbelegung Pin configuration

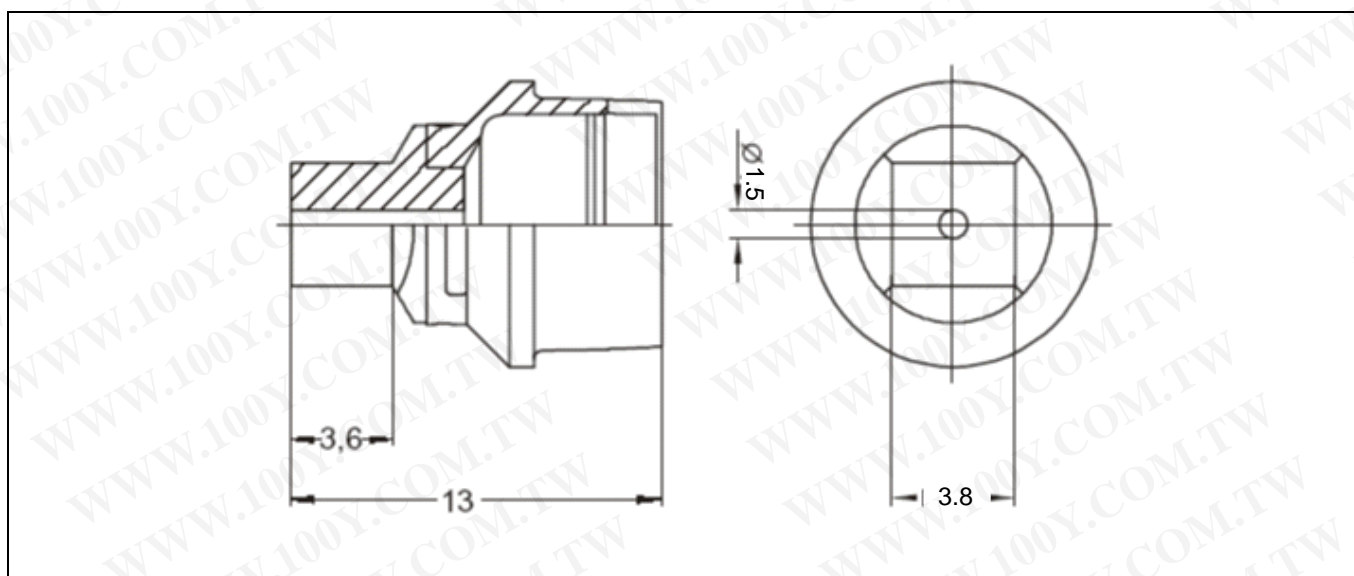
| Pin # | Description |
|-------|---|
| 1 | Anode LED (must be connected to external LED anode pin) |
| 2 | GND (must be connected to external LED cathode pin) |
| 3 | Out |
| 4 | Test (must be connected to GND) |
| 5 | V_{dd} |
| 6 | Prog |

Bauteilaufnahme device pickup

Vakuum Pipette sollte das Bauteil am rechteckigen Außenrahmen fassen.

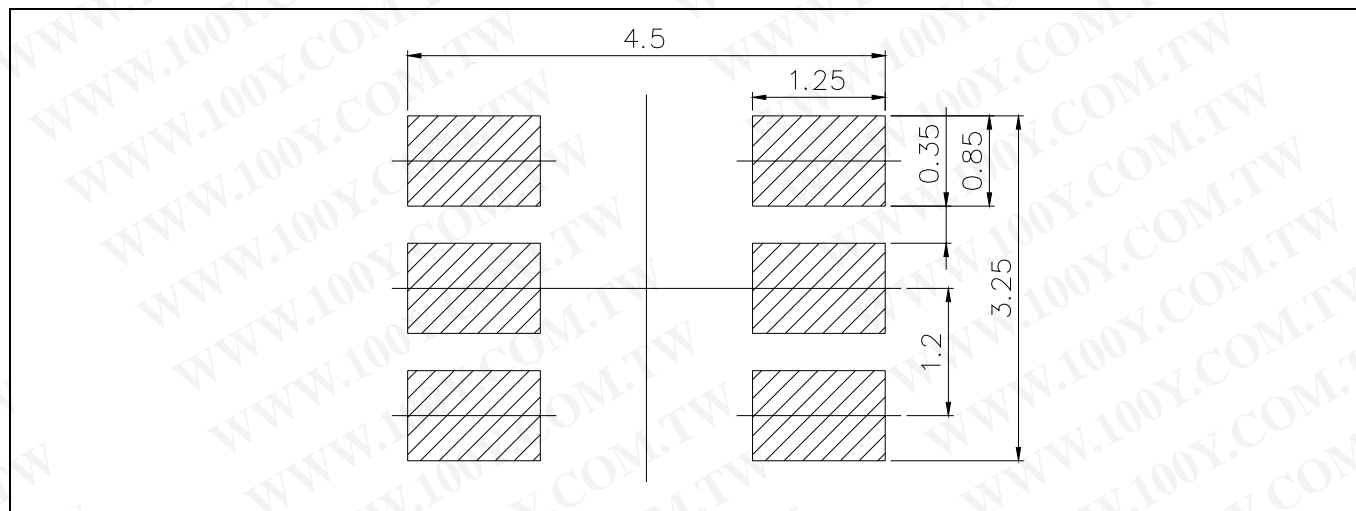
Laminar vacuum pickup nozzle should use the rectangular outer wall of the device for handling.

