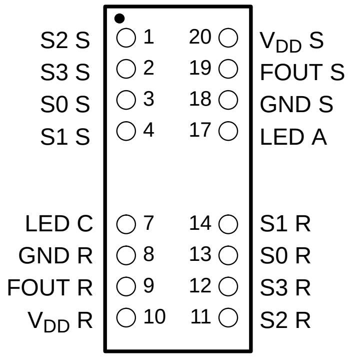
TEXAS
ADVANCED
OPTOELECTRONIC
SOLUTIONS™

TSLM5470, TSLM5550, TSLM5620, TSLM5660, TSLM5880
CHEMICAL-OPTICAL SENSOR PLATFORM FAMILY

SOES033 – OCTOBER 1997

- **Fully Integrated Sensor Includes LED and Photodetectors**
- **EOC230 Light-to-Frequency Converter Photodetectors Provide Outstanding Linearity**
- **Programming Pins Enable Very High Dynamic Range**
- **Operates Down to 3.3 V**
- **Reference Channel for Ambient Noise Cancellation**
- **Molded Plastic Lid With Optical Features Facilitates System Alignment**
- **Excellent for Calorimetric and Absorption and Refractive Index Measurements**
- **Various LED Wavelengths Available**

TSLM5xxx PACKAGE
(TOP VIEW)



Description

Each of these chemical-optical sensor platforms consists of two EOC230 light-to-frequency converter detectors and a single high-efficiency light-emitting diode mounted on a glass/epoxy substrate and encapsulated in an injection-molded plastic lid with integral optical features.

Light from the LED is projected into waveguides (attached separately) by means of the molded optics in the center of the sensor lid. Light passing through the waveguides is directed onto the detectors by means of molded optics at each end of the sensor lid. The light impinging upon the detector surface will be affected by changes in the chemistry deposited on the sense waveguides. Neither the waveguides nor the chemistry on the sense waveguides is included with the sensor platform. Two EOC230 light-to-frequency converter detectors are incorporated to provide a sense channel and a reference channel.

The detector outputs are pulses, the frequencies of which correspond linearly with the amount of light impinging upon the detector surface. Sensitivity for each detector can be programmed for 1x, 10x, or 100x via logic signals applied to control pins S0 and S2 as shown in Table 1. Output frequency of each detector can be scaled to divide by 2, 10, or 100 via logic signals applied to control pins S2 and S3 (Table 1). The TSLM5xxx family of devices offers light-emitting diodes of various wavelengths to match specific chemistries and applications.

These chemical-optical sensor platforms are well suited for a wide variety of applications, including sensors for hydrocarbon, carbon monoxide, and oxygen detection, industrial hygiene, home safety, and chemistry development.

Table 1. Control Pin Functions

S1	S0	SENSITIVITY	S3	S2	FOUT SCALING
0	0	Power down	0	0	÷1
0	1	1x	0	1	÷2
1	0	10x	1	0	÷10
1	1	100x	1	1	÷100

Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
S2 2	1	I	Sense channel
S3 S	2	I	Sense channel
S0 S	3	I	Sense channel
S1 S	4	I	Sense channel
	X		
	X		
LED C	7		LED cathode
GND R	8		Ground reference channel
FOUT R	9	O	Reference channel FOUT
V_{DD} R	10		Supply voltage reference channel
S2 R	11	I	Reference channel
S3 R	12	I	Reference channel
S0 R	13	I	Reference channel
S1 R	14	I	Reference channel
	X		
	X		
LED A	17		LED anode
GND S	18		Ground sense channel
FOUT S	19	O	Sense channel
$\overline{V_{DD}\ \mathrm{S}}$	20		Supply voltage sense channel

Absolute Maximum Ratings, T_A = 25°C (unless otherwise noted)[†]

