EVB90129

MLX90129 Evaluation Board Manual

Features

- Versatile A/D interface for resistive sensors
- ISO15693 13.56MHz transponder
- Slave / Master SPI interface
- 4 k-bit EEPROM with access protection
- Standalone data-logging mode
- Ultra low power
- Battery or battery-less applications
- Low cost and compact design

Application Examples

- Asset management and monitoring (security and integrity)
- Building automation
- Supply chain monitoring of temperature and other parameters
- Industrial, medical and residential control

Ordering Information

Part No. EVB90129

General Description

The EVB90129 is an assembled printed circuit board that simplifies evaluation of the MLX90129 sensor tag IC and to facilitate the development of wireless sensor applications based on the MLX90129.

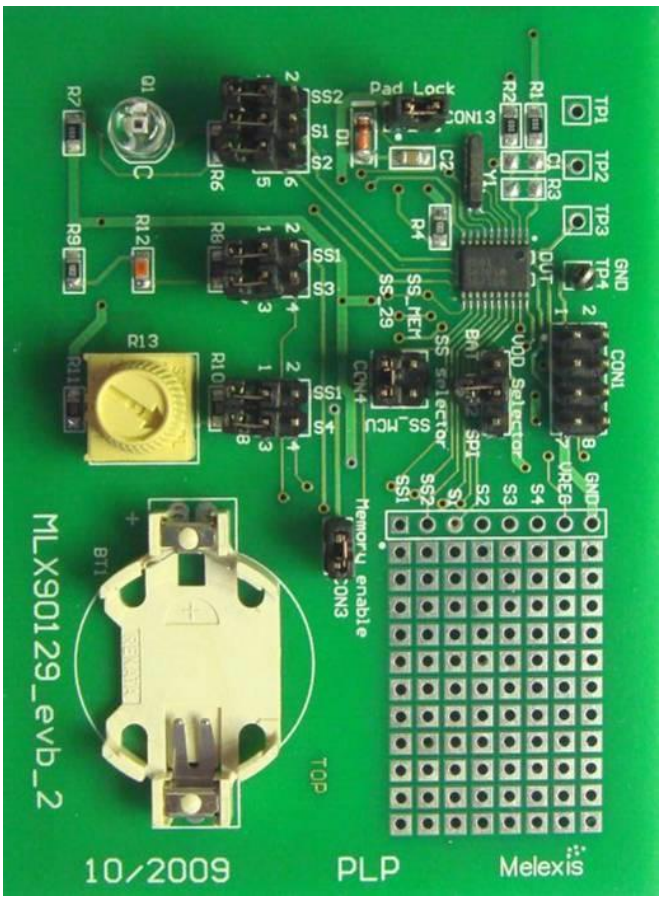
The EVB90129 was developed to demonstrate a wide range of applications, from fully passive sensor tag operation to complex data logging. Each of its elements can be reconfigured by means of jumpers.

The board can be powered either by an external voltage supply, the on-board battery or the electromagnetic field from a RFID reader.

In addition to the internal temperature sensor of the MLX90129, the EVB90129 embeds 3 external sensors, light, temperature and potentiometer to demonstrate the flexibility for measurement of a variety of physical quantities. The custom prototyping area allows users to integrate their own sensor or circuit into this evaluation board.

The EVB90129 is capable of storing 128 Kbit of data's in the SPI EEPROM memory connected to the MLX90129.

The EVB90129 can be accessed and controlled through a contactless (RFID) or a contact (SPI) interface. The RFID access to the MLX90129 and the related commands are compliant with the ISO15693 standard. The SPI and other digital inputs/outputs from the MLX90129 are connected to an 8-pin connector of the EVB90129. This allows easy connection to a microcontroller.



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1. EVB90129 global description

The EVB90129 simplifies evaluating all the features of the MLX90129. The following application can be executed on the EVB90129:

- Sensor control via SPI (application with a microcontroller)
- Passive sensor tag (sensor control via RFID without battery)
- Automatic data logging of the three sensors values logged to the external memory
- Automatic data logging of the three sensors values logged to the MLX90129 memory
- External memory access via RFID
- Padlock or security device function (antitheft system)

