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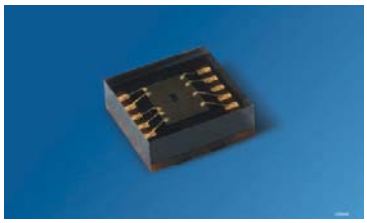
Umgebungslicht und Näherungssensor
Ambient Light and Proximity Sensor
Lead (Pb) Free Product - RoHS Compliant

SFH 7770 E6



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Wesentliche Merkmale

- Näherungssensor
  - Detektionsbereich bis 200mm
  - Programmierbare Integrationszeit
  - Gestenerkennung
  - Betrieb von bis zu drei IR Emittern
  - Optimiert für 850nm Emitter
  - Umgebungslicht-Unterdrückung
- Umgebungslichtsensor
  - 0.03lx - 65000lx
  - Programmierbare Integrationszeit
  - Gute Linearität
  - Spektrale Empfindlichkeit ähnlich dem menschlichen Auge
- I^2C interface
  - 100kHz / 400kHz und 3.4MHz Mode
  - verschiedene Messmoden programmierbar (STAND-BY, TRIGGERED, FREE-RUNNING)
- < 5 µA Stromverbrauch im STAND-BY
- Geringe Abmessungen, 2.8 x 2.8 x 0.9 mm^3

Features

- Proximity Sensor (PS)
  - Detection-range up to 200mm
  - Programmable PS integration time
  - Gesture recognition possible
  - Outputs to drive up to three IR emitters
  - Optimized for 850nm emitters
  - Suppression of ambient light
- Ambient Light Sensor (ALS)
  - 0.03lx - 65000lx
  - Programmable ALS integration time
  - High linearity
  - Spectral sensitivity well matched to the human eye
- I^2C interface
  - 100kHz / 400kHz and 3.4MHz mode
  - Measurement modes programmable (STAND-BY, TRIGGERED, FREE-RUNNING)
- Current consumption < 5µA in STAND-BY
- Small package size, 2.8 x 2.8 x 0.9 mm^3

Anwendungen

- Mobiltelefone
- PDA's und Notebooks
- Kameras
- Consumer Produkte

Applications

- Mobile phones
- PDAs and notebooks
- Cameras
- Consumer products

Typ Type	Bestellnummer Ordering Code
SFH 7770 E6	Q65111A3146

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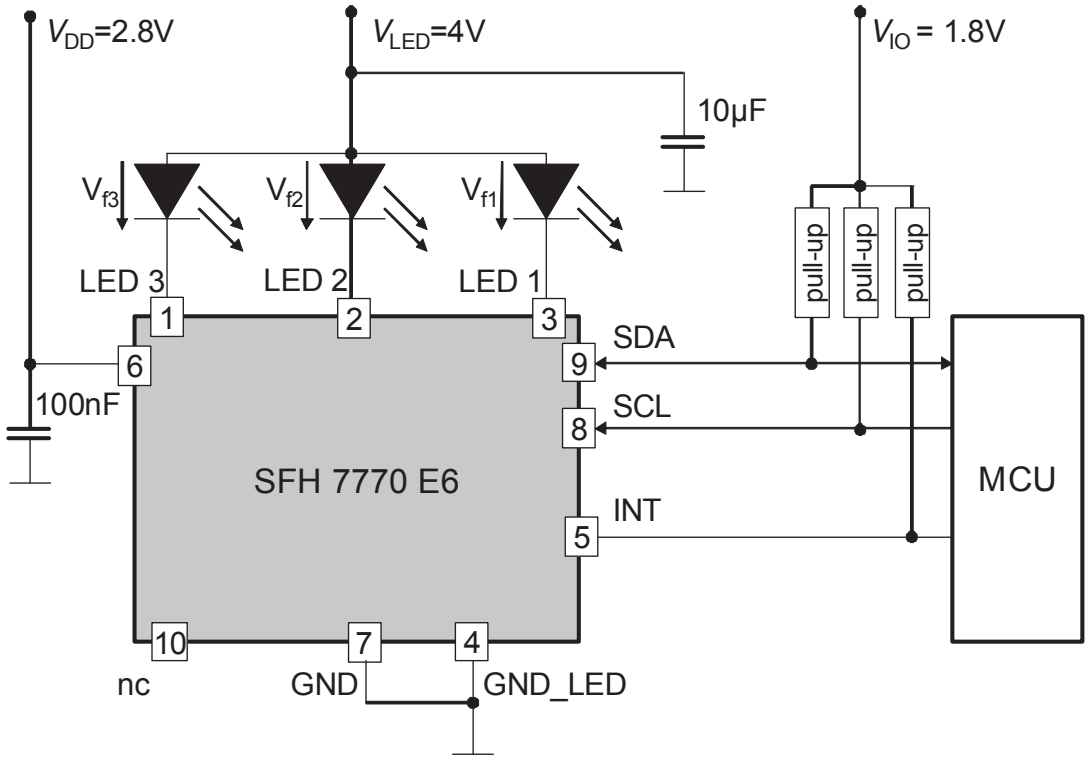
Application diagram and basic informations



- **The inductivity of the wire from the LED pin (1,2 or 3) to the cathode of the LED needs to be <20nH at If=200mA (e.g. max 2 – 3cm length of a wire).** The cable length may be increased for lower currents inversely proportional to forward current: cable length ~ 1/forward current (e.g. max 8 - 12cm at If=50mA).
- Proposed size for the pull-up resistor is 560 Ohm

- Short evaluation program

Adress	Command	Action
0x80	Write 03	Ambient Light Sensor in FREE-RUNNING mode
0x81	Write 03	Proximity Sensor in FREE-RUNNING mode
Wait 110 ms		
0x8C	Read data	read LSByte data from ambient light measurement
0x8D	Read data	read MSByte data from ambient light measurement
0x8F	Read data	read data from proximity measurement LED 1

