



## **Features and Benefits**

- Converts light intensity to an output frequency
- High dynamical light range
- High linearity
- Low temperature dependency
- Supply voltage range 3V to 5.5V
- Easy interface to microcontroller
- Low ppm defects
- Solder reflow 260degC, MSL3
- Automotive qualified AEC-Q100 Grade 1
- Operating temperature -40 up to 125degC
- RoHS compliant lead-free

## **Applications**

### **General**

- Ambient Light Sensor
- LCD Screen Backlight Dimming Sensor for Mobile Phones, Digital Frames
- LED Light Sensor
  - LED monitoring
  - Closed loop control for LED light intensity & LED color

### **Automotive**

- Cockpit Light Dimming
- LED Headlight Closed Loop Control
- Hand Presence Detection
- Sunload Sensor

### **Printers/Copiers**

- Paper feed detection
- Paper size and orientation detection
- Toner cartridge presence detection

## **Ordering Information**

<b>Part No.</b>	<b>Temperature Code</b>	<b>Package Code</b>	<b>Option Code</b>	<b>Delivery Form</b>
MLX75304EXD	E -40 °C to 85 °C	XD SO8 Open Cavity		Tape on Reel
MLX75304EXE	E -40 °C to 85 °C	XE DFN3x3 Open Cavity		Tape on Reel
MLX75304KXD	K -40 °C to 125 °C	XD SO8 Open Cavity		Tape on Reel
MLX75304KXE	K -40 °C to 125 °C	XE DFN3x3 Open Cavity		Tape on Reel

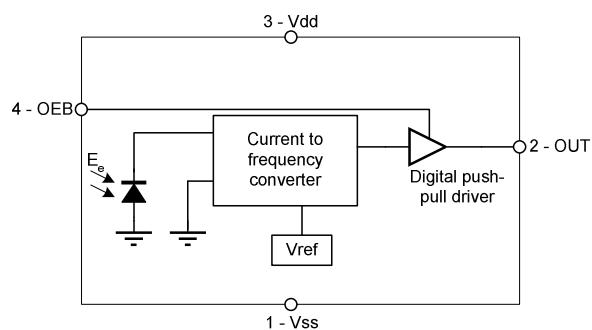


## 1 General Description

The MLX75304 is a CMOS integrated Light-to-Frequency sensor with an integrated photodiode. The sensor is intended for automotive applications and responds in a range of 500nm to 1000nm.

The MLX75304 block diagram is shown in Section 2 and contains following blocks: a photodiode, a current to frequency converter to convert the photocurrent into a useful output frequency and a digital push-pull output stage.

## 2 Functional Diagram



## Table of Contents

<b>1</b>	<b>General Description</b>	<b>2</b>
<b>2</b>	<b>Functional Diagram</b>	<b>2</b>
<b>3</b>	<b>Pin Definitions and Descriptions (SO8 Package)</b>	<b>3</b>
<b>4</b>	<b>Pin Definitions and Descriptions (DFN Package)</b>	<b>3</b>
<b>5</b>	<b>Absolute Maximum Ratings</b>	<b>3</b>
<b>6</b>	<b>MLX75304 Specifications</b>	<b>4</b>
<b>7</b>	<b>Applications Information</b>	<b>5</b>
<b>8</b>	<b>SO8 Open Cavity Package Information</b>	<b>6</b>
<b>9</b>	<b>DFN3x3 Open Cavity Package Information</b>	<b>7</b>
<b>10</b>	<b>Standard information regarding manufacturability of Melexis products with different soldering processes</b>	<b>8</b>
<b>11</b>	<b>ESD Precautions</b>	<b>8</b>
<b>12</b>	<b>Disclaimer</b>	<b>9</b>



