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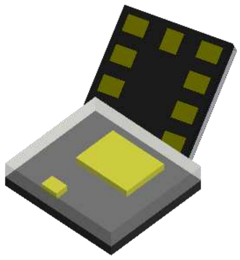
IQS621 Datasheet

Combination sensor with ambient light sensing (ALS), capacitive proximity/touch, Hall-effect sensor & inductive sensing capabilities

The IQS621 ProxFusion® IC is a multifunctional, ambient light sensing (ALS), capacitive, Hall-effect & inductive sensor designed for applications where any or all of the technologies may be required. The IQS621 is an ultra-low power solution designed for short or long term activations through any of the sensing channels. The IQS621 is fully I²C compatible.

Features

- **Unique combination of sensing technologies:**
  - Capacitive sensing
  - Ambient light sensing (ALS)
  - Hall-effect sensing
  - Inductive sensing
- **Capacitive sensing**
  - Full auto-tuning with adjustable sensitivity
  - 2pF to 200pF external capacitive load capability
  - Enhanced temperature stability
- **Ambient light sensing (ALS)**
  - Absolute lux output
  - Human eye response compensated
  - 4-bit ALS range output (0 - 10)
  - Dual threshold detection for day/night indication with hysteresis
- **Hall-effect sensing**
  - On-chip Hall-effect measurement plates
  - Dual direction Hall switch sensor UI
  - 2 level detection (widely variable)
  - Detection range 10mT – 200mT
- **Inductive sensing**
  - 2 Level detection and hysteresis for inductive sensing
  - Only external sense coil required (PCB trace)
- **Multiple integrated UI options** based on years of experience in sensing on fixed and mobile platforms:
  - Proximity / Touch
  - Proximity wake-up
- **A**utomatic **T**uning **I**mplementation (**ATI**) – performance enhancement (10bit)
- Minimal external components
- Standard **I²C** interface
- Optional **RDY indication** for event mode operation
- **Low power consumption:**
  - 75uA (100Hz response, 1ch inductive)
  - 95uA (100Hz response, 2ch Hall)
  - 75uA (100Hz response, 3ch capacitive)
  - 60uA (100Hz response, ALS)
  - 25uA (20Hz response, 1ch inductive)
  - 25uA (20Hz response, 2ch Hall)
  - 20uA (20Hz response, 3ch capacitive)
  - 18uA (20Hz response, ALS)
  - 2.5uA (4Hz response, 1ch cap. wake-up)
- **Supply voltage:** 1.8V to 3.3V
- **Low profile UOLG - 2.8 x 2.5 x 0.6 - 9-pin package**



UOLG 2.8 x 2.5 x 0.6
9-pin
Representations only

Applications

- Mobile electronics (phones/tablets)
- Home automation & lighting control
- White goods and appliances
- Wearable devices
- Human Interface Devices
- Aftermarket automotive[1]

Available Packages	
T_A	UOLG-2.8 x 2.5 x 0.6–9N
-20°C to +85°C	IQS621

[1] The part is not automotive qualified.

Table of Contents

List of abbreviations

AC	– Alternating Current
ACK	– I^2C Acknowledge condition
ALS	– Ambient Light Sensing
ATI	– Automatic Tuning Implementation
BOD	– Brown Out Detection
CS	– Sampling Capacitor
DSP	– Digital Signal Processing
ESD	– Electrostatic Discharge
FOSC	– Main Clock Frequency Oscillator
GND	– Ground
GPIO	– General Purpose Input Output
I^2C	– Inter-Integrated Circuit
IC	– Integrated Circuit
LP	– Low Power
LPOSC	– Low Power Oscillator
LTA	– Long Term Average
LTX	– Inductive Transmitting electrode
MCU	– Microcontroller unit
MSL	– Moisture Sensitive Level
MOQ	– Minimum Order Quantity
NACK	– I^2C Not Acknowledge condition
NC	– Not Connect
NP	– Normal Power
OTP	– One Time Programmable
PMU	– Power Management Unit
POR	– Power On Reset
PWM	– Pulse Width Modulation
QRD	– Quick Release Detection
RDY	– Ready Interrupt Signal
RX	– Receiving electrode
SAR	– Specific Absorption Rate
SCL	– I^2C Clock
SDA	– I^2C Data
SR	– Slew rate
THR	– Threshold
UI	– User Interface
ULP	– Ultra Low Power

1 Introduction

1.1 ProxFusion®

The ProxFusion® sensor series provide all the proven ProxSense® engine capabilities with additional sensors types. A combined sensor solution is available within a single platform.