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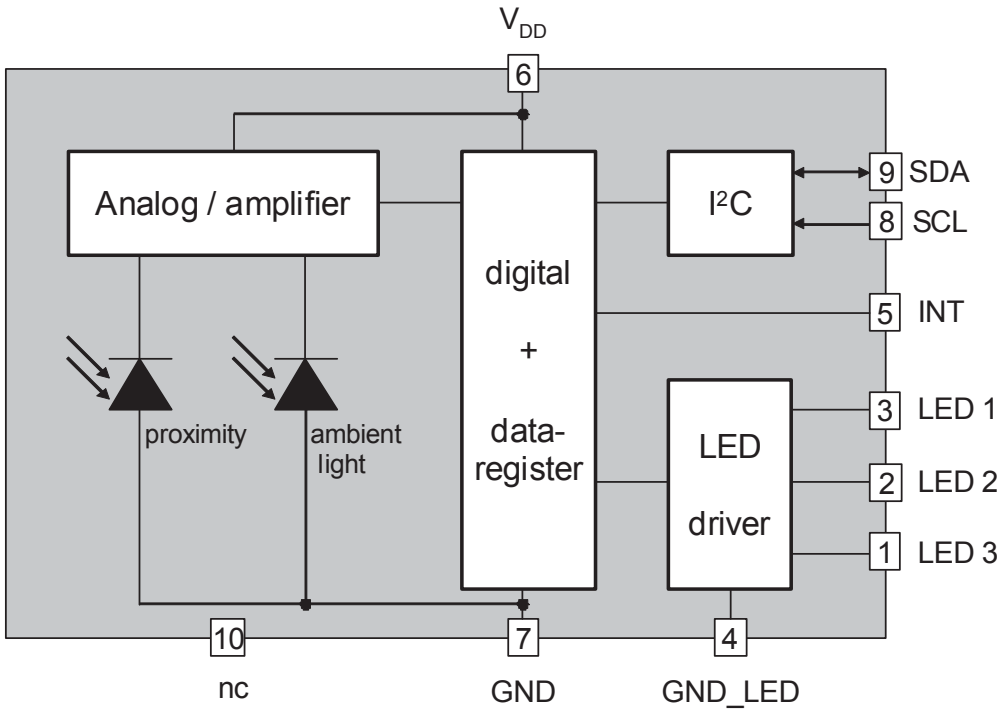
I²C interface

- 1.8V IO-logic level for SDA and SCL
- I/O-pins are open drain type and logic high level is set with external pull-up resistor
- SFH 7770 E6 operates always as slave, address is 0x38.
- Designed for the I²C-modes: Standard (100kHz), Fast (400kHz) and High Speed (3.4MHz)
- Combined format (see I²C Bus specification UM10204 from NXP) for data reading
- Block READ and WRITE modes are available. In these modes several registers can be read or written during single I²C traffic period. The register values are provided in a cyclic manner until master sends the stop condition. E.g. if master uses block read and starts from register 0x8C, the slave returns following register values: 0x8C, 0x8D, 0x8E, 0x8F, 0x90, 0x91, 0x92, 0x93, 0x94 and so on until the master sends stop condition.
- Interrupt pin (INT): open-drain output (like SDA and SCL)



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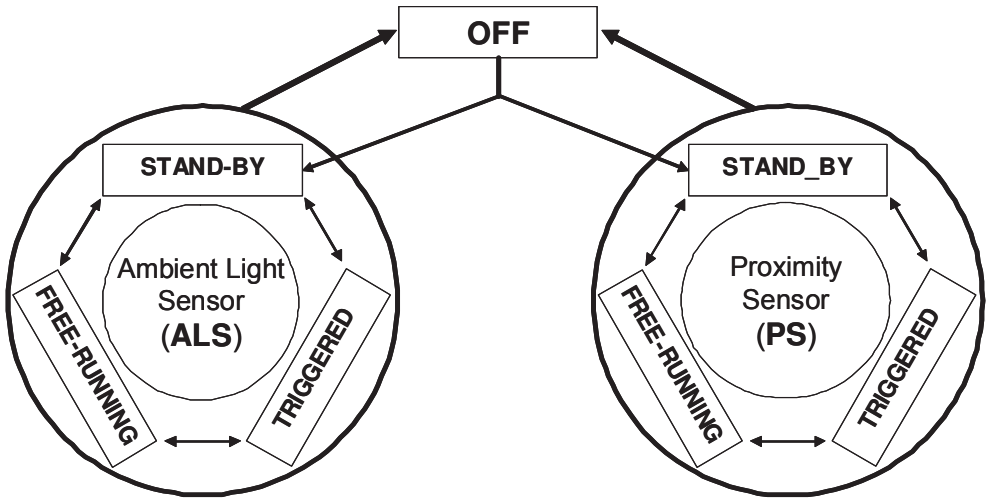
Measurement modes

OFF	I_{DD} is below 2µA and the device is inactive. Other units may use the I²C bus without any restrections; I/O pins and INT are in a high Z state. There is no sink current through the LEDs.
STAND-BY	This is the initial mode after power-up. I_{DD} is below 5µA. No measurement is performed. Device can be activated by I²C bus communication. Data registers can be read and written. The data will be stored in the registers when the device goes from TRIGGERED or FREE-RUNNING to STAND-BY.
TRIGGERED	Every measurement is separately initiated by MCU. This mode can be used for Ambient Light Sensor and Proximity Sensor. Measurement data are available in the registers after a defined delay time.
FREE-RUNNING	Measurements are triggered internally by SFH7770 E6. This mode can also be used for Ambient Light Sensor and Proximity Sensor. Measurement repetition rate and current through the LEDs are defined by the MCU. Measurement results can be read from the data register, the status from the interrupt register.



If V_{DD} exceeds the threshold-voltage, the sensor will switch from OFF to STAND-BY mode. As shown in the transition diagram above it is possible to switch between all modes without any restriction. The transition time between modes (t_{trans}) is < 10ms. The delay time between STAND-BY and start of measurement is max. 10ms for the Ambient Light Sensor.

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Maximum limits

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Storage temperature	T_{stg}	– 40		+ 85	°C
Supply voltage (between V_{DD} and GND)	V_{DD}	- 0.3		+ 4.5	V
Maximum Voltage of SDA, SCL and INT to GND	V_{dig}	- 0.3		+ 3.6	V
Maximum Voltage of LED1 ... LED3 to GND_LED	V_{LED}	- 0.3		+ 5.5	V
Maximum Voltage between GND and GND_LED	V_{GND}	-500		+500	mV
Electrostatic discharge - Human Body Model (according to ANSI/ESDA/JEDEC JS-001-2011; Class2)	ESD	2			kV

Operating conditions

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Operation temperature	T_{op}	- 20		+ 85	°C
Supply Voltage	V_{DD}	2.3		3.1	V
Ripple on Supply Voltage (V_{DD} = 2.35 - 3.05V, DC ... 100MHz)	$V_{DD,rip}$			10	mV
Voltage for I/O (SDA, SCL, INT)[1)]	V_{IO}	1.6		2.0	V
extended Voltage range for I/O (SDA, SCL, INT)[2)]	$V_{IO,ext}$	1.6		3.1	V
Supply Voltage LED	V_{LED}	2.3		4.25	V
Ripple V_{LED} DC... 30kHz 30kHz ... 100MHz	$V_{LED,rip}$			500 200	mV mV

1) The limits for the logic levels of SCL and SDA pins are in accordance with the I²C bus specification from NXP (UM10204 „I²C bus specification and user manual“, Rev. 03 - 19 June 2007). The same limits are valid for the logic levels of the interrupt pin (INT): the maximum level for logic „LOW“ level is 30% of the I/O voltage V_{IO}, the minimum level for logic „HIGH“ level is 70% of the I/O voltage V_{IO}.