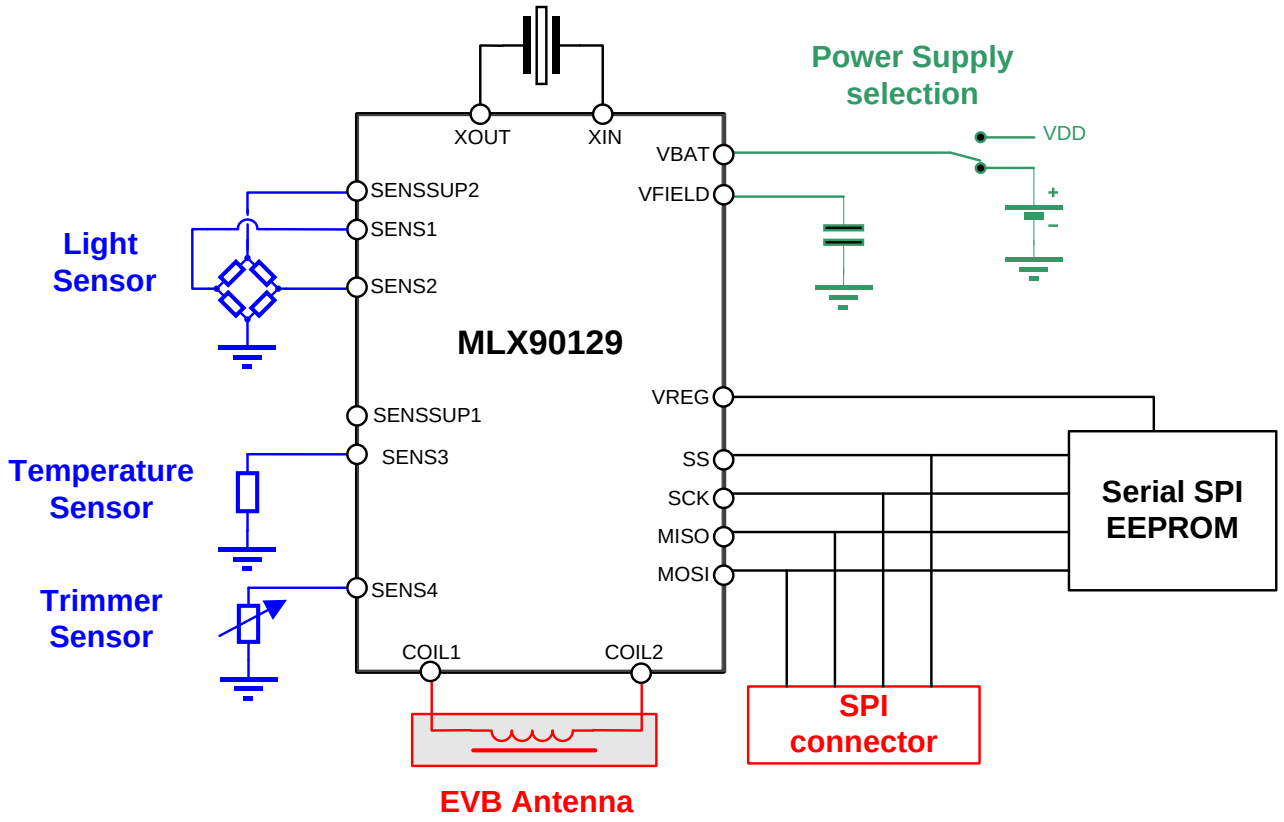
EVB90129 provides three ways to supply the MLX90129. A battery, an external voltage or the electromagnetic field can be used.

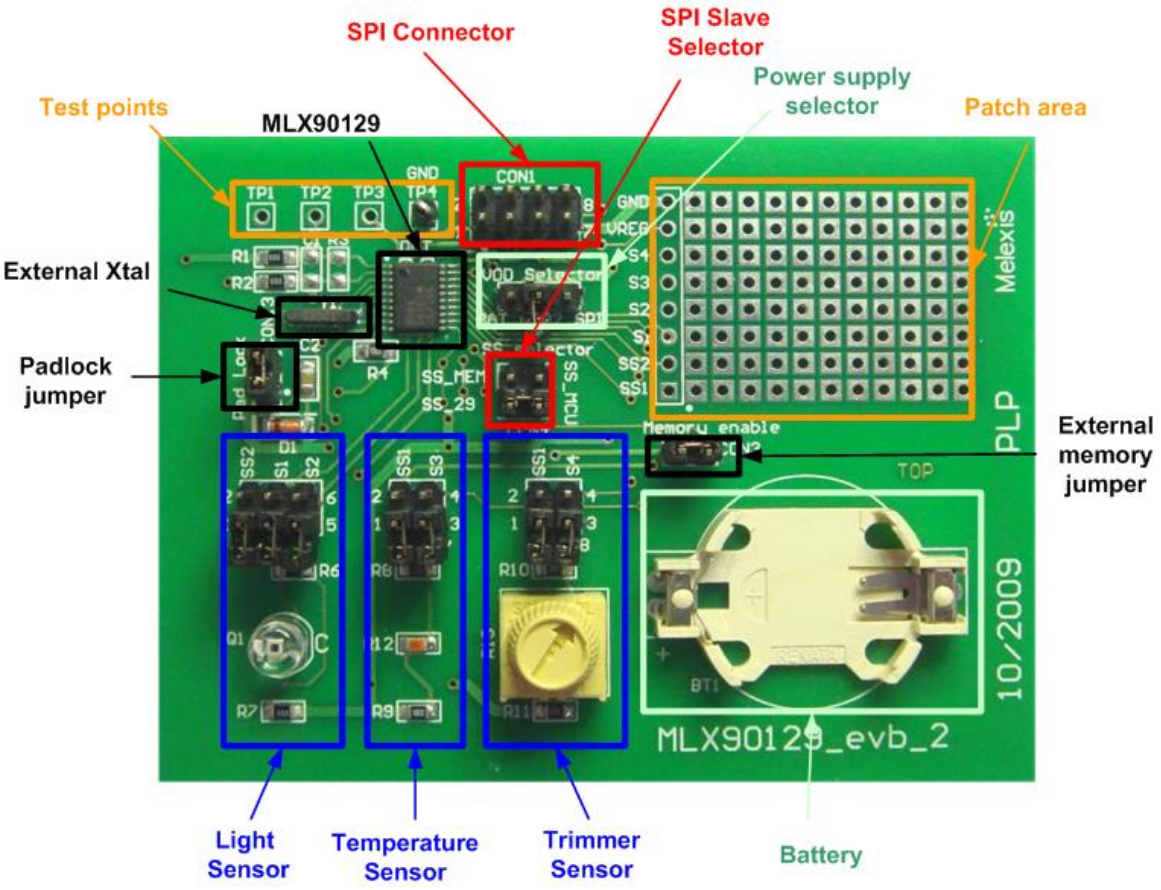
There are two communication channels to communicate with MLX90129: SPI and RFID. The SPI signals are available through the SPI connector and the RFID antenna has been tuned to match with the MLX90129 internal capacitance.