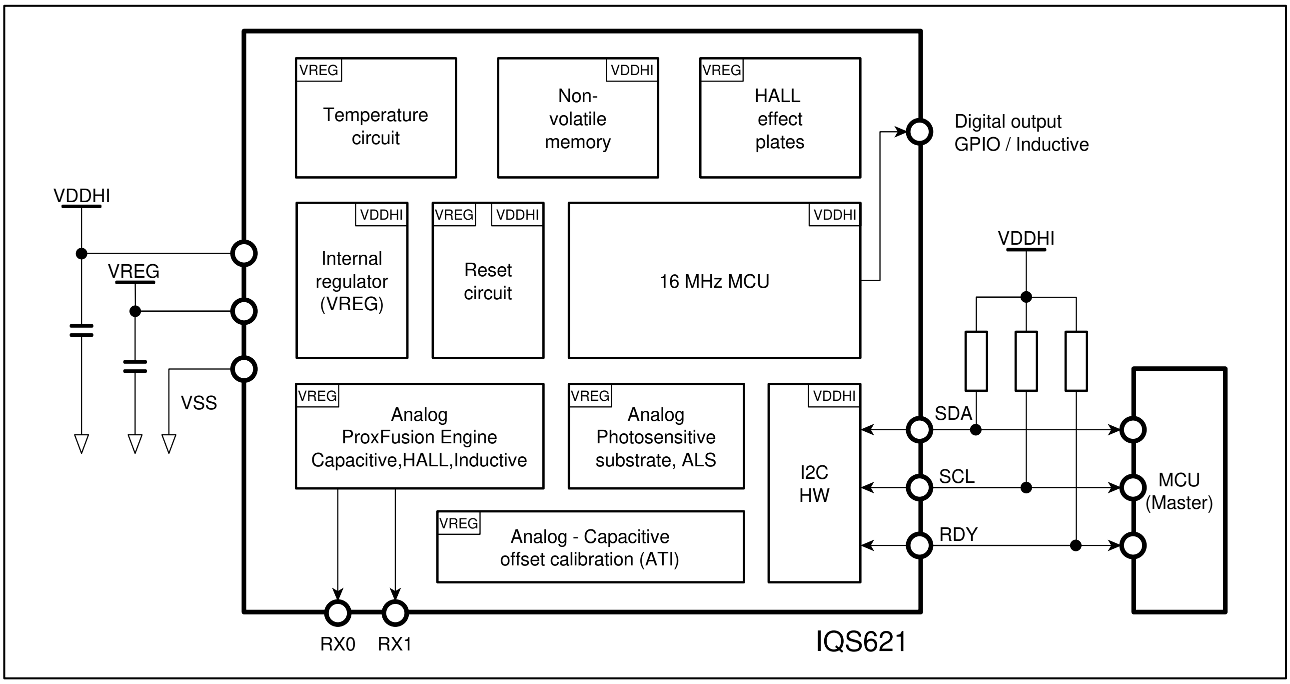


Figure 1.1 IQS621 functional block diagram

1.2 Packaging and Pin-Out

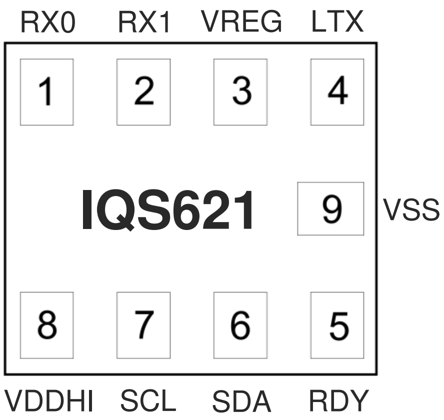


Figure 1.2 IQS621 pin-out (UOLG-2.8x2.5x0.6–9-pin package top view; appearance may differ)