2) Extended voltage range for I²C bus communication is only valid for standard- and fast-mode. Input levels are internally referenced to 1.8V. So „LOW“ level threshold is 30% of 1.8V and „HIGH“ level threshold is 70% of 1.8V regardless of the external I/O voltage V_{IO}. Operating at V_{IO}>2.0V can lead to minor timing violations to the I²C bus specification from NXP concerning the minimum/maximum hold time requirement.

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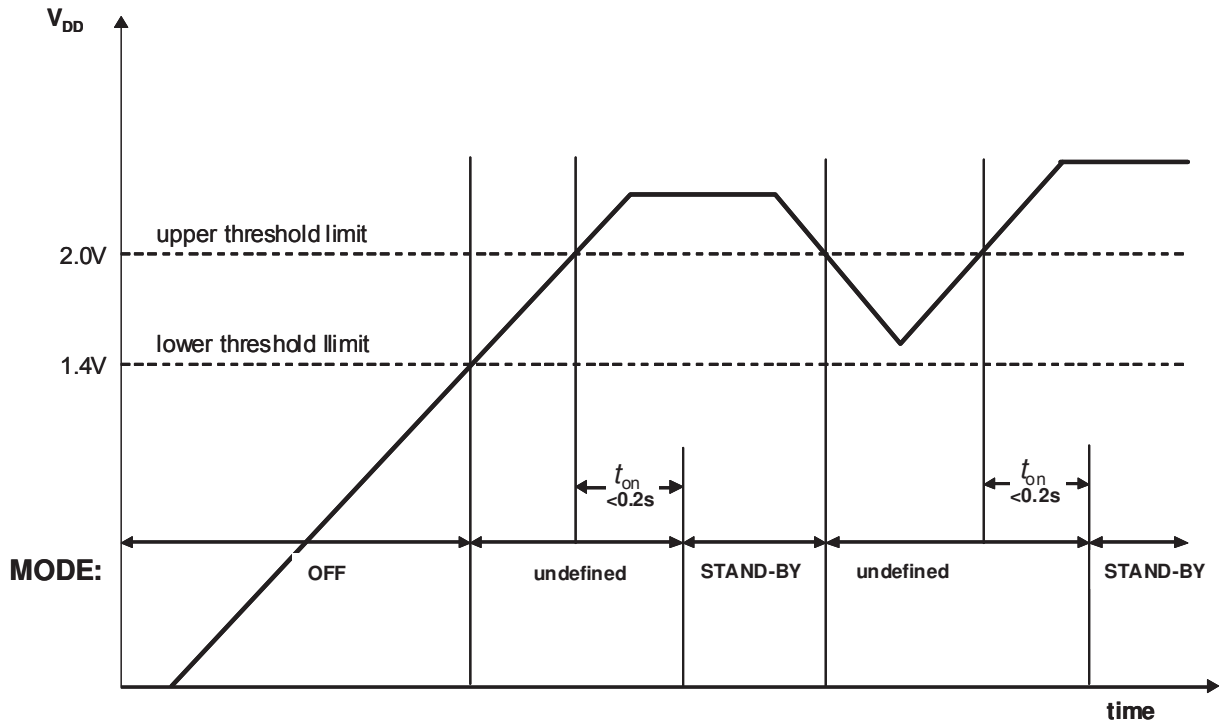
Characteristics (Ta = 25℃)

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
General					
Conditions for OFF mode [1]	$V_{DD,off}$			1.4	V
On-time (from OFF to STAND-BY) [1]	t_{on}			0.2	s
Threshold level for STAND-BY mode [1]	$V_{DD,on}$	2.0			V
Transition time between modes (STAND-BY ...TRIGGERED ...FREE-RUNNING)	t_{trans}			10	ms
STAND-BY mode current consumption	$I_{DD,stby}$			5	µA
OFF mode current consumption	$I_{DD,off}$			2	µA

[1] **Start-up sequence**



The threshold limit where the device switches from OFF to STAND-BY is between V_{DD} =1.4V and V_{DD} =2.0V. Within 0.2s after exceeding the threshold voltage the device will switch from OFF to STAND-BY mode.

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Characteristics (Ta = 25℃)

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Proximity Sensor (PS)					
Wavelength of max. sensitivity	$\lambda_{S,max}$		850		nm
Sensitivity range, λ = 850nm [2)]	E_e		10 ... 2000		µW/cm²
Sensor signal (logarithmic) [2)]			0 ... 180		counts
Measurement accuracy for irradiance Ee, λ=850nm at Ee=500µW/cm²		- 6		+ 6	dB
LED pulse current, programmable, (only when V_{LED} - $V_{f1, f2, f3}$ > 0.4V)[1)]	$I_{LED,PP}$	5		200	mA
Accuracy of LED pulse current	$\Delta I_{LED,PP}$	-20		+20	%
Mean current consumption, FREE-RUNNING (one LED „ON“, If=100mA, t_{rep} = 100ms)	I_{act}			300	µA
Modulation frequency of LED current	f_{mod}		667		kHz
Repeat frequency in FREE-RUNNING mode (programmable)	t_{rep}		10 ... 2000		ms
Length of a single LED burst (programmable)	t_{burst}		750		µs
Update of register data after MCU request	t		10		ms
Sunlight suppression		50			klx

[1)] DC-offset of 0.5mA has to be added to LED current consumption during LED burst

[2)] Output signal of the Proximity Sensor

The sensitivity range of the Proximity Sensor is typ. 10 µW/cm² to 2000 µW/cm² . Within this range, the data in the SFH 7770 E6 output register are available in an approximately logarithmic scale. The advantage of the logarithmic scale is the possibility to cover a large range of distance without changing the sensitivity settings of the sensor.