Empfohlene Pipette Recommended pickup nozzle



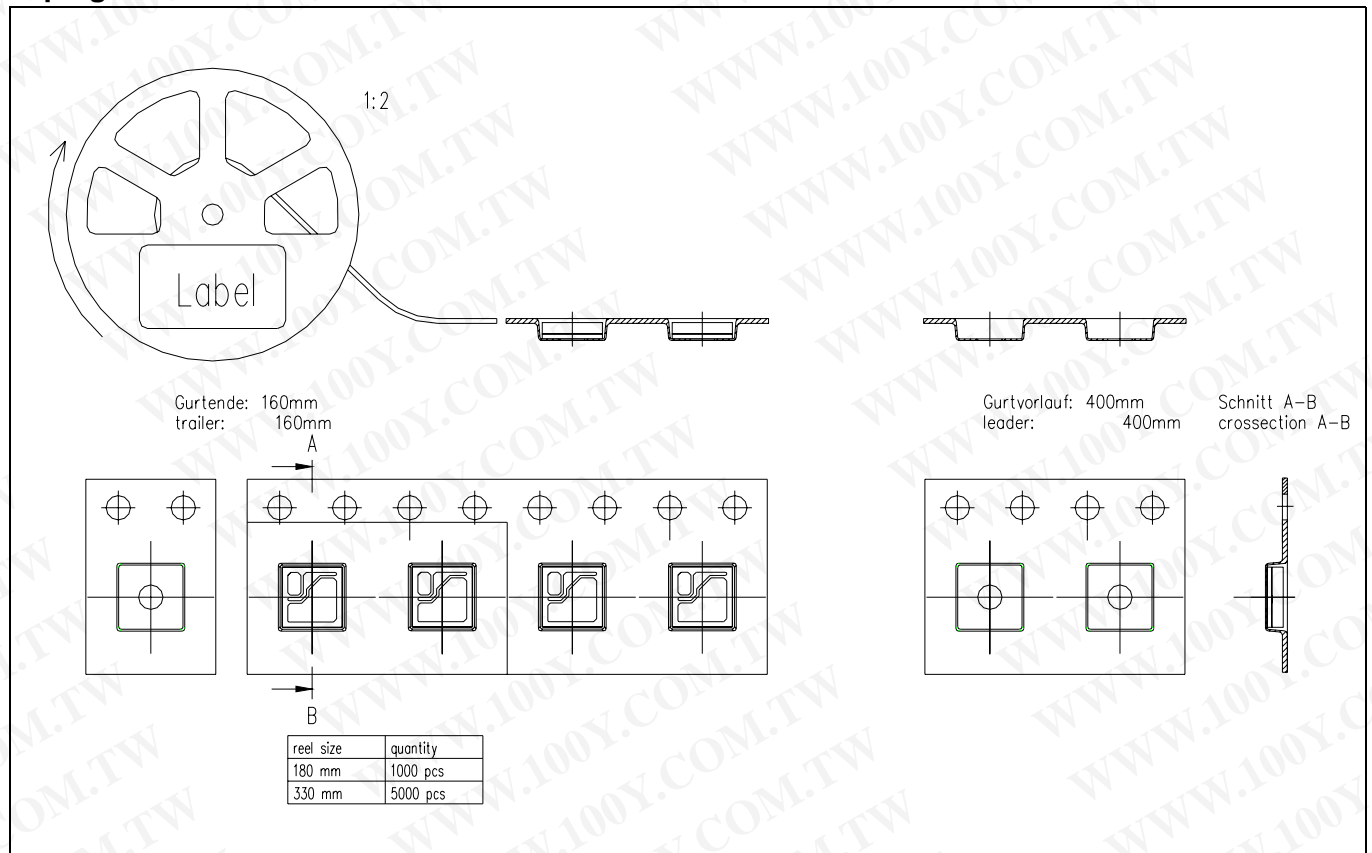
Maße in mm / Dimensions in mm

Empfohlenes Lötpad-Design
Recommended Solderpad Design

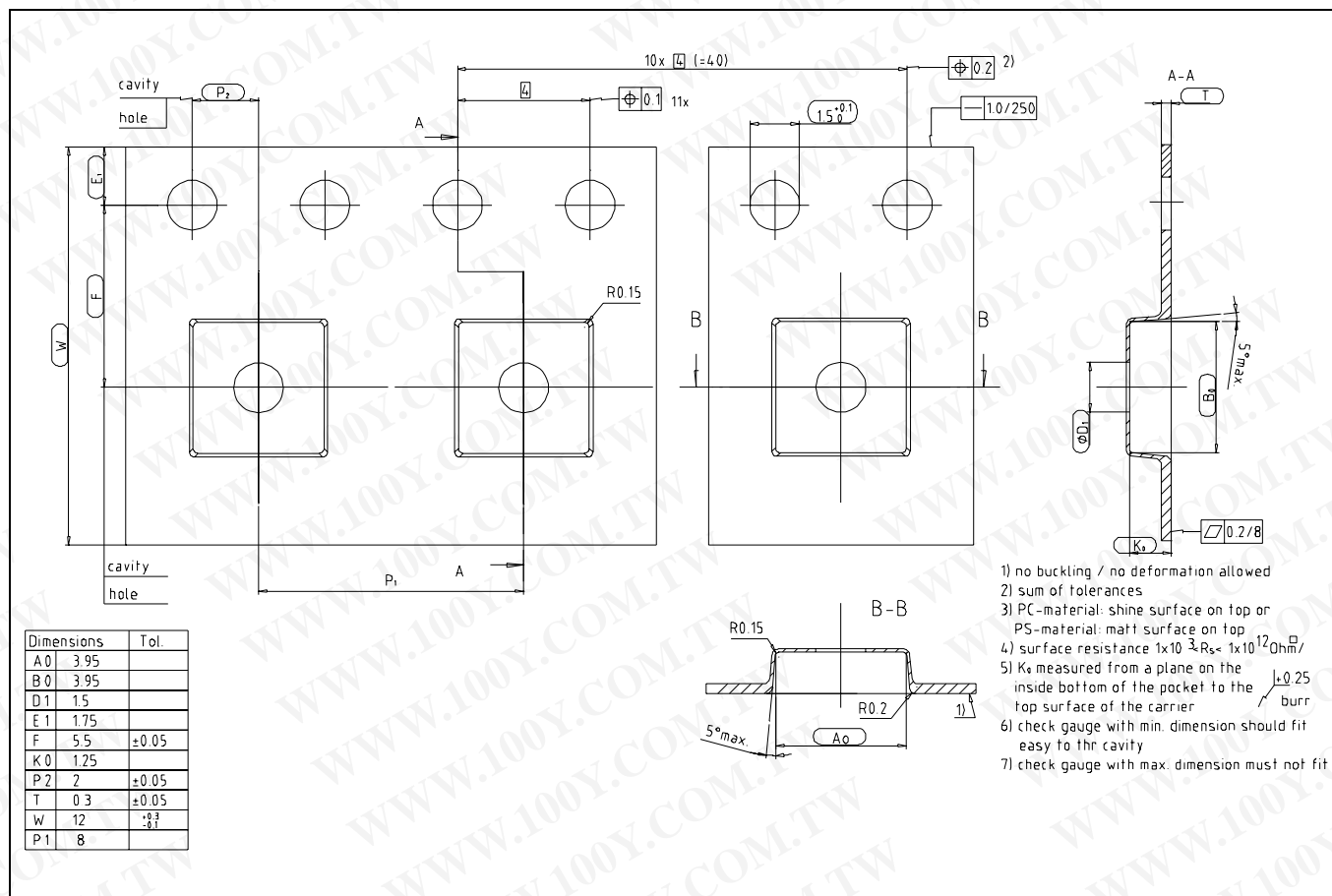


Maße in mm / Dimensions in mm

Gurtverpackung
Taping



Maße in mm / Dimensions in mm



