



Features

- High precision light switching level
- Low temperature dependency
- TTL and CMOS compatible
- Operating temperatures: -20..85degC (consumer) or -40..125degC (automotive)
- Supply voltage range 3V to 5.5V
- Target 0 ppm defects; guarantee <10 ppm defects
- Solder reflow 260degC, MSL3
- RoHS compliant lead-free
- Automotive version is AEC-Q100 qualified

Applications

General

- Contactless Switch
- Contactless Position Switch
- Hand presence detection, e.g. for water taps
- Range detection, e.g. staircase detection for robot vacuum cleaners
- Twilight Sensor, e.g. for sun screens, roof windows
- Security Screens

Automotive

- Steering angle measurement
- Contactless switch for steering stocks
- Headlights ON/OFF sensor
- Keyless car entry – hand presence detection

Printers/Copiers

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

Versions

| Part No. | Temperature Code | Package Code | Option Code | Delivery Form |
|----------|-----------------------|-----------------------|-------------|---------------|
| MLX75303 | S -20 °C to 85 °C | XD SO8 Open Cavity | | Tape On Reel |
| MLX75303 | K -40 °C to 125 °C | XD SO8 Open Cavity | | Tape On Reel |
| | | | | |

1 Functional Diagram



2 General Description

The Melexis SensorEyeC series are CMOS integrated optical sensor ICs including photodiode, transimpedance amplifier and output transistor on one chip.

The MLX75303 features a Schmitt Trigger output and is designed for high-volume automotive and non-automotive applications.

The MLX75303 block diagram is shown in Section 1 and contains following blocks: a transimpedance amplifier to convert and amplify the photocurrent of the photodiode, a voltage reference, a Schmitt trigger and an open drain output stage.

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3 SO8 Pin Definitions and Descriptions

| Pin Number | Pin Name | Description | Type |
|------------|----------|--------------------------------|-------------------|
| 1 | Vss | Ground connection | Ground |
| 2 | OUT | Active low (= light on) output | Open drain output |
| 3 | Vdd | Power supply | Supply |
| 4 | N.C. | Not connected | Floating |
| 5..8 | N.C. | Not connected | Floating |

4 Absolute Maximum Ratings

Valid for all MLX75303 versions. 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 Vdd+0.3V | V |
| I _{out} | DC Output Current, per Pin | ±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) | 4 | kV |
| V _{ESD-MM} | ESD Sensitivity (Machine Model according to CDF-AEC-Q100) | 200 | V |

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

5 MLX75303 Specifications

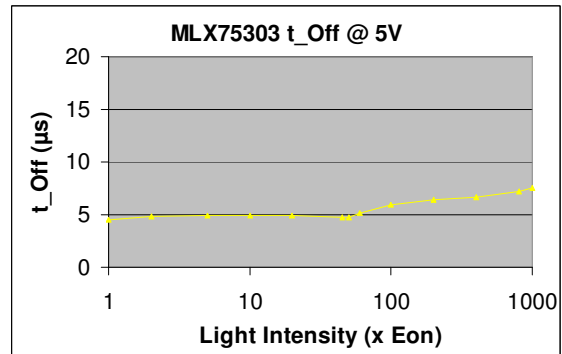
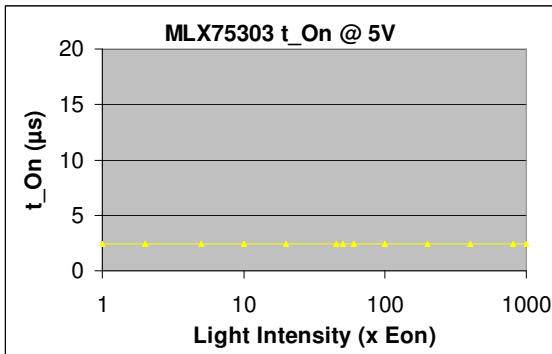
All voltages are referenced to Vss.