When the irradiance is below 10 µW/cm², the PS output signal exhibits noise which is typically below 40 output counts (see the dashed line in the graph below).

For irradiance higher than typ. 10µW/cm², the PS output signal increases monotonically.

The proximity signal is converted to a 8 bit signal.

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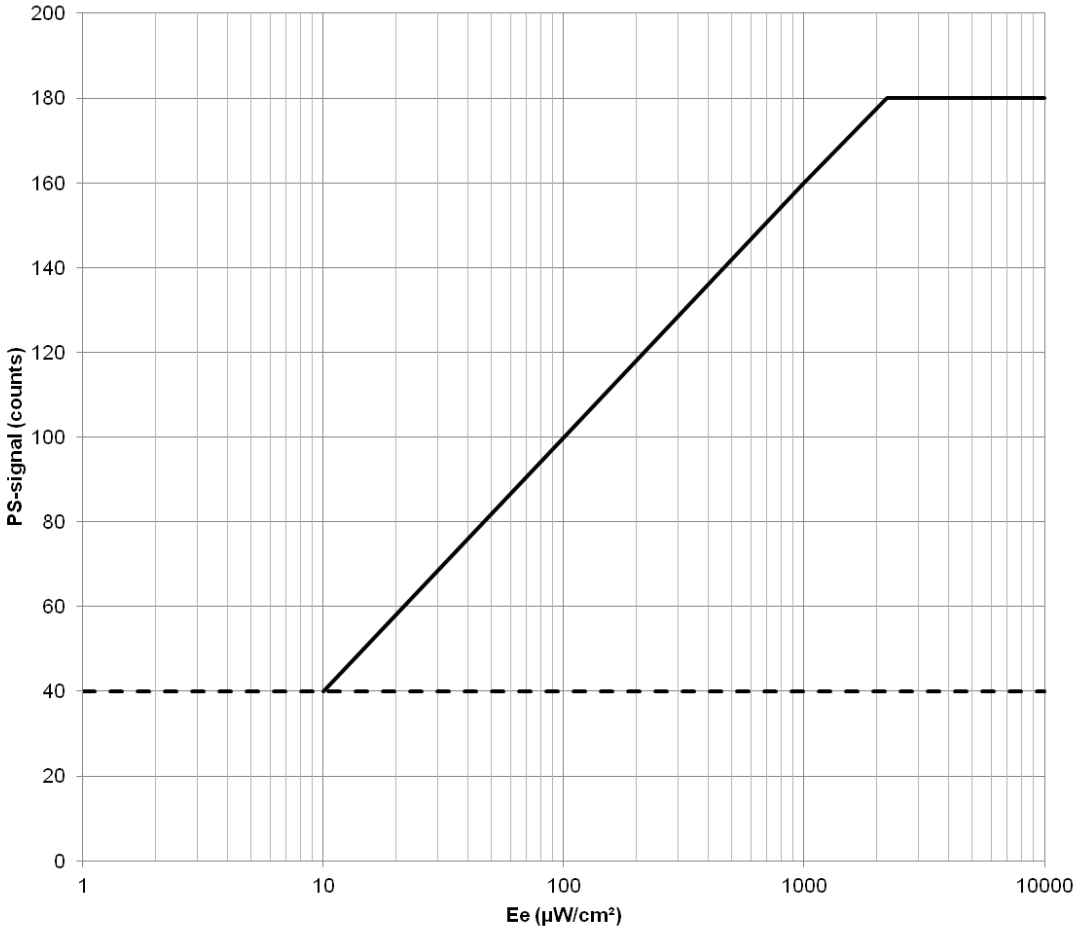

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Characteristics (Ta = 25℃)

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Ambient Light Sensor (ALS)					
Wavelength of max. sensitivity	$\lambda_{S\,max}$		555		nm
Spectral range of sensitivity (10% of S_{max})	$\lambda_{S10\%}$		480-660		nm
Measurement range, programmable		0.03		65000	counts
Maximum Resolution of the digital output signal (Range: 0.03lx ... 650lx at 1000ms integration time) [1]	*Out*		0.01		lx/count
Deviation from linear output characteristics [2] X = 10 - 6500lx X = 1 - 10lx X = 0.3 - 1lx	f_{lin}		 ±5 ±10 ±33		%
Temperature coefficient for E_V measurement 0℃ ... 50℃ -15℃ ... 70℃	T_{cEv}	 - 0.20 - 0.25		 + 0.20 + 0.25	 %/K %/K
Update of register data after MCU request	*t*			100	ms
Measurement repetition rate in FREE-RUNNING mode, programmable	t_{rep}		100 ... 2000		ms
Mean current consumption in FREE-RUNNING mode, t_{rep} = 500ms	I_{act}			200	µA
Current consumption in STAND-BY mode	I_{stby}			5	µA
Error by Flicker noise (caused by bulbs or fluorescent lamps) (f = 50 or 60Hz, 100% modulation)		-5		+5	%

[1] The absolute resolution range of the ALS depends on the integration time. This can be set in register 0x26. Default value is 100ms resulting in a resolution range of 0.3 lx ... 6500 lx. To access register 0x26, register 0x20 must first be set to 0x01. After changing the integration time it is recomended to set register 0x20 back to 0x00. For a detailed description please see **page 11**.

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[2] The deviation of the linear output characteristic is referenced to 1000lx and follows the formula:

$$f_{lin} = \left(\frac{Y_X}{Y_{1000lx}} \times \frac{1000lx}{X} - 1 \right) \times 100\%$$

X: sensor illumination level in lux
Y_X: sensor output / measurement value at illumination level X
Y_{1000lX}: sensor output / measurement value at illumination level 1000lx

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I2C-Address

The SFH7770 E6 has a 7-bit I²C address: **0x38**

Integration Time access register

Note: After setting bit 0 there must be a stop condition to confirm writing.

R/W-Register 0x20								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used							
default	**0000000**							**0 not accessible**
								0 not accessible
								1 accessible

Ambient light sensor Integration Time

Note: Register 0x26 is only accessible if access-bit 0 of register 0x20 is set to ’1’. Integration time can then be changed.

It is recommended to set access-bit 0 of the Integration Time Access register afterwards back to ’0’.