EVB90129 provides four sensors: the MLX90129 internal temperature sensor and three external sensors. The three external sensors are composed of a light sensor, an external temperature sensor and one potentiometer. Another sensor can be connected to the MLX90129 using the prototyping development area included on the EVB.

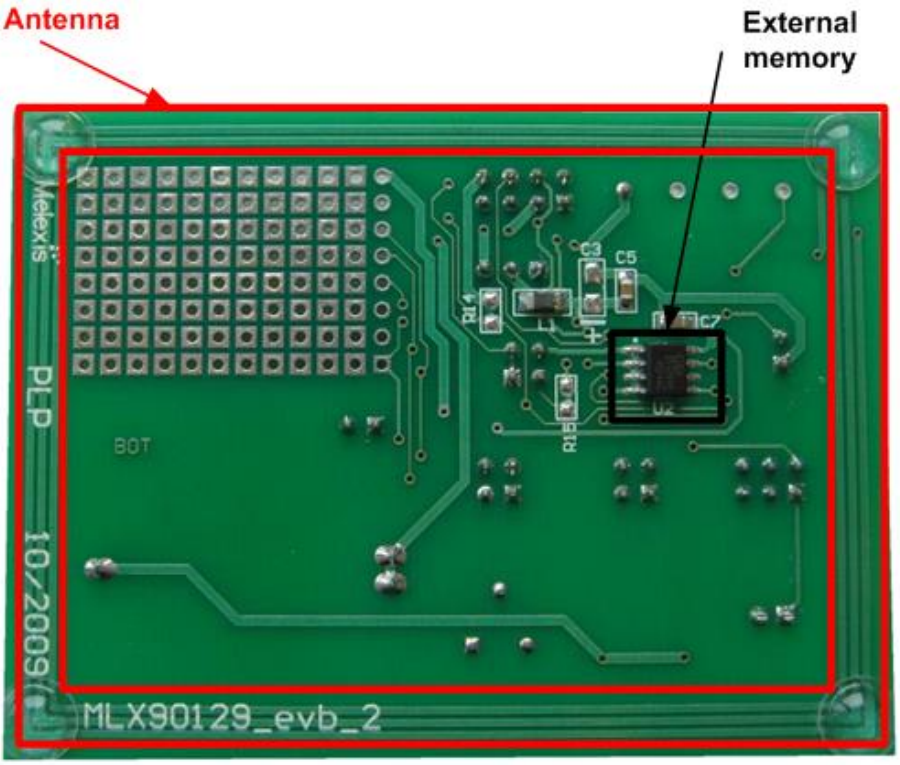
To store a large amount of data during data logging application, an external SPI memory is available.

The following diagram describes the principles of the EVB90129 and the following pictures describe the hardware blocks.





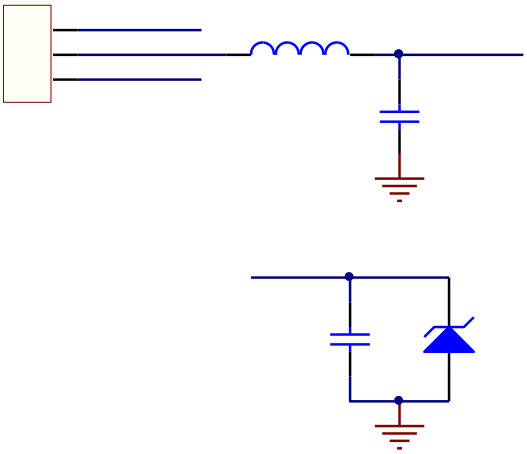
EVB90129 Top – hardware block description