Supply voltage range, V_{DD} . . . . 0 V to 6.5 V
Input voltage range, V_I, all inputs . . . . –0.3 V to V_{DD} + 0.3 V
Average LED current, dc . . . . 50 mA
Peak pulsed LED current, ≤ 2-µs pulse width, ≤ 10% duty cycle . . . . 500 mA
Operating temperature range, T_A . . . . 0°C to 70°C
Storage temperature range, T_{stg} . . . . –20°C to 85°C
Lead temperature 1, 6 mm (1/16 inch), from seating plane . . . . 260°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Recommended Operating Conditions

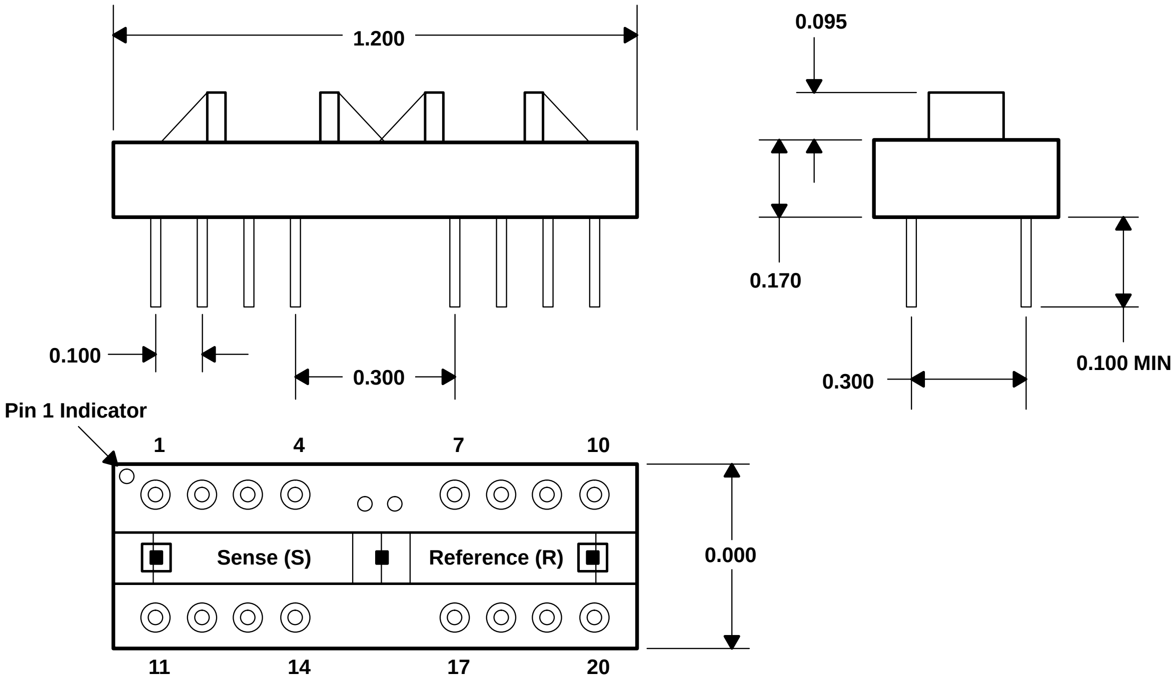
		MIN	MAX	UNIT
Supply voltage, V_{DD}		4.75	5.25	V
LED forward current, I_F	TSLM5585, TSLM5660, TSLM5880	5	20	mA
	TSLM5470, TSLM5550, TSLM5620	20	50	
Operating temperature	Case-to-ambient thermal resistance ≤ 50°C/W	0	70	°C

Electrical Characteristics at V_{DD} = 5 V, T_A = 25°C (unless otherwise noted); test conditions represent worst-case values for the parameters under test