When reading or writing in block-read/-write mode, it is recomended to start at register 0x26 and stop at register 0x27, as there are other registers accessible which are not intended for user access. Afterwards set the access bit of register 0x20 back to ’0’.

Note that the absolut ambient light sensor range depends on the integration time. I.e. default setting range is 0.3 lx to 6.5 klx with resolution of 0.1 lx per count, whereas 1000 ms results in a range of 0.03lx to 650 lx with 0.01 lx resolution per count.

R/W-Register 0x26								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used					**ALS integration time (typical range, resolution)**		
default	**00000**					**000 100 ms**		**(range: 0.3lx ... 6.5klx, resolution: 0.1lx/count)**
						000 100 ms		(range: 0.3lx ... 6.5klx, resolution: 0.1lx/count)
						001 200 ms		(range: 0.15x ... 3.2klx, resolution: 0.05lx/count)
						010 500 ms		(range: 0.06lx ... 1.3klx, resolution: 0.02lx/count)
						011 1000 ms		(range: 0.03lx ... 650lx, resolution: 0.01lx/count)
						100 10 ms		(range: 3lx ... 65klx, resolution: 1lx/count)
						101 20 ms		(range: 1.5lx ... 32klx, resolution: 0.5lx/count)
						110 50 ms		(range: 0.6lx ... 13klx, resolution: 0.2lx/count)
						111 50 ms		(range: 0.6lx ... 13klx, resolution: 0.2lx/count)

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Proximity sensor Integration Time

Note: Register 0x27 is only accessible if access-bit 0 of register 0x20 is set to ’1’. Integration time can then be changed. It is recommended to set access-bit 0 of the Integration Time Access register afterwards back to ’0’. When reading or writing in block-read/-write mode, it is recomended to start at register 0x26 and stop at register 0x27, as there are other registers accessible which are not intended for user access. Afterwards set the access bit of register 0x20 back to ’0’.

Note that the PS Integration Time sets the absolute PS signal count. I.e. an integration time of 1000 us delivers a signal count which is around 60 counts higher compared to an integration time of 100 us. A factor of 10 in signal level (resp. integration time) corresponds to around an increase of 60 counts (pseudo-logarithmic relationship).

R/W-Register 0x27								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used					**PS integration time**		
default	**00000**					**100 750 us**		
						000 100 us		
						001 200 us		
						010 300 us		
						011 500 us		
						100 750 us		
						101 1000 us		
						110 1500 us		
						111 2500 us		

Software reset and control of the Ambient Light Sensor

R/W-Register 0x80								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used					**complete SW reset**	**mode of Ambient Light Sensor**	
default	**00000**					**0**	**00 STAND-BY**	
						1 SW reset	00 STAND-BY	
							01 STAND-BY	
							10 TRIGGERED (by MCU)	
							11 FREE-RUNNING (internally triggered)	

SW reset (Bit 3 = ’1’) sets all registers to default (same as POWER UP). Bit 3 is set back to ’0’ by FH automatically.

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Control of the Proximity Sensor

R/W-Register 0x81								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used						**mode of Proximity Sensor**	
default	**XXXXXX**						**00 STAND-BY**	
							00 STAND-BY	
							01 STAND-BY	
							10 TRIGGERED by MCU	
							11 FREE-RUNNING (internally triggered)	

Emitter current setting

R/W-Register 0x82								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	activation of LEDs		**setting LED2 pulse current**			**setting LED1 pulse current**		
default	**00**		**011 50 mA**			**011 50 mA**		
	00 LED1 active		000 5 mA			000 5 mA		
	01 LED1 and 2 active		001 10 mA			001 10 mA		
	10 LED1 and 3 active		010 20 mA			010 20 mA		
	11 all LEDs active		011 50 mA			011 50 mA		
			100 100 mA			100 100 mA		
			101 150 mA			101 150 mA		
			110 200 mA			110 200 mA		

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Emitter current setting

R/W-Register 0x83								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used					**setting LED3 pulse current**		
default	**XXXXX**					**011**	**50 mA**	
						000	5 mA	
						001	10 mA	
						010	20 mA	
						011	50 mA	
						100	100 mA	
						101	150 mA	
						110	200 mA	

MCU-triggered measurement (for Ambient Light Sensor and Proximity Sensor)

R/W-Register 0x84								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used						**trigger ambient light**	**trigger proximity**
default	**XXXXXX**						1	1

If „1“ is set, a new measurement will start after the I^2C stop commmand from the MCU. As soon as the measurement is finished, the corresponding bit of the register will be set to „0“ automatically by the SFH7770 E6.

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Proximity measurement: time interval settings (repetition time) for FREE-RUNNING mode

R/W-Register 0x85								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used				**time-interval**			
default	**XXXX**				**0101 100 ms**			
					0000 10 ms			
					0001 20 ms			
					0010 30 ms			
					0011 50 ms			
					0100 70 ms			
					0101 100 ms			
					0110 200 ms			
					0111 500 ms			
					1000 1000 ms			
					1001 2000 ms			

Ambient light measurement: time interval settings (repetition time) for FREE-RUNNING mode

R/W-Register 0x86								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used					**time-interval**		
default	**XXXXX**					**010 500 ms**		
						000 100 ms		
						001 200 ms		
						010 500 ms		
						011 1000 ms		
						100 2000 ms		

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Part number and revision Identification

R-Register 0x8A								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	Part number ID				**Revision ID**			
	1	0	0	1	0	1	1	1

Manufacturer Identification

R-Register 0x8B								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	Manufacturer Identification							
	0	0	0	0	0	0	1	1

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Ambient Light measurement data (0x8C: LSB , 0x8D: MSB)

R-Register 0x8C								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	LSB data							
default	**00000000**							

R-Register 0x8D								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	MSB data							
default	**00000000**							

The result of the Ambient Light Sensor is a 16bit word with MSB and LSB and is stored in two registers.. The binary data can be converted directly to decimal „lx“ values (max. 65535lx). Conversion of counts to „lx“ vlaues depends on the ALS integration time settings (see register 0x26).

Status of measurement data for Ambient Light Sensor (ALS) and Proximity Sensor (PS)

R-Register 0x8E								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	ALS threshold	**ALS data**	**PS LED3 threshold**	**PS LED3 data**	**PS LED2 threshold**	**PS LED2 data**	**PS LED1 threshold**	**PS LED1 data**
default	**00000000**							

When the measurement data are available in the register, the corresponding status bit (bit 6 for ambient-light; bit 4, 2 and 0 for proximity) in register 0x8E is set to ’1’. When the measurement data have been read by the MCU, the status bit is automatically set back to ’0’.