EVB90129 Bottom – hardware block description

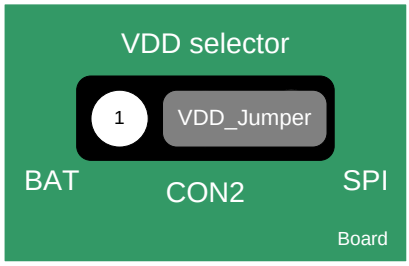
2. EVB90129 Power Supplies

The EVB90129 allows supplying the MLX90129 through three ways. Power supply can be provided by a battery CR2032, by an external power supply input or a by an electromagnetic field from a RFID reader. The jumper CON2/ VDD_Selector allow selecting the regulated source of power. This source is filtered by L1 and C5. C3 is not mounted. The energy from an applied electromagnetic field is collected with the 13.56MHz tuned antenna through the pin COIL1 and COIL2. A Zener diode on the VFIELD pin ensures the compliance with the maximum electrical rating defined in the MLX90129 datasheet. Indeed, very powerful reader could provide enough energy to exceed this rating. The 100 nF capacitor C2 on VFIELD pin allows storing of this energy in order to supply the MLX90129 and the external sensor in sensor tag application.

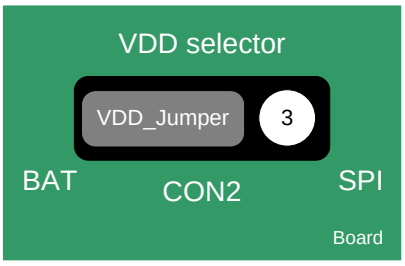


The following drawings show how to set jumpers in order to select the power supply source

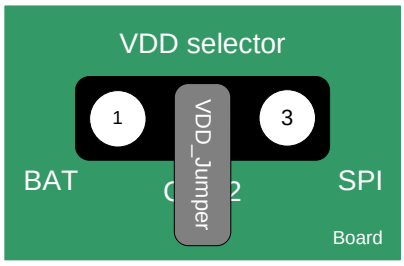
External power supply



Battery powered



Electromagnetic field powered



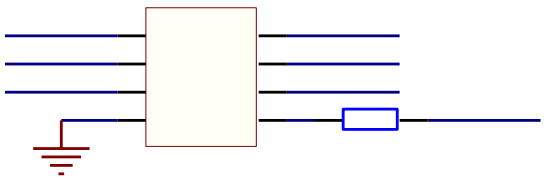
Depending on the mode used, care should be taken about the internal MLX90129 switches for power management. Please read the datasheet for more information on this topic.

3. EVB90129 Communication

The EVB90129 allows communication with the MLX90129 through SPI and RFID and also between the MLX90129 and an external memory during a data logging application. The SPI signals are received through the SPI connector and the SS_Selector allows selecting the communication channel. RFID signals are received through the RFID antenna connected to the MLX90129.

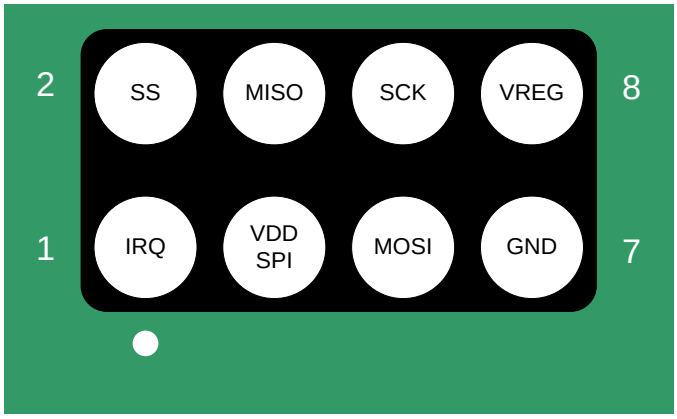
3.1. External SPI connector

The digital Inputs/Outputs of the SPI bus and the IRQ pin of the MLX90129 are available on the connector CON1/CON_SPI. In addition the external SPI connector provides pins to supply EVB90129 (VDD_SPI and GND), and a connection to the Voltage Regulated output VREG. The following table, schematic and diagram give information about the SPI connector. Per default, the resistor R14 is not mounted.



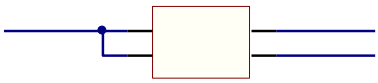
Pin	I/O	Name	Description
1	Output	IRQ_29	Interrupt output
2	Input	SS_MCU	Slave Select signal of the SPI bus
3	Input	VDD_SPI	External power supply
4	Output	MISO	Master In Slave Out of the SPI bus
5	Input	MOSI	Master Out Slave In of the SPI bus
6	Input	SCK	Clock of the SPI bus
7	Input	GND	Ground of the EVB
8	Output	VREG	Regulated supply voltage from MLX90129*

*Not connected per default / R14 not mounted



3.2. Slave Select selector

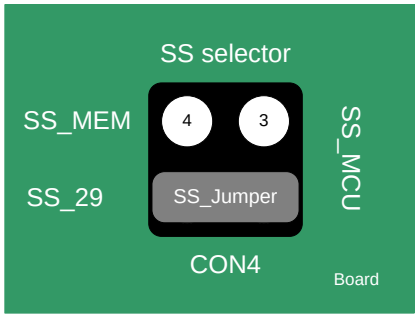
The CON4/SS_Selector allows switching between the several SPI devices on the EVB. There are three communication channels:



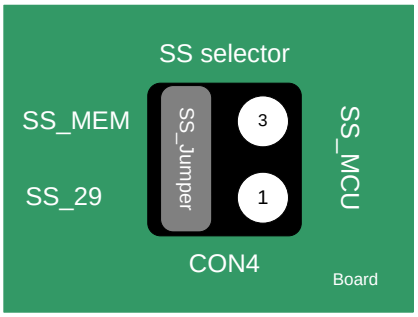
- External MCU as SPI-Master and MLX90129 as SPI-Slave
- MLX90129 as SPI-Master and external memory as SPI-Slave (data logging application)
- External MCU as SPI-Master and external memory as SPI-Slave

By selecting the connection of the Slave Selects, the SPI communication channels are switched as shown in the following schematic and draws.

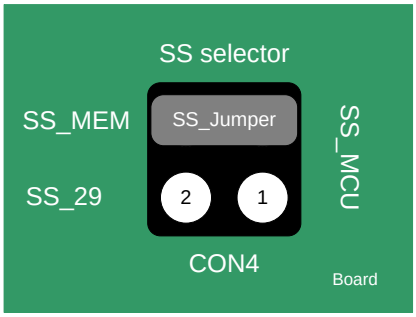
External MCU <–> MLX90129



MLX90129 <–> External memory

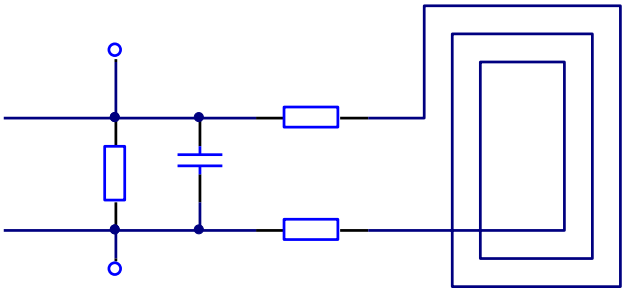


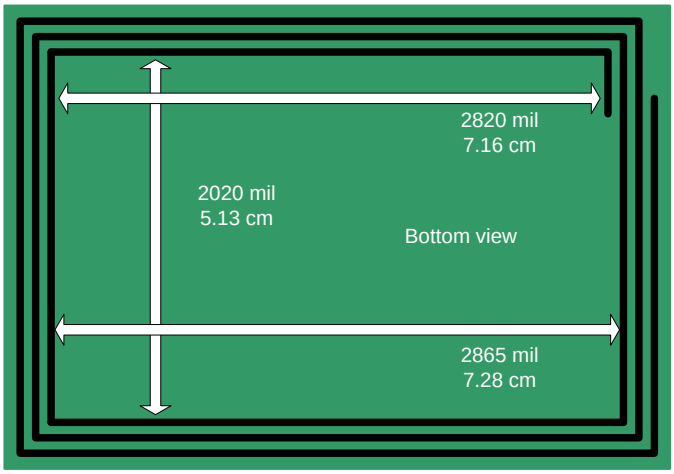
External MCU<–>External memory

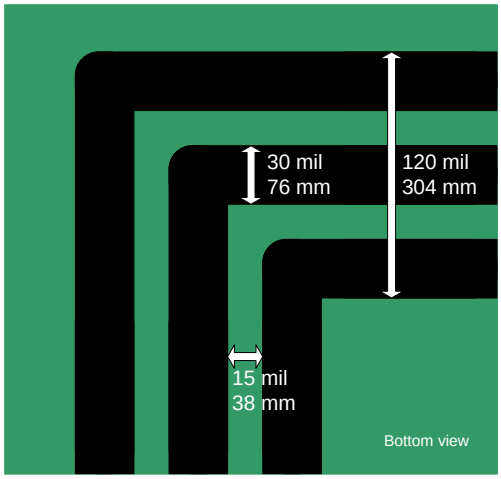


3.3. RFID antenna

The EVB antenna has been designed to work with a 13.56MHz electromagnetic field. The antenna can be directly connected to the MLX90129 through pins COIL1 and COIL2. The Shortcut R1 and R2 allows for disconnecting the antenna and R3 and C1 footprint (components not mounted) could be used to match MLX90129 with another antenna. The following schematic and drawing show the antenna connection and the antenna shape:







For information: 1 mil = 2.54E-3 cm

3.4. Register Configuration

There are a lot of possible configurations for enabling communication features. For example SPI or RFID access can be disabled and EEPROM area or register file access can be restricted. The following configuration puts the MLX90129 in a security free mode. The device is fully accessible by RFID and SPI. More information is available in the MLX90129 datasheet.

Content	#	Hexa	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EEPROM security	04	AAA8	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	0
Device security	05	3FF0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0

4. Sensor description

EVB90129 is delivered with three external sensors in addition to the internal temperature sensor of the MLX90129; a light sensor, an external temperature sensor and a potentiometer. For each sensor, the schematic and a configuration of the MLX90129 register is provided. The sensors are provided as examples and have not been calibrated. The configuration provided is basic, there is no amplification (per default gain=8), no threshold, and no offset with the DAC. The ADC mode is "11", the initialization time is minimal and there is no averaging so the chopper is disabled. The datalogging control bits (b4, b5, b6) of the "Control word" are set. The MLX90129 datasheet provides more details about the register configuration.
The basic following configuration for sensor conditioning can be used for all sensors.