### 3 Pin Definitions and Descriptions (SO8 Package)

Pin Number	Pin Name	Description	Type
1	Vss	Ground connection	Ground
2	OUT	Digital frequency output	Digital push-pull output
3	Vdd	Power supply	Supply
4	OEB	Enable for pin OUT. Active low.	Digital input with pull-down
5-8	N.C.	Not connected	Floating

### 4 Pin Definitions and Descriptions (DFN Package)

Pin Number	Pin Name	Description	Type
1	N.C.	Not connected	Floating
2	Vss	Ground connection	Ground
3	OUT	Digital frequency output	Digital push-pull output
4	Vdd	Power supply	Supply
5	OEB	Enable for pin OUT. Active low.	Digital input with pull-down
6-10	N.C.	Not connected	Floating

### 5 Absolute Maximum Ratings

All voltages are referenced to Vss.

Symbol	Rating	Value	Unit
Vdd	Supply Voltage, $V_{DD}$ (over voltage)	-0.3 to 7	V
$V_{out}$	DC Output Voltage	-0.3 to $V_{dd}+0.3V$	V
$I_{out}$	DC Output Current, per Pin	$\pm 20$	mA
$T_{Stg}$	Storage Temperature Range, $T_s$	-40 to 125	°C
$V_{ESD-HBM}$	ESD Sensitivity (Human Body Model according to CDF-AEC-Q100)	2	kV
$V_{ESD-MM}$	ESD Sensitivity (Machine Model according to CDF-AEC-Q100)	200	V

For proper operation  $V_{out}$  should be constrained to the range  $V_{ss} \leq V_{out} \leq V_{dd}$ .

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.



## 6 MLX75304 Specifications

All voltages are referenced to Vss.

Symbol	Parameter	Conditions	Min	Typ	Max	Units	Test <sup>1</sup>
Vdd	Supply Voltage		3		5.5	V	V
Idd	Static Power Supply Current	At Vdd=5.5V			7	mA	V
f <sub>D</sub>	Dark frequency	(a), E <sub>e</sub> = 0 μW/cm <sup>2</sup> At 25 °C At 125 °C		1 1.2		Hz kHz	
f <sub>O</sub>	Output frequency	(a), E <sub>e</sub> = 21.7 μW/cm <sup>2</sup>	-10%	50	+10%	kHz	
f <sub>FS</sub>	Full-scale frequency <sup>2</sup>	(a), E <sub>e</sub> = 430 μW/cm <sup>2</sup>		1.6		MHz	
NL10	Non-linearity <sup>3</sup>	f <sub>O</sub> = 0 kHz to 10kHz	-1%		1%	%	
NL100	Non-linearity <sup>3</sup>	f <sub>O</sub> = 0 kHz to 100kHz	-2%		2%	%	
TC	Temperature coefficient	λ = 540nm λ = 880nm		0 300		ppm/K	
t <sub>setup</sub>	Electrical setup-time	95%		10	30	μs	
S <sub>PD</sub>	Area of photodiode			0.36		mm <sup>2</sup>	
λ <sub>0.3</sub>	Spectral bandwidth	T <sub>amb</sub> = 25 °C	500		1000	nm	
	Output duty cycle			50%		%	
V <sub>OL</sub>	Output voltage low	(a) I <sub>OH</sub> = 5mA	0		0.4Vdd	V	
V <sub>OH</sub>	Output voltage high	(a) I <sub>OH</sub> = -5mA	0.6Vdd		Vdd	V	
V <sub>IL</sub>	Input voltage low	(a)	0		0.3Vdd	V	
V <sub>IH</sub>	Input voltage high	(a)	0.7Vdd		Vdd	V	
R <sub>I,PD</sub>	Input pull down resistance	(a)	50	60	70	kOhm	
T <sub>A</sub>	Operating Temperature Range		-40		125	°C	V

(a) Vdd=5V, C<sub>L</sub>=50pF, λ= 880nm

<sup>1</sup> The column *Test* indicates if the specific parameter is tested in production. Following symbols are used:

V: the specific parameter is tested in production

X: the specific parameter is verified in characterisation, but is not tested in production (e.g. timings and capacitances)

D: the specific parameter is guaranteed by design and is not tested as such in production

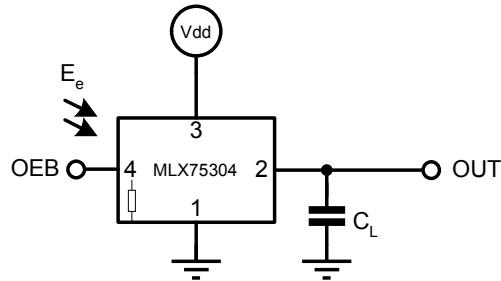
<sup>2</sup> Full-scale frequency is the maximum frequency of the device, corresponding to a typical irradiance of 430 μW/cm<sup>2</sup> at a wavelength of 880nm. Note that this is a hard limit as any higher irradiance will not result in an addition increase of the output frequency.

<sup>3</sup> Non-linearity is defined as the deviation from a line fitted in between the dark frequency and the maximum of the indicated range, expressed as a percentage of this maximum.



## 7 Applications Information

A typical connection diagram is shown in the figure below. The load capacitance  $C_L$  is typically formed by the input capacitance of the component that is connected to the sensor output, the wiring capacitance and the output capacitance of the sensor itself.