Bit 7 is set ’1’ when the measured ALS value is outside the threshold level settings (register 0x96... 0x99). Bit 1, 3 and 5 are set when the measured PS value is above the threshold level (register 0x93... 0x95).

The status of register 0x8E will always be updated when a new measurement is available.

Proximity measurement data (LED 1 , 8bit, logarithmic)

R-Register 0x8F								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	data							
default	**00000000**							

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Proximity measurement data (LED 2 , 8bit, logarithmic)

R-Register 0x90								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	data							
default	**00000000**							

Proximity measurement data (LED 3 , 8bit, logarithmic)

R-Register 0x91								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	data							
default	**00000000**							

Interrupt register / INT output.

R/W-Register 0x92								
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
	not used	**Interrupt trigger source**		**not used**	**Output mode**	**Output polarity**	**Interrupt mode (triggered by..)**	
R/W	**not used**	**R only**		**not used**	**R/W**	**R/W**	**R/W**	
default	**X**	**00**		**X**	**1**	**0**	**00**	
		00 ALS			0 latched	0 active L	00 Z state	
		01 PS (LED 1)			1 not latched	1 active H	01 only PS	
		10 PS (LED 2)					10 only ALS	
		11 PS (LED 3)					11 PS and ALS	

In Bit6/5 the source which triggers the interrupt is noted. Data from the status register (0x8E) are used. In latched mode (set by bit3) this remains unchanged until the Interrupt register has been read by the MCU, afterewards it is set to ’0’ automatically. In unlatched mode it is updated after every measurement. The output polarity (pin 5 of the SFH7770 E6) can be changed by bit 2.
The interrupt can be triggered by the Ambient Light Sensor and / or by the Proximity Sensor; this can be set by the Interrupt mode (bit 1/bit 0). When bit 1 and bit 0 are set to ’0’, the INT output is in the high Z state (high impedance).

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Threshold level for Proximity Sensor (LED 1)

RW-Register 0x93								
Bit	7	6	5	4	3	2	1	0
		data						
default	11111111							
	threshold value							

Threshold level for Proximity Sensor (LED 2)

RW-Register 0x94								
Bit	7	6	5	4	3	2	1	0
		data						
default	11111111							
	threshold value							

Threshold level for Proximity Sensor (LED 3)

RW-Register 0x95								
Bit	7	6	5	4	3	2	1	0
		data						
default	11111111							
	threshold value							

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Upper threshold level for Ambient Light Sensor (LSB)

RW-Register 0x96								
Bit	7	6	5	4	3	2	1	0
	LSB data (upper threshold)							
default	11111111							

Upper threshold level for Ambient Light Sensor (MSB)

RW-Register 0x97								
Bit	7	6	5	4	3	2	1	0
	MSB data (upper threshold)							
default	11111111							

Lower threshold level for Ambient Light Sensor (LSB)

RW-Register 0x98								
Bit	7	6	5	4	3	2	1	0
	LSB data (lower threshold)							
default	00000000							

Lower threshold level for Ambient Light Sensor (MSB)

RW-Register 0x99								
Bit	7	6	5	4	3	2	1	0
	MSB data (lower threshold)							
default	00000000							

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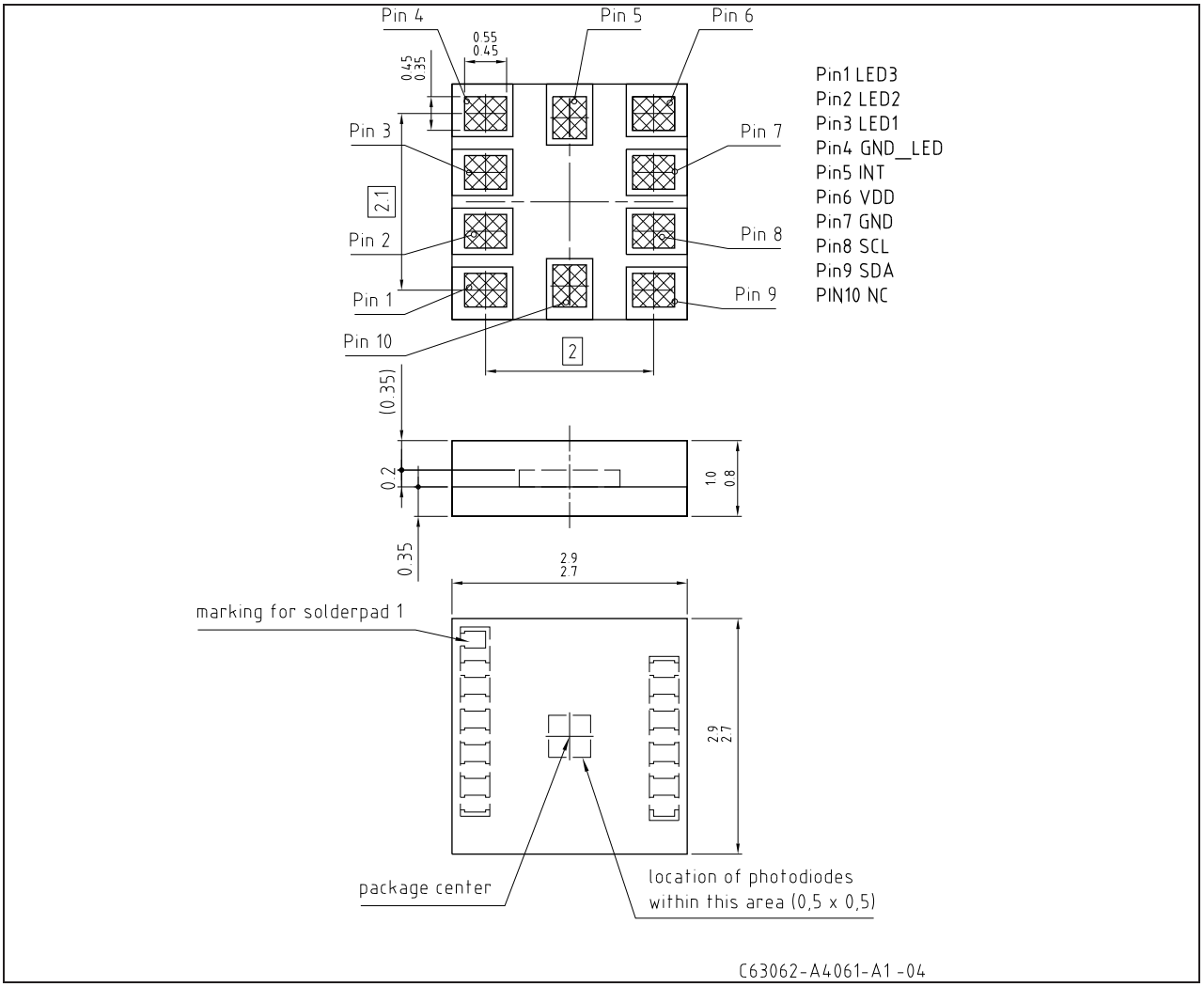
Package Outlines



