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OSRAM Opto Semiconductors, Inc. SFH 7770 E6

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

SFH 7770 E6

DRAFT - This design is for reference only. Subject to change without notice.

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
- I²C 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 mm³

Anwendungen

- Mobiltelefone
- PDA's und Notebooks
- Kameras

2012-08-23

Consumer Produkte

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
- I²C 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 mm³

Applications

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

51	Bestellnummer Ordering Code
SFH 7770 E6	Q65111A3146

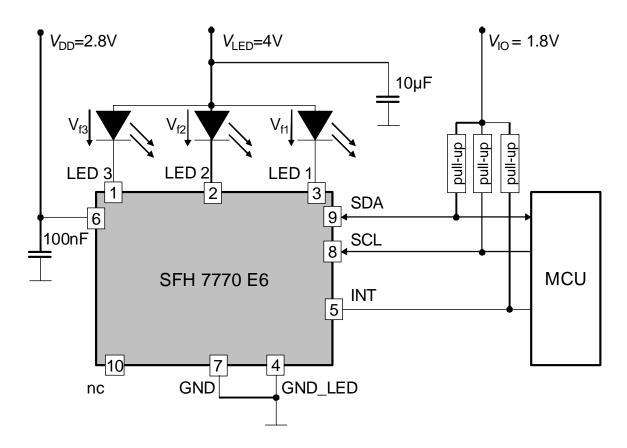




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SFH 7770 E6

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 lf=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 lf=50mA).
- Proposed size for the pull-up resistor is 560 Ohm
- Short evaluation program

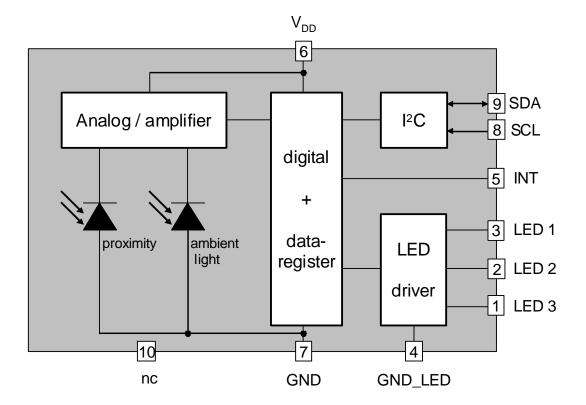
Adress	Command	Action
0x80	Write 03	Ambient Light Sensor in FREE-RUNNING mode
0x81	Write 03	Proximity Sensor in FREE-RUNNING mode
Wait 110 ms		
0x8C	Read data	read LSByte data from ambient light measurement
0x8D	Read data	read MSByte data from ambient light measurement
0x8F	Read data	read data from proximity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





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)

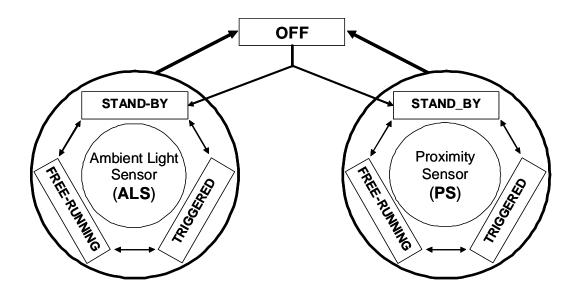




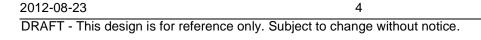


Measurement modes

OFF	I_{DD} is below 2µA and the device is inactive. Other units may use the I ² C 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 I ² C 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.







Maximum limits

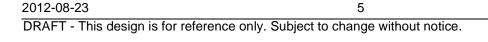
Parameter	Symbol		Unit		
		min.	typ.	max.	
Storage temperature	T _{stg}	- 40		+ 85	°C
Supply voltage (between $V_{\rm DD}$ and GND)	V_{DD}	- 0.3		+ 4.5	V
Maximum Voltage of SDA, SCL and INT to GND	V_{dig}	- 0.3		+ 3.6	V
Maximum Voltage of LED1 LED3 to GND_LED	V_{LED}	- 0.3		+ 5.5	V
Maximum Voltage between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

Operating conditions

Parameter	Symbol		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)	$V_{\rm DD,rip}$			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.