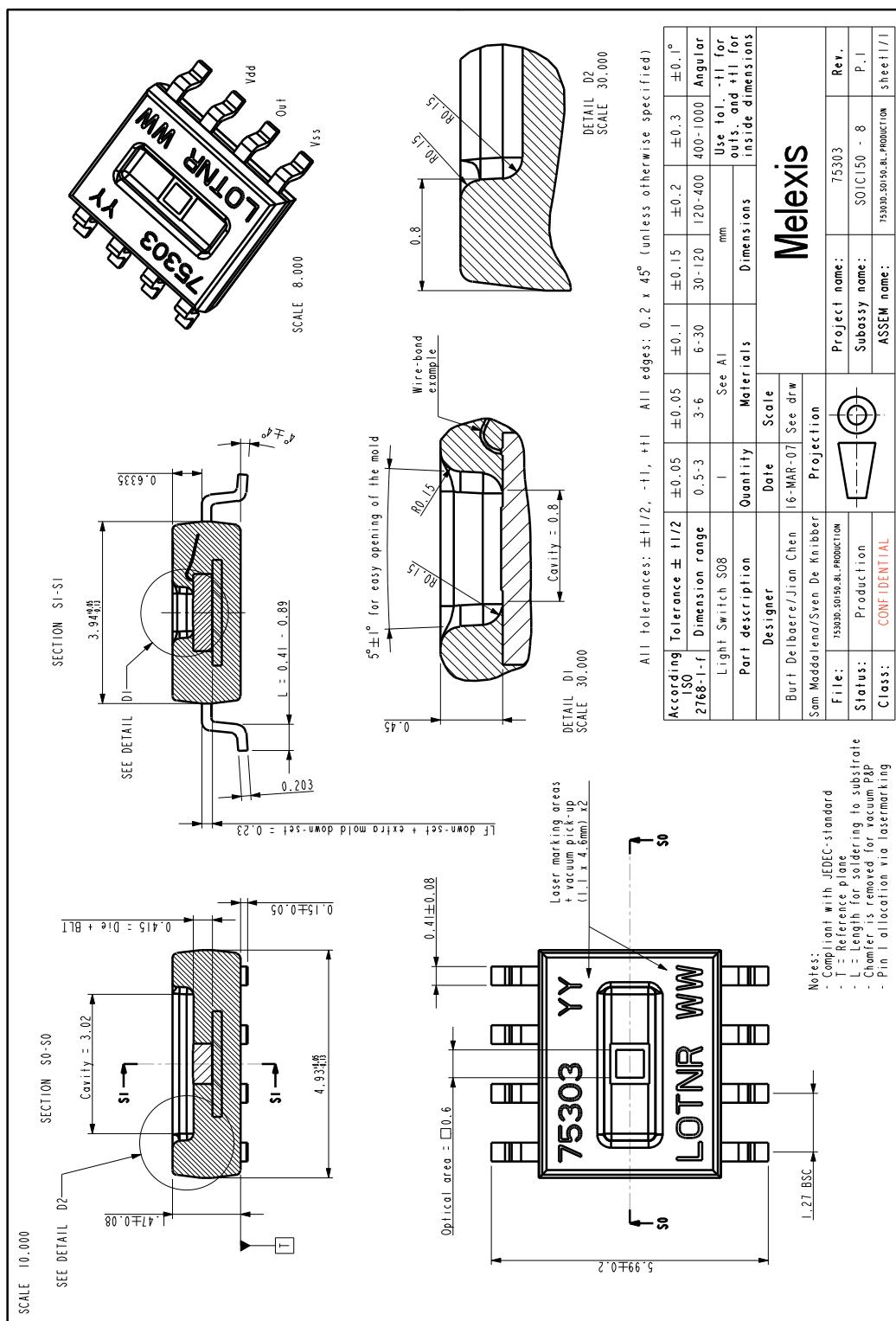


Decoupling capacitors between  $Vdd$  and  $Vss$  (1uF in parallel with 100nF) are highly recommended in all configurations.



## **8 SO8 Open Cavity Package Information**

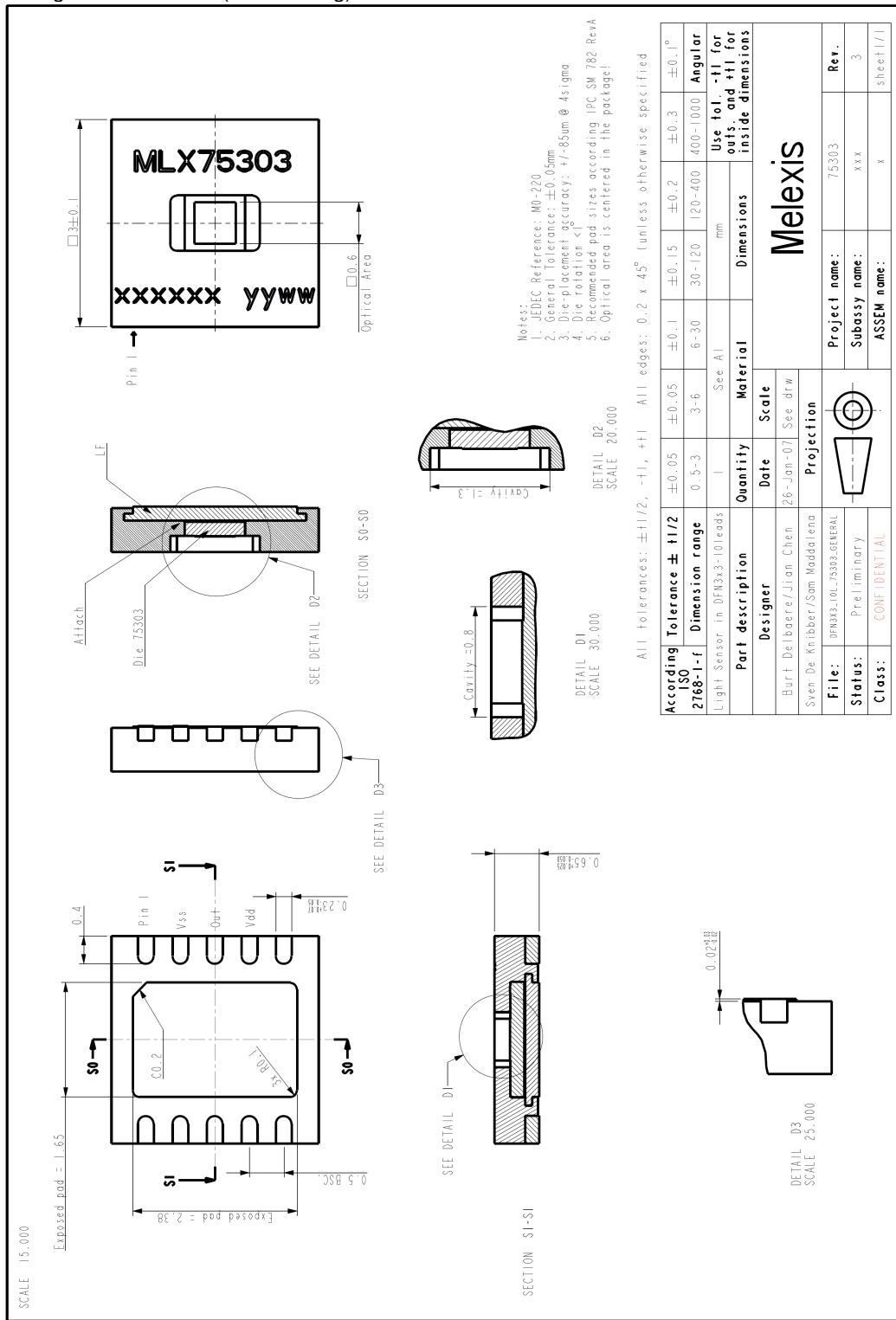
SO8 open cavity package, MSL3, 260°C soldering profile (target). Lead free component. Same package as MLX75303 (see drawing)