Maße in mm/ Dimensions in mm

Pin 1 identifier: one additional yellow pad in the edge, visible in front view

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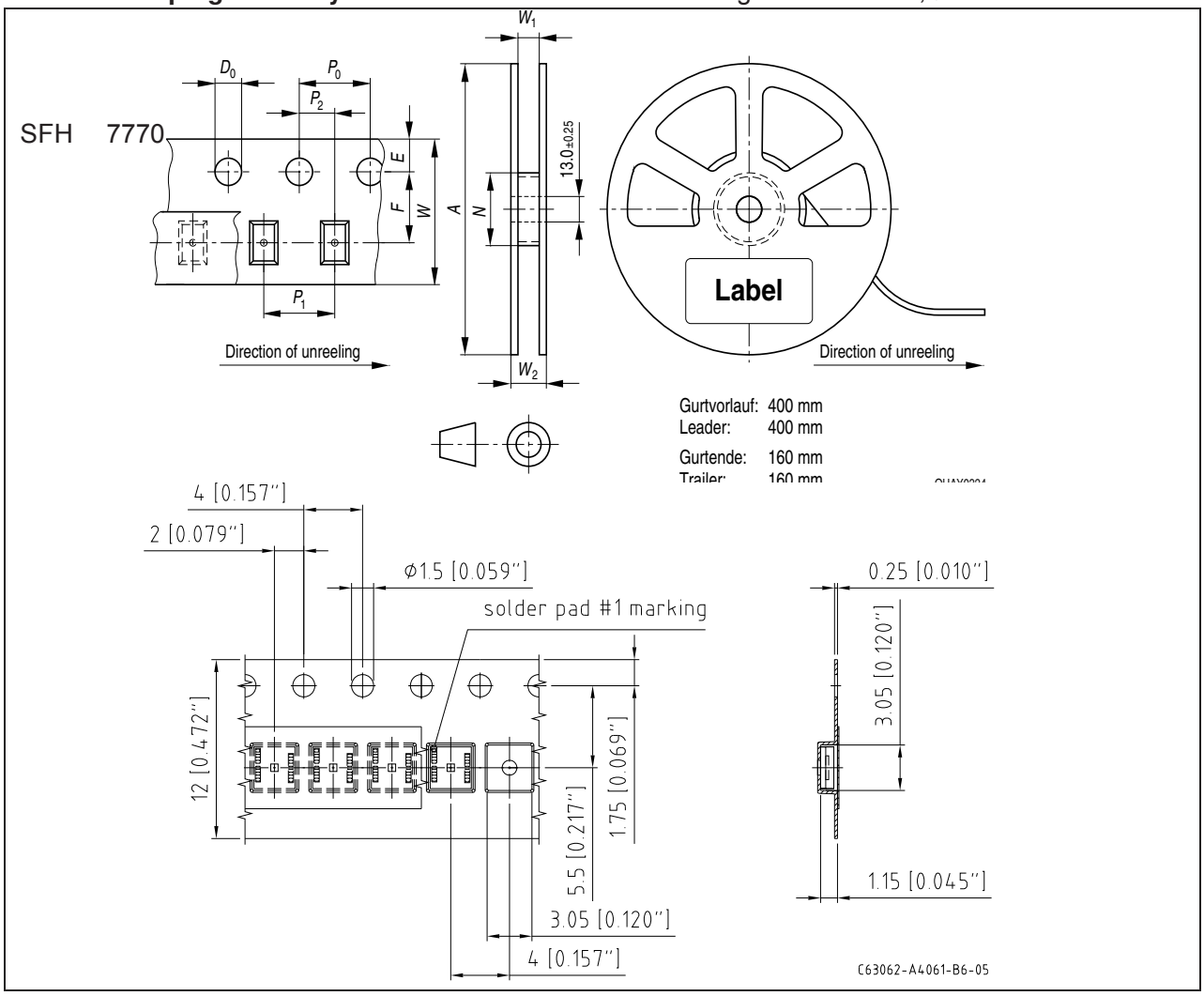
Gurtung / Polarität und Lage
Method of Taping / Polarity and Orientation

Verpackungseinheit 3000/Rolle, ø180 mm
Packing unit 3000/reel, ø180 mm



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

Tape dimensions in mm (inch)

W	P_0	P_1	P_2	D_0	E	F
8 +0.3 / -0.1	4 ± 0.1 (0.157 ± 0.004)	4 ± 0.1 (0.157 ± 0.004)	2 ± 0.05 (0.079 ± 0.002)	1.5 + 0.1 (0.059 + 0.004)	1.75 ± 0.1 (0.069 ± 0.004)	3.5 ± 0.05 (0.138 ± 0.002)

Reel dimensions in mm (inch)

A	W	N_{min}	W_1	$W_{2\ max}$
180 (7)	8 (0.315)	60 (2.362)	8.4 + 2 (0.331 + 0.079)	14.4 (0.567)