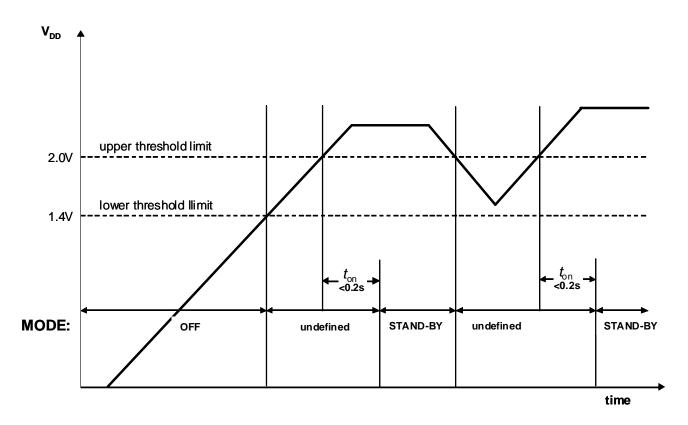
Characteristics (Ta = 25°)

Parameter	Symbol		Value		Unit
		min.	typ.	max.	

General

Conditions for OFF mode ¹⁾	$V_{\rm DD,off}$		1.4	V
On-time (from OFF to STAND-BY) ¹⁾	t _{on}		0.2	S
Threshold level for STAND-BY mode ¹⁾	$V_{\rm DD,on}$	2.0		V
Transition time between modes (STAND-BYTRIGGEREDFREE-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.





Characteristics (Ta = 25° C) Parameter **Symbol** Value Unit min. typ. max. **Proximity Sensor (PS)** $\lambda_{\mathrm{S,max}}$ Wavelength of max. sensitivity 850 nm Sensitivity range, $\lambda = 850$ nm²⁾ E_{e} 10 ... µW/cm² 2000 Sensor signal (logarithmic)²⁾ 0 ... 180 counts Measurement accuracy for irradiance Ee, dB - 6 + 6 λ =850nm at Ee=500 μ W/cm² LED pulse current, programmable, $I_{I.ED,PP}$ 5 200 mΑ (only when V_{LED} - $V_{\text{f1, f2, f3}} > 0.4 \text{V})^{1)}$ -20 Accuracy of LED pulse current +20% $\Delta I_{LED,PP}$ Mean current consumption, FREE-RUNNING 300 μA I_{act} (one LED "ON", If=100mA, t_{rep} = 100ms) Modulation frequency of LED current 667 f_{mod} kHz Repeat frequency in FREE-RUNNING mode 10 ... ms t_{rep} (programmable) 2000 Length of a single LED burst (programmable) 750 μs t_{burst} 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

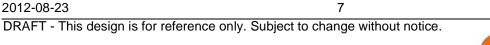
²⁾ Output signal of the Proximity Sensor

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.

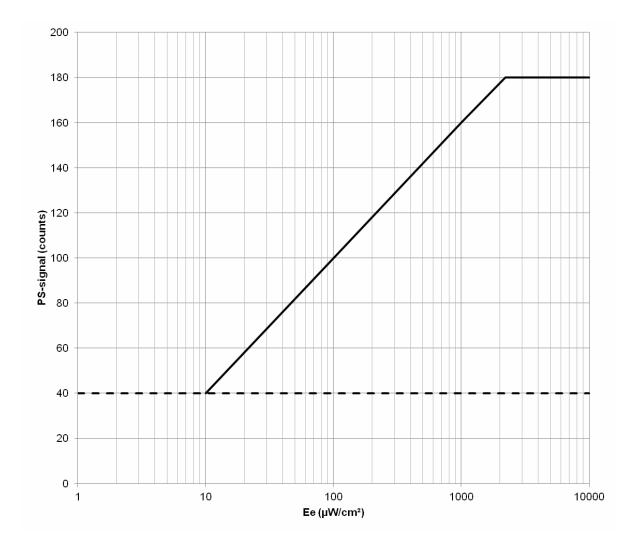






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SFH 7770 E6







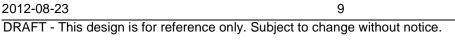
Characteristics (Ta = 25° C)

Parameter	Symbol Value min. typ. max.				
		min.	typ.	max.	