## 9 DFN3x3 Open Cavity Package Information

DFN open cavity package, MSL3, 260°C soldering profile (target). Lead free component. Same package as MLX75303 (see drawing)





## **10 Standard information regarding manufacturability of Melexis products with different soldering processes**

Our products are classified and qualified regarding soldering technology, solderability and moisture sensitivity level according to following test methods:

### **Reflow Soldering SMD's (Surface Mount Devices)**

- IPC/JEDEC J-STD-020  
Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices  
(classification reflow profiles according to table 5-2)
- EIA/JEDEC JESD22-A113  
Preconditioning of Nonhermetic Surface Mount Devices Prior to Reliability Testing  
(reflow profiles according to table 2)

### **Wave Soldering SMD's (Surface Mount Devices)**

- EN60749-20  
Resistance of plastic- encapsulated SMD's to combined effect of moisture and soldering heat

### **Solderability SMD's (Surface Mount Devices)**

- EIA/JEDEC JESD22-B102 and EN60749-21  
Solderability

For all soldering technologies deviating from above mentioned standard conditions (regarding peak temperature, temperature gradient, temperature profile etc) additional classification and qualification tests have to be agreed upon with Melexis.

The application of Wave Soldering for SMD's is allowed only after consulting Melexis regarding assurance of adhesive strength between device and board.

Melexis is contributing to global environmental conservation by promoting **lead free** solutions. For more information on qualifications of **RoHS** compliant products (RoHS = European directive on the Restriction Of the use of certain Hazardous Substances) please visit the quality page on our website:  
<http://www.melexis.com/quality.asp>

## **11 ESD Precautions**

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).  
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

## **12 Disclaimer**

Devices sold by Melexis are covered by the warranty and patent indemnification provisions appearing in its Term of Sale. Melexis makes no warranty, express, statutory, implied, or by description regarding the information set forth herein or regarding the freedom of the described devices from patent infringement. Melexis reserves the right to change specifications and prices at any time and without notice. Therefore, prior to designing this product into a system, it is necessary to check with Melexis for current information. This product is intended for use in normal commercial applications. Applications requiring extended temperature range, unusual environmental requirements, or high reliability applications, such as military, medical life-support or life-sustaining equipment are specifically not recommended without additional processing by Melexis for each application.

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