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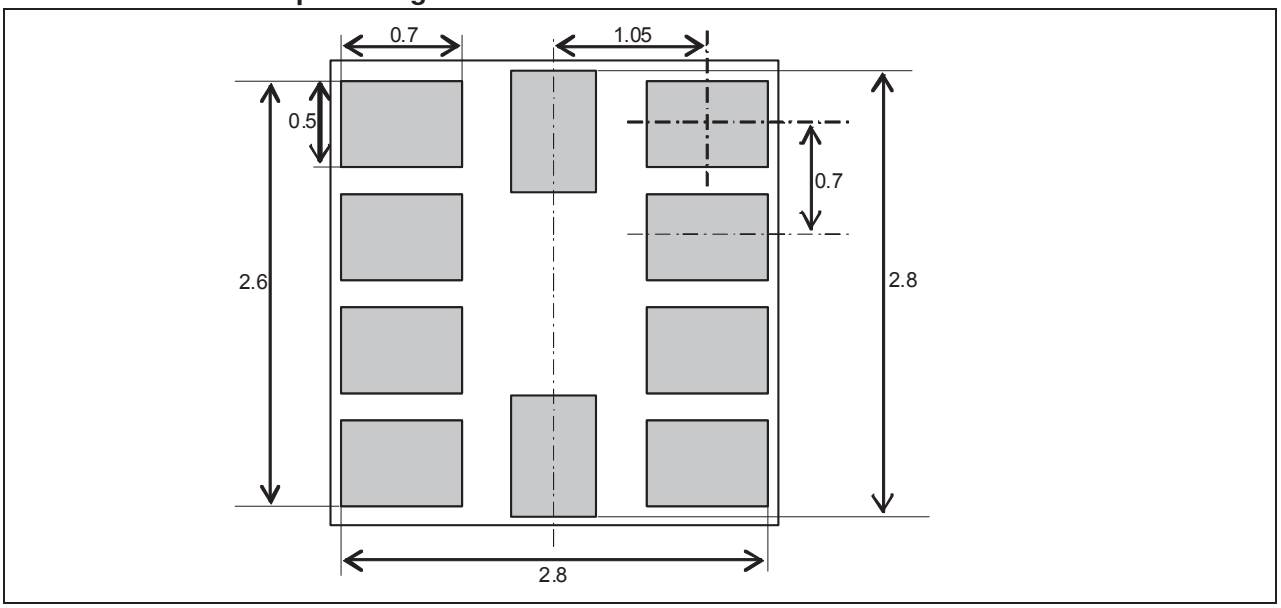
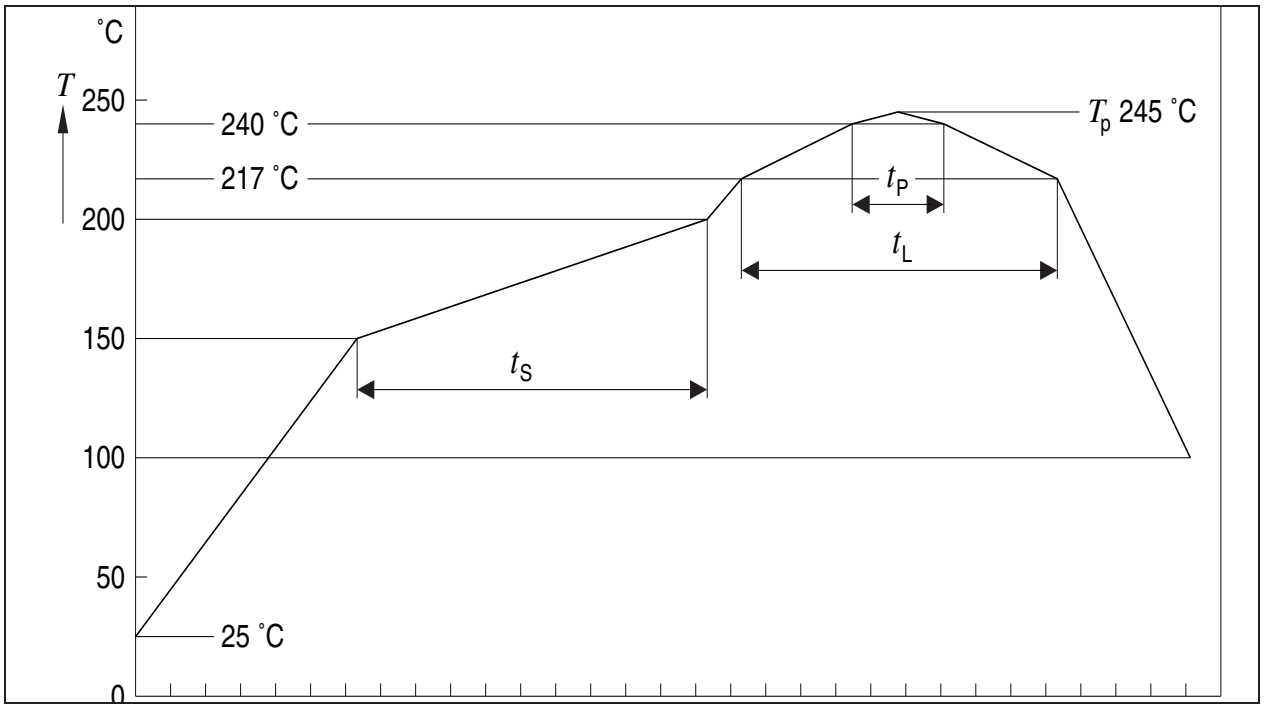
Recommended solderpad design



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 3
Preconditioning acc. to JEDEC Level 3
(nach J-STD-020-D.01)
(acc. to J-STD-020-D.01)



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	Pb-Free (SnAgCu) Assembly	
Profile Feature	**Recommendation**	**Max. Ratings**
Ramp-up Rate to Preheat*) 25℃ to 150℃	2℃ / sec	3℃ / sec
Time t_s from T_{Smin} to T_{Smax} (150℃ to 200℃	100s	min. 60sec max. 120sec
Ramp-up Rate to Peak*) T_{Smax} to T_P	2℃ / sec	3℃ / sec
Liquidus Temperture T_L	217℃	
Time t_L above T_L	80sec	max. 100sec
Peak Temperature T_P	245℃	max. 260℃
Time t_P within 5℃ of the specified peak temperature T_P - 5K	20sec	min. 10sec max. 30sec
Ramp-down Rate* T_P to 100℃	3℃ / sec	6℃ / sec maximum
Time 25℃ to Peak temperature		max. 8 min.

All temperatures refer to the center of the package, measured on the top of the component
* slope calculation $\Delta T/\Delta t$: Δt max. 5 sec; fulfillment for the whole T-range

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Components used in life-support devices or systems must be expressly authorized for such purpose! Critical components [1] , may only be used in life-support devices or systems [2] with the express written approval of OSRAM OS.

[1] A critical component is a component usedin a life-support device or system whose failure can reasonably be expected to cause the failure of that life-support device or system, or to affect its safety or effectiveness of that device or system.

[2] Life support devices or systems are intended (a) to be implanted in the human body, or (b) to support and/or maintain and sustain human life. If they fail, it is reasonable to assume that the health of the user may be endangered.

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