Ambient Light Sensor (ALS)

$\lambda_{ m Smax}$		555		nm
		480-660		nm
	0.03		65000	counts
Out		0.01		lx/count
f _{lin}		±5 ±10 ±33		%
T _{cEv}	- 0.20 - 0.25		+ 0.20 + 0.25	%/K %/K
t			100	ms
t _{rep}		100 2000		ms
I _{act}			200	μA
I _{stby}			5	μA
	-5		+5	%
	$\begin{array}{c c} \lambda_{S10\%} \\ \hline \\ Out \\ \hline \\ f_{lin} \\ \hline \\ T_{cEv} \\ \hline \\ t \\ t_{rep} \\ \hline \end{array}$	$ \begin{array}{c c} \lambda_{S10\%} & & & \\ \hline & & 0.03 \\ \hline Out & & \\ \hline \\ I_{lin} & & \\ \hline \\ T_{cEv} & & \\ - 0.20 \\ - 0.25 \\ \hline \\ t & \\ I_{rep} & \\ \hline \\ I_{act} & \\ \hline \\ I_{stby} & \\ \end{array} $	$\lambda_{S10\%}$ 480-660 0.03 0.01 Out 0.01 f_{lin} ± 5 f_{cEv} -0.20 -0.25 $100 \dots$ t $100 \dots$ I_{act} I I_{stby} I	$\lambda_{S10\%}$ 480-660 0.03 65000 Out 0.01 f_{iin} ± 5 f_{iin} ± 5 T_{cEv} - 0.20 + 0.20 t 100 + 0.25 t 100 2000 I_{rep} 100 200 I_{act} 200 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.







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

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

X: sensor illumination level in lux

Y_x: sensor output / measurement value at illumination level X

 Y_{1000IX} : sensor output / measurement value at illumination level 1000lx





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-Re	R/W-Register 0x20												
Bit	7 6 5 4 3 2 1 0												
	not used												
default	00	00	000)				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 recommended 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	0					
		no	t us	ed			ALS integ	egration time (typical range, resolution)					
default	00	000				000	100 ms	(r	ange: 0.3lx	6.5klx, re	solution: 0.11x/count)		
						000	100 ms	(ra	ange: 0.3lx	. 6.5klx, reso	olution: 0.11x/count)		
						001	200 ms	(range: 0.15x 3.2klx, resolution: 0.05lx/count)					
						010	500 ms	(ra	ange: 0.06lx	1.3klx, res	solution: 0.02lx/count)		
						011	1000 ms	(ra	ange: 0.03lx	650lx, res	olution: 0.011x/count)		
						100	10 ms	(ra	ange: 31x (65klx, resolu	tion: 1lx/count)		
						101	20 ms	(ra	ange: 1.5lx	. 32klx, reso	lution: 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).

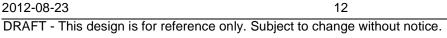
R/W-Reg	ister	' 0x2	27							
Bit	7	6	5	4	3		2		1	0
		not used PS integration til								
default	00	000				100	750 us			
						000	100 us			
						001	200 us			
						010	300 us			
						011	500 us			
						100	750 us			
						101	1000 us			
						110	1500 us			
						111	2500 us			

Software reset and control of the Ambient Light Sensor

R/W-Register 0x80

Bit	7	6	5	4	3	2		1	0				
		no	ot us	ed		complete SW reset	mode of Ambient Light Sensor						
default	000	00000				0	00	00 STAND-BY					
				1 SW reset	00	STAND-BY							
							01	STAND-BY					
						10	TRIGGERED (by I	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.