Content	#	Hexa	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Sensor power	12	00FF	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Sensor trimming	14	0TT0	0	0	0	0	0	0	T	T	T	T	0	0	0	0	0	0

'**T**' means Melexis trimming bits. Do not change.

4.1. Internal temperature sensor

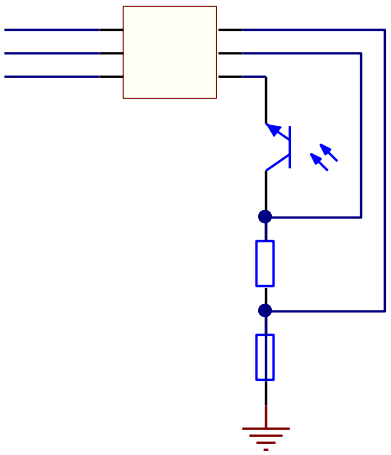
The specifications of the internal temperature sensor are available in the MLX90129 datasheet. The following register configuration allows monitoring the full range of the internal temperature sensor.

Content	#	Hexa	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Control word	15	C070	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0
Low threshold	16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High threshold	17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conditioner config.	18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Connection config.	19	0231	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1
Resistance network	1A	8000	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

4.2. Light sensor

The light sensor is a phototransistor for ambient light sensor measurement. To use, it, all the jumpers of the CON6/ LIGHT_SELECTOR have to be set in order to connect MLX90129 pins SENSSUP2, SENS1 and SENS2 to the sensor.

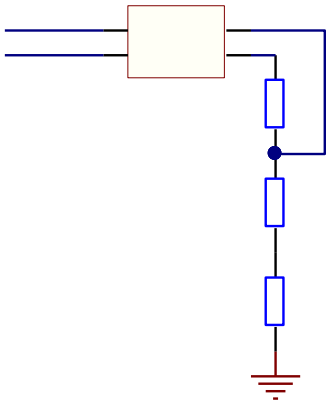
The schematic shows the sensor implementation and the following register configuration allows monitoring the ambient light on the phototransistor through the MLX90129.
This sensor fits mainly for the sun light monitoring. The output voltage with flashlight is very low.



Content	#	Hexa	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Control word	15	C070	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0
Low threshold	16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High threshold	17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conditioner config.	18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Connection config.	19	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resistance network	1A	0002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

4.3. External temperature sensor

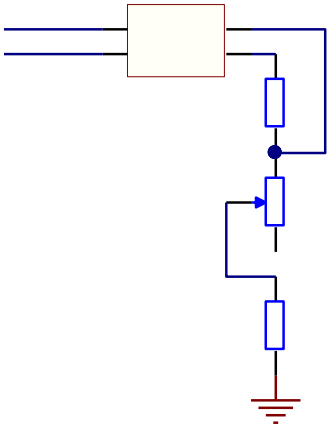
The external temperature sensor is a thermistor of 1KOhm with an operating temperature range from -40 to +125 degrees Celsius. The output voltage monitored by SENS 3 corresponds to SENSSUP1 divided per 2 plus the variation of the sensor. This voltage will be compared with VCM (SENSSUP1 divided by 2) value internally of the MLX90129. The datasheet gives more information about this setup. To be used, all the jumpers of the CON7/ TEMP_SELECTOR have to be set in order to connect MLX90129 pins SENSSUP1 and SENS3 to the sensor. The schematic shows the sensor implementation and the following register configuration allows monitoring the ambient temperature through the MLX90129.



Content	#	Hexa	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Control word	15	C070	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0
Low threshold	16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High threshold	17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conditioner config.	18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Connection config.	19	0123	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1
Resistance network	1A	0040	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

4.4. Potentiometer sensor

The external trimmer is a 100 Ohm variable resistor. The output voltage monitored by SENS 4 corresponds to SENSsUP1 divided per 2 plus the variation of the sensor. This voltage will be compared with VCM (SENSSUP1 divided by 2) value internally of the MLX90129. The datasheet gives more information about this setup.
To be used, all the jumpers of the CON8/ TRIM_SELECTOR have to be set in order to connect MLX90129 pins SENSSUP1 and SENS4 to the sensor. The schematic shows the sensor implementation and the following register configuration allows monitoring the variation of trimmer resistivity through the MLX90129.