Table 1.1 Pin-out description

IQS621 in UOLG-2.8 x 2.5 x 0.6 – 9-pin			
Pin	**Name**	**Type**	**Function**
1	RX0	Analogue receiving electrode	Connect to conductive area intended for sensor receiving
2	RX1	Analogue receiving electrode	Connect to conductive area intended for sensor receiving
3	VREG	Voltage regulator output	Regulates the system's internal voltage Requires external capacitors to ground
4	LTX	Transmitter electrode	Connect to conductive area intended for sensor transmitting
5	RDY	Digital Input / Output	**RDY** (I^2C Ready interrupt signal)
6	SDA	Digital Input / Output	**SDA** (I^2C Data signal)
7	SCL	Digital Input / Output	**SCL** (I^2C Clock signal)
8	VDDHI	Supply Input	Supply: 1.8V – 3.3V
9	VSS	Signal GND	Common ground reference

1.3 Reference schematic

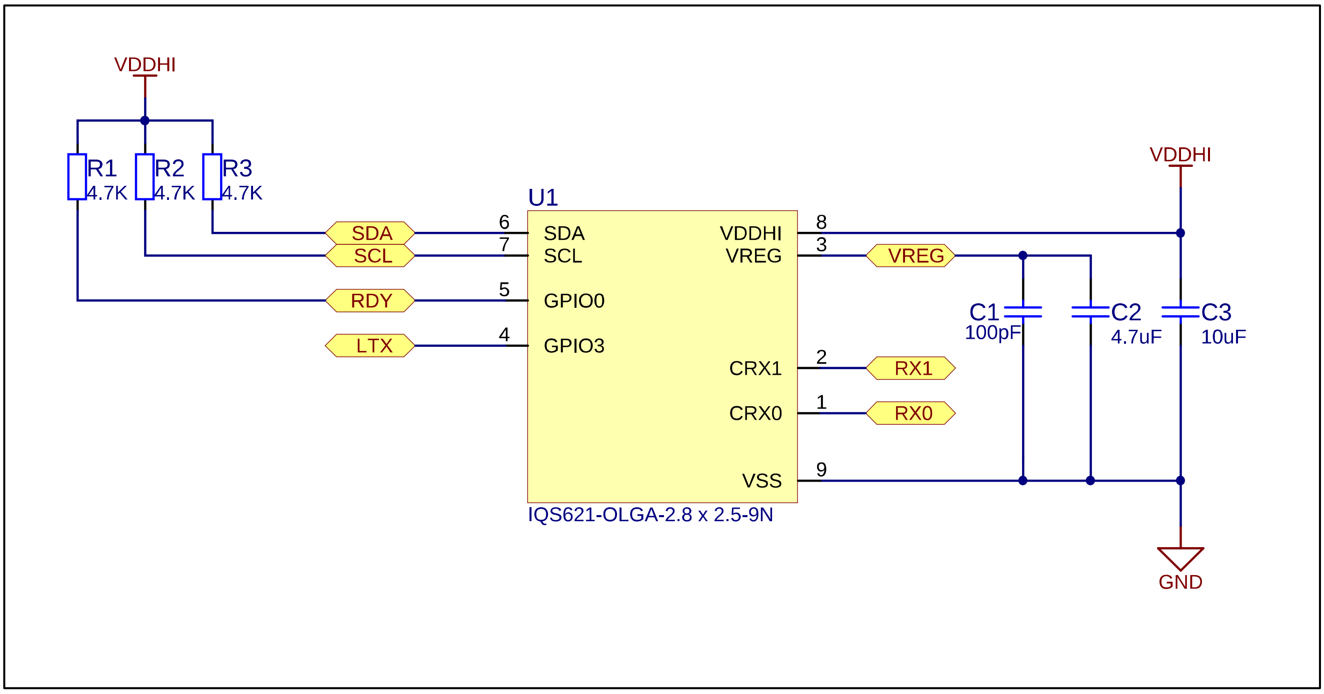


Figure 1.3 IQS621 reference schematic

1.4 Sensor channel combinations

The table below summarizes the IQS621 sensor and channel associations.