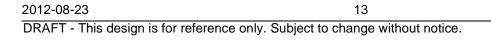


Control of the Proximity Sensor

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

Emitter current setting

R/W-Re	gister 0x82								
Bit	7	6	5	4	3	2	1	0	
	activation	of LEDs	setting LED2 pulse current			setting LED1 pulse current			
default	00		011 5	0 mA		011 5	0 mA		
	00 LED1 a	active	000	5 mA		000	5 mA		
	01 LED1 a	and 2 active	001 1	0 mA		001 1	0 mA		
	10 LED1 a	and 3 active	010 2	0 mA		010 2	0 mA		
	11 all LED	s active	011 5	0 mA		011 5	0 mA		
			100 10	0 mA		100 10	0 mA		
			101 15	0 mA		101 15	0 mA		
			110 20	0 mA		110 20	0 mA		







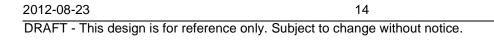
R/W-Re	gister 0x83								
Bit	7	6	5	4	3	2	1	0	
			not used		setting LED3 pulse current				
default	XXXXX					011 5	0 mA		
						000	5 mA		
						001 1	0 mA		
						010 2	0 mA		
						011 5	0 mA		
						100 10	0 mA		
						101 15	0 mA		
	1					110 20	0 mA		

Emitter current setting

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

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

If "1" is set, a new measurement will start after the I^2C stop command 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.







	-					,				
R/W-Re	gister 0x85									
Bit	7	6	5	4	3		2	1	0	
		not u	used				time-iı	nterval		
default	XXXX				0101 100 ms					
					0000	1) ms			
					0001	2) ms			
					0010	3) ms			
					0011	5) ms			
					0100	7) ms			
					0101	10) ms			
					0110	20) ms			
					0111	50) ms			
					1000	100) ms			
					1001	200) ms			

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

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

R/W-Re	R/W-Register 0x86											
Bit	7	7 6 5 4 3 2 1 0						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					





Part number and revision Identification

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

Manufacturer Identification

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





Ambien	Ambient Light measurement data (0x8C: LSB, 0x8D: MSB)											
R-Register 0x8C												
Bit	7	7 6 5 4 3 2 1 0										
	LSB data											
default	0000000											
default	0000000											

R-Register 0x8D												
Bit	7 6 5 4 3 2 1 0											
		MSB data										
default	0000000											

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-Regis	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		0000000									

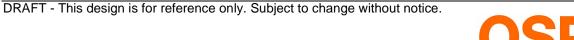
When the measurement data are available in the register, the corresponding status bit (bit 6 for ambient-light; bit 4, 2 and 0 for proximity) in register 0x8E is set to '1'. When the measurement data have been read by the MCU, the status bit is automatically set back to '0'.

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	7 6 5 4 3 2 1 0									
		data									
default		0000000									







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

R-Register 0x90												
Bit	7	7 6 5 4 3 2 1 0										
		data										
default		0000000										

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

R-Register 0x91										
Bit	7 6 5 4 3 2 1 0									
		data								
default		0000000								

Interrupt register / INT output.

R/W-Re	gister (0x92						
Bit	7	6	5	4	3	2	1	0
	not used	Inter trigger	rupt source	not used	Output mode	Output polarity	Interrupt mod (triggered by.	
R/W	not used	Ro	nly	not used	R/W	R/W	R/W	
default	Х	00		X	1	0	00	
		00 ALS			0 latched	0 active L	00 Z stat	e
		01 PS (LE	D 1)		1 not latched	1 active H	01 only F	°S
		10 PS (LE	D 2)				10 only A	LS
		11 PS (LE	D 3)				11 PS ar	d 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).