| Symbol | Parameter | Conditions | Min | Typ | Max | Units | Test ¹ |
|-------------------------------------|---|--|-----------------------------|-------|-----------------|--|-------------------|
| Vdd | Supply Voltage | | 3 | | 5.5 | V | V |
| Idd | Static Power Supply Current | At Vdd=5.5V, unloaded output | | | 2.5 | mA | V |
| E _{eon} | Irradiance for Threshold "on" | Vdd=5V, λ=850nm, T _{amb} =25°C | -20% | 105 | +20% | μW/cm ² | V |
| E _{eoff} /E _{eon} | Hysteresis | Vdd=5V, λ=850nm, T _{amb} =-40 .. 85°C T _{amb} =85 .. 125°C | 60 60 | | 80 90 | % % | V V |
| TC | Temperature Coefficient of threshold "on" | Vdd=5V, λ=850nm | | -0.44 | | %/K | X |
| E _{emax} | Maximum Irradiance | Vdd=5V, λ=850nm, T _{amb} =25°C | 15x E _{eon_max} | | | μW/cm ² μW/cm ² | V X |
| λ _{0.3} | Spectral Bandwidth | T _{amb} =25°C | 500 | | 1000 | nm | X |
| V _{OL} | Output voltage low | Vdd=5.5V, E _e >E _{on} , I _{OL} =16mA | 0 | | 0.4 | V | V |
| V _{OH} | Output voltage high | Vdd=5.5V, E _e =0 | | | Vdd+0.3 | V | X |
| I _{OH} | High level output current | Vdd=5.5V, E _e =0 | 0 | | 1 | μA | V |
| t _{setup} | Electrical setup-time | R _L =1kOhm, C _L =2nF, λ= 850nm | 0 | | 24 | μs | V |
| S _{pd} | Area of photodiode | | | 0.36 | | mm ² | D |
| t _f | Fall time | (a), E _e =E _{eon_max} | 0 | | 300 | ns | X |
| t _{on} | Turn-on time | (a), E _e =E _{eon_max} | 0 | 10 | 20 | μs | V |
| t _{off} | Turn-off time | (a), E _e =30x E _{eon_max} | 0 | 10 | 20 | μs | V |
| t _p | Light pulse duration | (a) | 20 | | | μs | V |
| t _G | Light pulse rejection | (a) | | 2 | | μs | X |
| T _A | Operating Temperature Range | Temperature Code S Temperature Code E Temperature Code K | -20 -40 -40 | | 85 85 125 | °C °C °C | V V V |

(a) Vdd=5V, R_L=1kOhm, C_L=2nF, λ= 850nm

¹ 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

Typical t_{on} and t_{off} values for light intensities up to $1000x E_{on}$ (at 25degC)