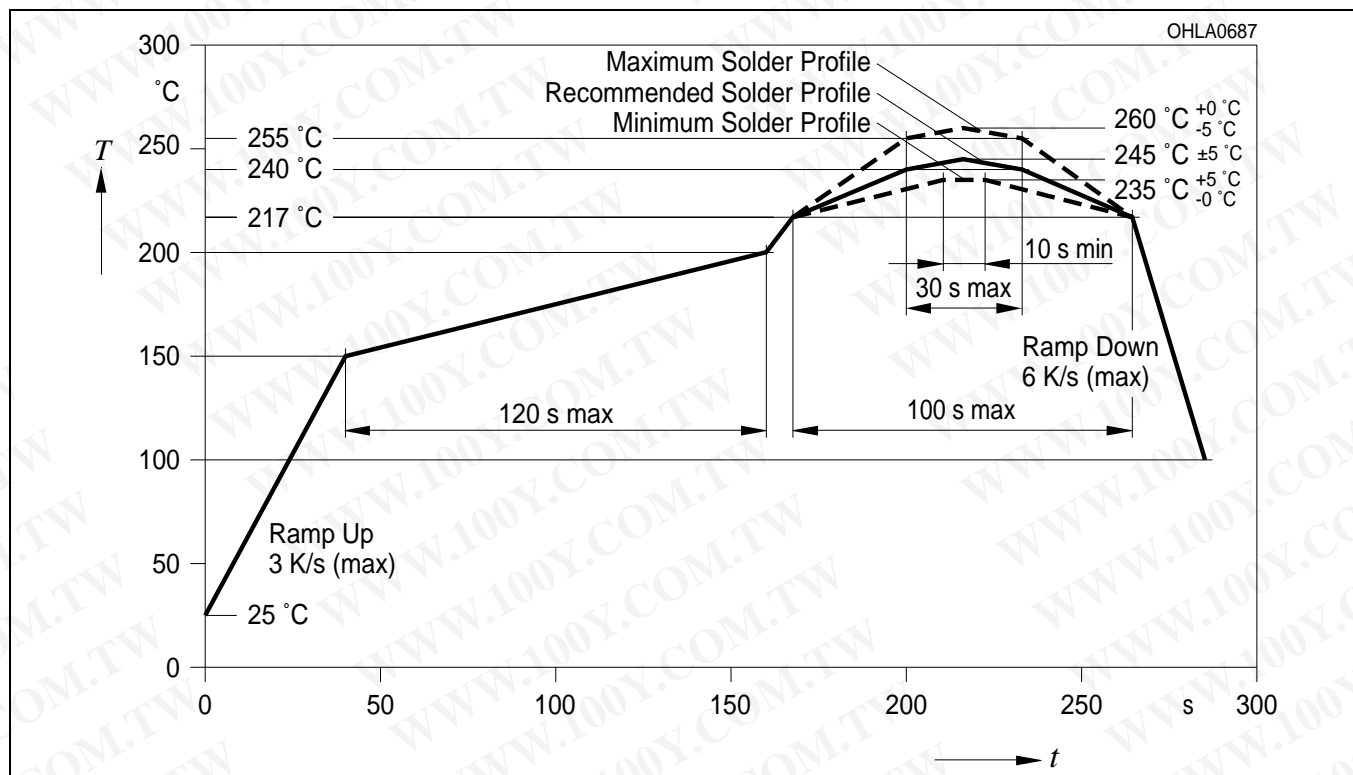
Maße in mm / Dimensions in mm

- 1) no buckling / no deformation allowed
- 2) sum of tolerances
- 3) PC-material: shine surface on top or PS-material: matt surface on top
- 4) surface resistance $1 \times 10^3 R_{sq} - 1 \times 10^{12} \Omega \text{m}^2$
- 5) K_{ϕ} measured from a plane on the inside bottom of the pocket to the top surface of the carrier
- 6) check gauge with min. dimension should fit easy to the cavity
- 7) check gauge with max. dimension must not fit

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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