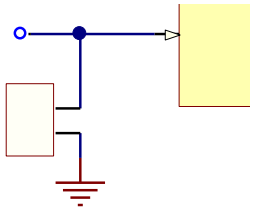


Content	#	Hexa	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Control word	15	C070	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0
Low threshold	16	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High threshold	17	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conditioner config.	18	0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Connection config.	19	0069	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1
Resistance network	1A	0040	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

5. Miscellaneous peripheries

5.1. Padlock or security device function

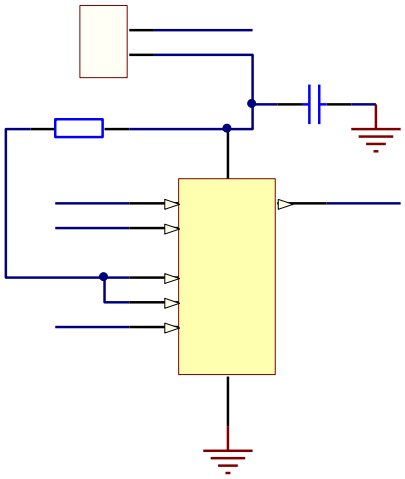
The pin 7 of the MLX90129 can be used as a Padlock function, else it has to be connected to the ground. The padlock function allows generating an IRQ when the jumper between pin 7 and the ground is removed.
The schematic shows the Padlock jumper implementation and the following register configuration allows configuring the MLX90129 in order to use this feature.



Content	#	Hexa	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Power configuration	12	0A00	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0

5.2. External SPI memory

The MLX90129 can be connected to a SPI external memory in order to store a large amount of data during a data logging application. An external 128Kbit memory is available on the EVB90129. It can be connected by setting the jumper CON3 / ExtMemSelector. In this configuration, the external memory is supplied by the regulated voltage output (VREG) of the MLX90129. The SPI pins (SS / SCK / MISO /MOSI) are connected to the MLX90129 SPI pins. The CON4 / SS_selector allows connecting the SS pin of the MLX90129 to the SS pin of the external memory. The schematic shows the memory implementation and the following register configuration allows the MLX90129 to communicate with the memory as a SPI master. More information is available in the MLX90129 datasheet.
The SPI memory datasheet gives the following commands:



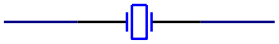
- Write Enable = 0x06
- Write Memory = 0x02
- Read Memory = 0x03

The MLX90129 has to be in SPI master mode. The bit 0 of the Device security register has to be set either in EEPROM (restricted access by RFID) or in the register files.

Content	#	Hexa	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Control word	0D	0639	0	0	0	0	0	1	1	0	0	0	1	1	1	0	0	1
Command codes	0E	0203	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
Device security	05	3FF1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1

5.3. External XTAL

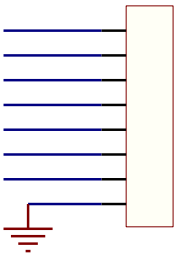
For Auto logging function an external precise clock can be used to enhance timing between two sensor acquisitions. The 32,768 KHz crystal is connected between the pins XIN and XOUT of the MLX90129. The bit 14 of the Internal Devices Domain, address #03 has to be set.



5.4. Test points and patch area

Some analogue outputs are foreseen on the evaluation board as test pins referenced from **TP1** to **TP4**. These test pins can be used to monitor signals. In order to connect other sensors to the MLX90129, a patch area is available. The following table describes all test pins available and the following schematic shows the signals available on the patch area.

Test pins number	Name	Description
TP1	Coil1	Coil 1 pin
TP2	Coil2	Coil 2 pin
TP3	NC	Not used
TP4	GND	Ground