Threshold level for Proximity Sensor (LED 1)

RW-Register 0x93												
Bit	7	7 6 5 4 3 2 1 0										
		data										
default		1111111										
		threshold value										

Threshold level for Proximity Sensor (LED 2)

RW-Register 0x94											
Bit	7	7 6 5 4 3 2 1 0									
		data									
default		1111111									
		threshold value									

Threshold level for Proximity Sensor (LED 3)

RW-Register 0x95											
Bit	7	7 6 5 4 3 2 1 0									
		data									
default		1111111									
		threshold value									





Upper tl	Upper threshold level for Ambient Light Sensor (LSB)										
RW-Register 0x96											
Bit	7	7 6 5 4 3 2 1 0									
	LSB data (upper threshold)										
default		1111111									

Upper threshold level for Ambient Light Sensor (MSB)

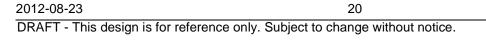
RW-Register 0x97											
Bit	7	6	5	4	3	2	1	0			
		MSB data (upper threshold)									
default		1111111									

Lower threshold level for Ambient Light Sensor (LSB)

RW-Register 0x98												
Bit	7	7 6 5 4 3 2 1 0										
		LSB data (lower threshold)										
default		0000000										

Lower threshold level for Ambient Light Sensor (MSB)

RW-Reg	RW-Register 0x99											
Bit	7	7 6 5 4 3 2 1 0										
		MSB data (lower threshold)										
default		0000000										



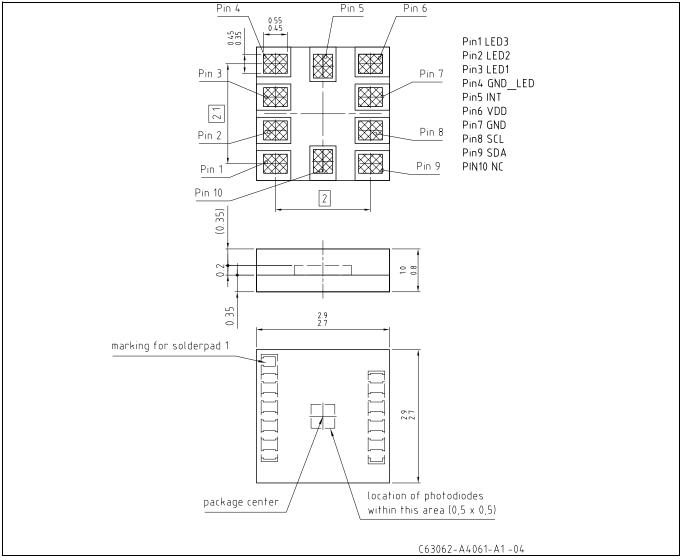




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SFH 7770 E6

Package Outlines



Maße in mm/ Dimensions in mm

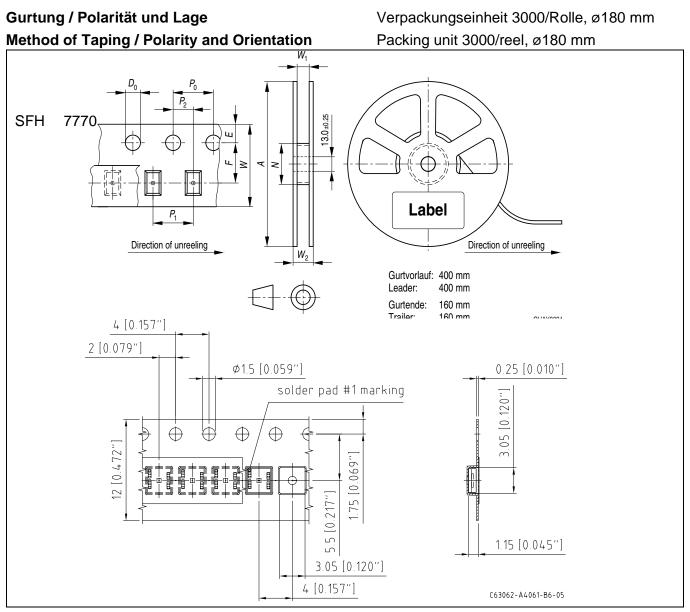
Pin 1 identifier: one additional yellow pad in the edge, visible in front view