Typical E_{on}/E_{off} (Hysteresis) value over temperature



Spectral Responsivity Curve



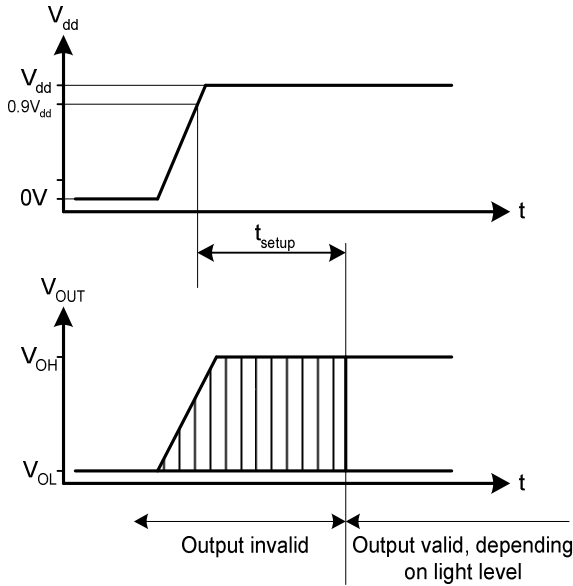
6 Timing diagrams



Definition of the switch-on and switch-off thresholds



Definition of the switch-on and switch-off delays



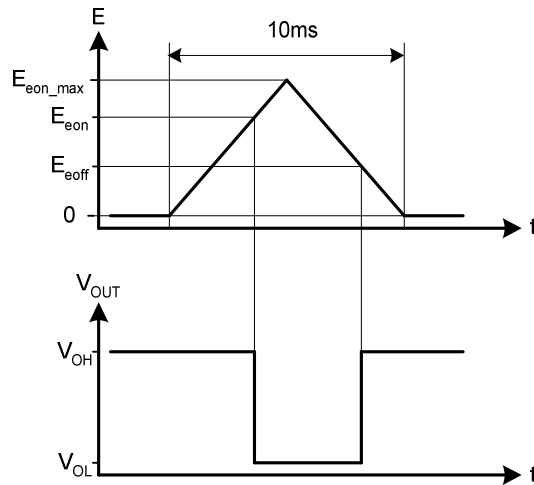
Definition of the power-on delay



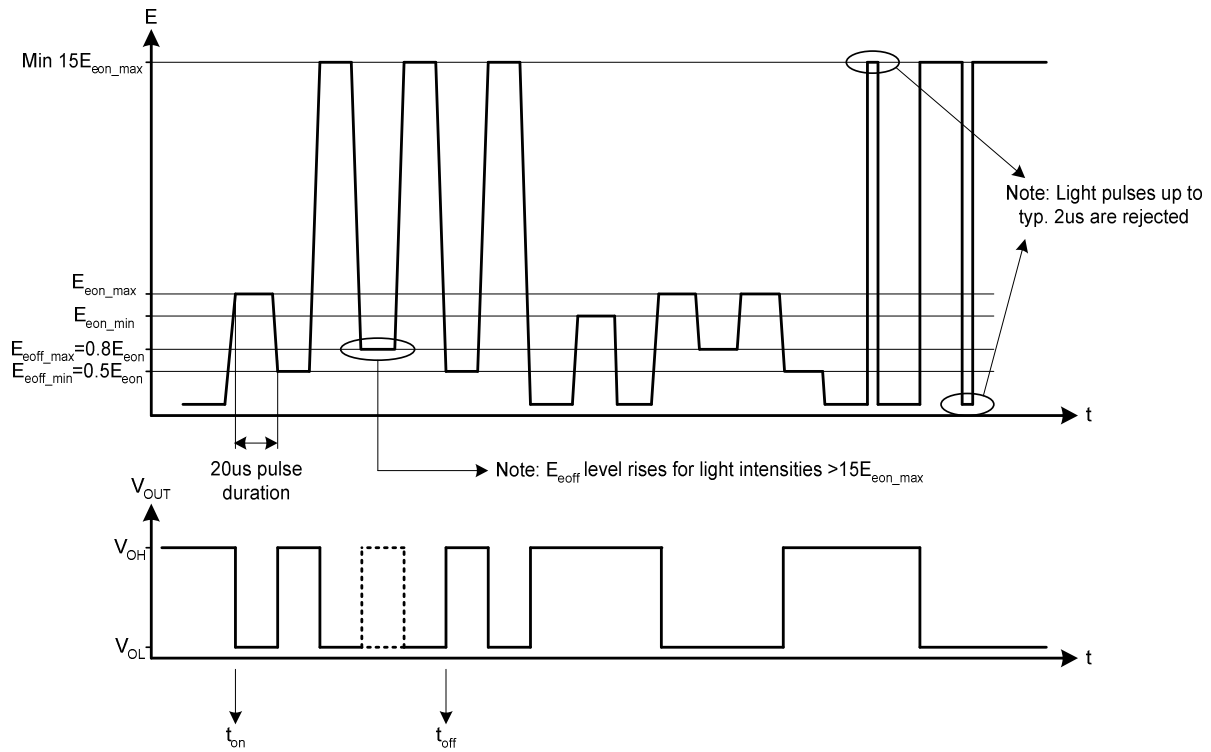
Definition of the light pulse duration

7 Test diagrams

Measurement and trimming of E_{eon} , E_{eoff} and hysteresis:



Functional check of $E_{e_{on}}$ and $E_{e_{off}}$ thresholds and timing measurements (Go-NoGo tests):



8 Applications Information

A typical connection diagram is shown in the figure below. A load resistor R_L is needed to get a voltage level out. 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 V_{dd} and V_{ss} (1uF in parallel with 100nF) are highly recommended in all configurations.

Recommendation: every change in the application should be agreed by both parties.

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 Developments)

- 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 Developments)

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

Solderability SMD's (Surface Mount Developments)

- 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

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