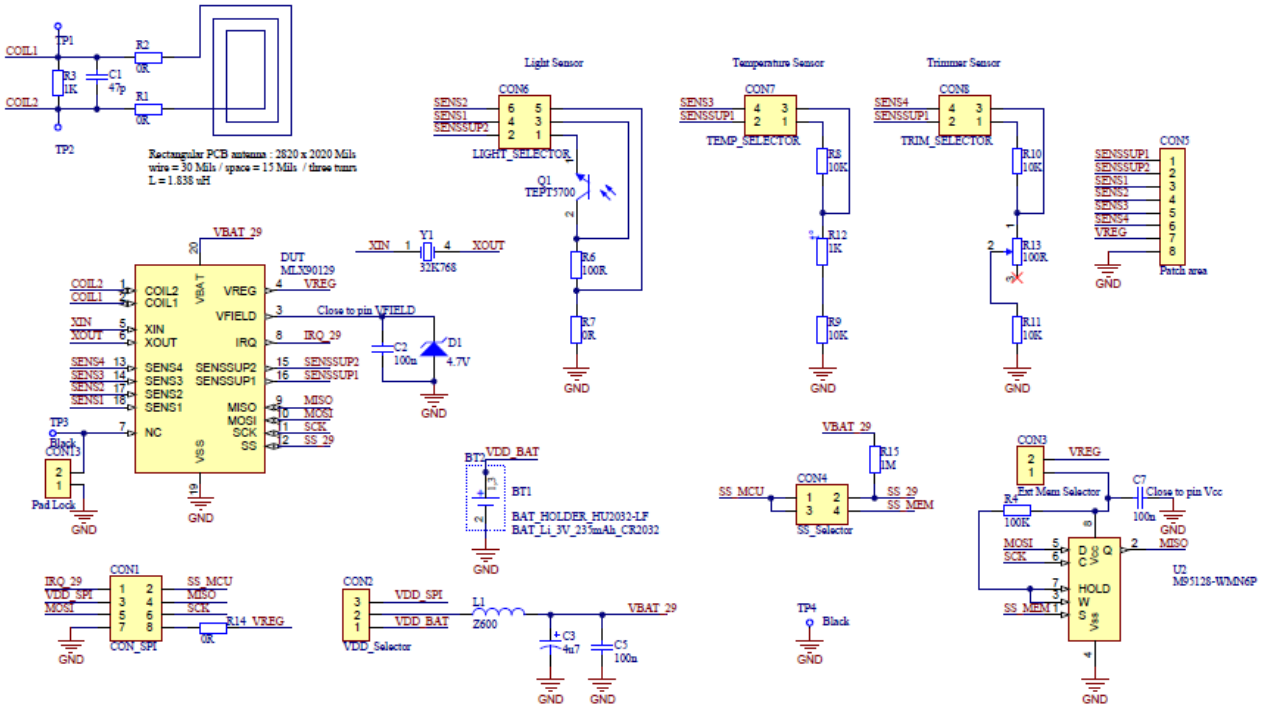


6. Using the EVB90129

The EVB90129 can be configured and controlled through its RFID and its SPI interface. Please refer to the MLX90129 Datasheet and the application notes for information about register configuration and command description. A bad configuration can lock the MLX90129 communication completely. Care should be taken about the command sent and the configuration applied. In order to avoid bad manipulation and to speed up the development, the MLX90129 development kit is available (DVK90129). It contains the EVB90129, a USB RFID reader and user friendly software interface. Please refer to our website (www.melexis.com) for more information.

7. Schematic

Schematic of the MLX90129 evaluation board:



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8. List of components

The table below gives an overview of all components that compose the evaluation board EVB90129.

Reference	Value	Description
BT1	-	Battery Holder 1 x CR2032
BT2	3V	Battery CR2032
C1*	-	Capacitor
C2	100nF	Capacitor Multilayer Ceramic X7R 50V
C3*	4u7 F	Capacitor Tantalum 4.7uF; 16V;
C5	100nF	Capacitor Multilayer Ceramic X7R 50V
C7	100nF	Capacitor Multilayer Ceramic X7R 50V
CON1	CON_SPI	Header, 2x4 pins, pitch 2.54mm, Male, Straight
CON2	VDD_Selector	Header, 1x3 pins, pitch 2.54mm, Male, Straight
CON3	Ext Mem Selector	Header, 1x2 pins, pitch 2.54mm, Male, Straight
CON4	SS_Selector	Header, 2x2 pins, pitch 2.54mm, Male, Straight
CON6	LIGHT_SELECTOR	Header, 2x3 pins, pitch 2.54mm, Male, Straight
CON7	TEMP_SELECTOR	Header, 2x2 pins, pitch 2.54mm, Male, Straight
CON8	TRIM_SELECTOR	Header, 2x2 pins, pitch 2.54mm, Male, Straight
CON13	Pad Lock	Header, 1x2 pins, pitch 2.54mm, Male, Straight
DUT	MLX90129	MLX90129, soldered, TSSOP20
D1	4.7V	Zener diode
L1	Z600	Ferrite Bead 1206; Z=600ohm/100MHz; Current=200mA
Q1	TEPT5700	Phototransistor, Sensor, ambient light
R1	0R	Resistor Thick Film; 0R; 0805; 0.125W; 1%; 150V
R2	0R	Resistor Thick Film; 0R; 0805; 0.125W; 1%; 150V
R3*	-	Resistor
R4	100K	Resistor Thick Film; 100K; 0805; 0.125W; 1%; 150V
R6	100R	Resistor Thick Film; 100R; 0805; 0.125W; 1%; 150V
R7	0R	Resistor Thick Film; 0R; 0805; 0.125W; 1%; 150V
R8	10K	Resistor Thick Film; 10K; 0805; 0.125W; 1%; 150V
R9	10K	Resistor Thick Film; 10K; 0805; 0.125W; 1%; 150V
R10	10K	Resistor Thick Film; 10K; 0805; 0.125W; 1%; 150V
R11	10K	Resistor Thick Film; 10K; 0805; 0.125W; 1%; 150V
R12	1K	Thermistor; 1K, 0805, 0.1W, 5%, 50V, TCR=3000ppm/DegC
R13	100R	POTENTIOMETER; 100R, 0.5W, 10%, 300Vdc, turns=1
R14*	0R	Resistor
R15*	1M	Resistor
TP1	Black	Test Terminal, BLACK; Head=1.3mm
TP2	Black	Test Terminal, BLACK; Head=1.3mm
TP3	Black	Test Terminal, BLACK; Head=1.3mm
TP4	Black	Test Terminal, BLACK; Head=1.3mm
U2	M95128-WMN6P	128Kbit Serial SPI Bus EEPROM
Y1	32K768	Quartz Crystal MD 6.9x1.4x1.3mm; 32.768kHz, 20ppm

* Components not mounted

9. Contact

For the latest version of this document, go to our website at www.melexis.com.

For additional information, please contact our Direct Sales team and get help for your specific needs:

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