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

Tape dimensions in mm (inch)

W	P ₀	<i>P</i> ₁	<i>P</i> ₂	D ₀	E	F
8 +0.3 / -0.1	4 ± 0.1 (0.157 ± 0.004)	4 ± 0.1 (0.157 ± 0.004)	$\begin{array}{c} 2\pm 0.05 \\ (0.079\pm 0.002) \end{array}$			3.5 ± 0.05 (0.138 \pm 0.002)

Reel dimensions in mm (inch)

A	W	$N_{\sf min}$	W ₁	W _{2 max}
180 (7)	8 (0.315)	60 (2.362)	8.4 + 2 (0.331 + 0.079)	14.4 (0.567)

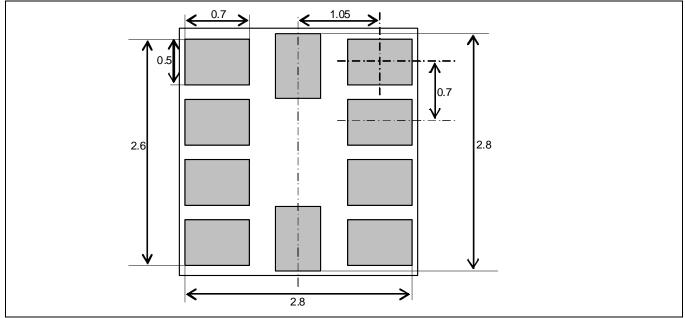
2012-08-23

DRAFT - This design is for reference only. Subject to change without notice.





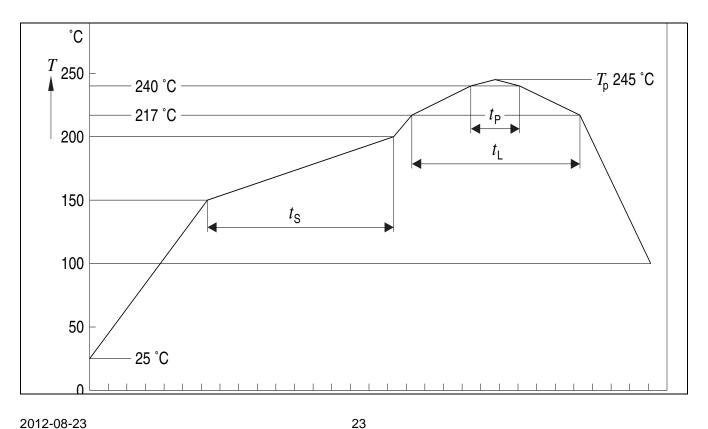
Recommended solderpad design



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)



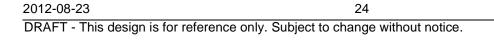




	Pb-Free (SnAgCu) Assembly	
Profile Feature	Recommendation	Max. Ratings
Ramp-up Rate to Preheat ^{*)} 25℃ to 150℃	2°C / sec	3°C / sec
Time t _s from T _{Smin} to T _{Smax} (150℃ to 200℃	100s	min. 60sec max. 120sec
Ramp-up Rate to Peak ^{*)} T _{Smax} to T _P	2°C / sec	3°C / sec
Liquidus Temperture T _L	217℃	
Time t_L above T_L	80sec	max. 100sec
Peak Temperature T _P	245°C	max. 260℃
Time t_P within 5°C of the specified peak temperature T_P - 5K	20sec	min. 10sec max. 30sec
Ramp-down Rate* T _P to 100℃	3℃ / sec	6°C / 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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Please use the recycling operators known to you. We can also help you – get in touch with your nearest sales office. By agreement we will take packing material back, if it is sorted. You must bear the costs of transport. For packing material that is returned to us unsorted or which we are not obliged to accept, we shall have to invoice you for any costs incurred.

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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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