PARAMETER			TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage		V_{DD} = 5 V,	I_F = 0 mA	4.1		20	V
V_{OL}	Low-level output voltage		V_{DD} = 5 V,	I_F = 5 mA			0.38	
$V_{F(LED)}$	Forward voltage, LED		I_F = 5 mA				2	
$I_{R(LED)}$	Reverse current, LED		V_R = 5 V				10	µA
I_{DDH}	Supply current, high-level output						8	mA
I_{DDL}	Supply current, low-level output						2	µA
I_{IH}	High-level input current				–400		400	nA
I_{IL}	Low-level input current				–400		400	
λ	Wavelength, LED	TSLM5470	I_F = 20 mA			470		nm
		TSLM5550	I_F = 20 mA			555		
		TSLM5585	I_F = 5 mA			585		
		TSLM5620	I_F = 20 mA			620		
		TSLM5660	I_F = 5 mA			660		
		TSLM5880	I_F = 5 mA			880		
f_O	Output frequency	$f_{Off(1)}$, ÷ 1	S0, S1 = 1, V_{DD} = 5 V See Notes 1 and 3	S2, S3 = 0, I_F = 20 mA,	2		20	kHz
			V_{DD} = 5 V See Notes 1 and 4	I_F = 5 mA,	10		50	
		$f_{OH(2)}$, ÷ 2	S0, S1, S2 = 1, V_{DD} = 5 V See Notes 1 and 3	S3 = 0, I_F = 20 mA,	1		10	
			V_{DD} = 5 V See Notes 1 and 4	I_F = 5 mA,	5		25	
		$f_{OH(10)}$, ÷ 10	S0, S1, S3 = 1, V_{DD} = 5 V See Notes 1 and 3	S2 = 0, I_F = 20 mA,	.2		2	
			V_{DD} = 5 V See Notes 1 and 4	I_F = 5 mA,	1		5	
		$f_{OH(100)}$, ÷ 100	S0, S1, S2, S3 = 1, V_{DD} = 5 V	I_F = 20 mA, See Notes 1 and 3	0.02		0.2	
			V_{DD} = 5 V See Notes 1 and 4	I_F = 5 mA,	0.1		0.5	
		$f_{OL(1)}$, medium	S0, S2, S3 = 1, V_{DD} = 5 V	S1 = 1, I_F = 20 mA,	0.1		2	
			V_{DD} = 5 V See Notes 1 and 4	I_F = 5 mA,	0.5		5	
		$f_{OL(1)}$, low	S1, S2, S3 = 0, V_{DD} = 5 V See Notes 1 and 3	S0 = 1, I_F = 20 mA,	0.01		0.2	
			V_{DD} = 5 V See Notes 1 and 4	I_F = 5 mA,	0.05		0.5	
	Ratio		S0, S1 = 1, V_{DD} = 5 V See Notes 2 and 3	S2, S3 = 0, I_F = 20 mA,	0.25		4	
			V_{DD} = 5 V See Notes 2 and 4	I_F = 5 mA,				

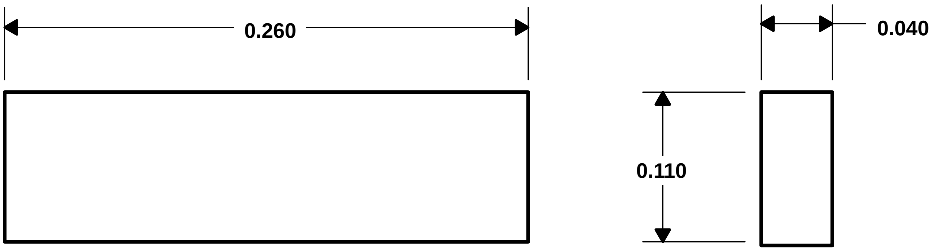
NOTES: 1. Applies both to sense and to reference channels
2. Variance between sense and reference channels expressed as a ratio
3. Applies to TSLM5470, TSLM5550 and TSLM5620 only
4. Applies to TSLM5585, TSLM5660 and TSLM5880 only

MECHANICAL INFORMATION



NOTES: A. All linear dimensions are in inches.
B. This drawing is subject to change without notice.

Figure 1. Mechanical Data



NOTES: A. All linear dimensions are in inches.
B. This drawing is subject to change without notice.

Figure 2. Typical Waveguide Dimensions

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