Table 1.2 Sensor - channel allocation

Sensor / UI type		CH0	CH1	CH2	CH3	CH4	CH5	CH6
Capacitive	Self capacitive	○	○	○				
	Hysteresis UI		●					
Inductive	Mutual inductive	○	○					
	Hysteresis UI		●					
ALS	Ambient light sensing				●	●		
Hall-effect	Hall-effect switch UI						● Positive	● Negative
Temperature	Temperature trip and output			●				

Key:

○ - Optional implementation

● - Fixed use for UI

1.5 ProxFusion® Sensitivity

The measurement circuitry uses a temperature stable internal sample capacitor (C_S) and internal regulated voltage (V_{REG}). Internal regulation provides for more accurate measurements over temperature variation. The size C_S can be decreased to increase sensitivity on the capacitive channels of the IQS621.

$$Sensitivity \propto \frac{1}{C_s}$$

The Automatic Tuning Implementation (ATI) is a sophisticated technology implemented on the ProxFusion® series devices. It allows for optimal performance of the devices for a wide range of sense electrode capacitances, without modification or addition of external components. The ATI functionality ensures that sensor sensitivity is not affected by external influences such as temperate, parasitic capacitance and ground reference changes.

The ATI process adjusts three values (Coarse multiplier, Fine multiplier, Compensation) using two parameters (ATI base and ATI target) as inputs. A 10-bit compensation value ensures that an accurate target is reached. The base value influences the overall sensitivity of the channel and establishes a base count from where the ATI algorithm starts executing. A rough estimation of sensitivity can be calculated as:

$$Sensitivity \propto \frac{Target}{Base}$$

As seen from this equation, the sensitivity can be increased by either increasing the Target value or decreasing the Base value. A lower base value will typically result in lower multipliers and more compensation would be required. It should, however, be noted that a higher sensitivity will yield a higher noise susceptibility. Refer to Appendix B: Hall ATI for more information on Hall ATI.

2 Capacitive sensing

2.1 Introduction to ProxSense®

Building on the previous successes from the ProxSense® range of capacitive sensors, the same fundamental sensor engine has been implemented in the ProxFusion® series.

The capacitive sensing capabilities of the IQS621 include:

- Self capacitive sensing.
- Maximum of 2 capacitive channels to be individually configured.
  - Prox and touch adjustable thresholds
  - Individual sensitivity setups
  - Alternative ATI modes
- Discreet button UI (always enabled):
  - Fully configurable 2 level threshold setups for prox & touch activation levels.
  - Customizable filter halt time.
- Hysteresis UI:
  - 4 Optional prox and touch activation hysteresis selections
  - Fully configurable 2 level threshold setups for prox & touch activation levels.
  - Configurable filter halt threshold.

2.2 Channel specifications

The IQS621 provides a maximum of 2 channels available to be configured for capacitive sensing. Each channel can be setup separately according to the channel's associated settings registers.

There are two distinct capacitive user interfaces available to be used.

a) Discreet proximity/touch UI (always enabled)

b) Hysteresis UI (fixed use of channel 1)

Table 2.1 Capacitive sensing - channel allocation

Sensor/UI type	CH0	CH1	CH2	CH3	CH4	CH5	CH6
Self capacitive	o	o					
Hysteresis UI		•					

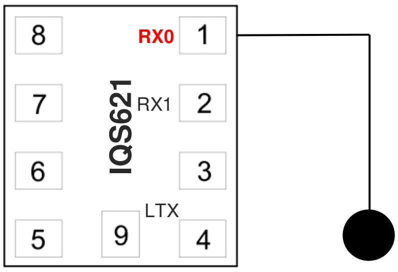
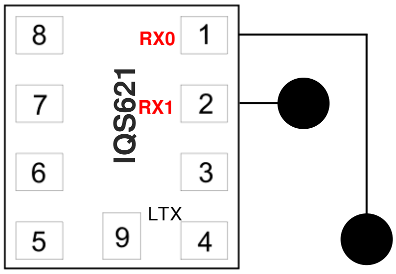
Key:

o - Optional implementation
• - Fixed use for UI

2.3 Hardware configuration

In the table below are multiple options of configuring sensing (RX) and transmitting (LTX) electrodes to realize different implementations (combinations not shown).

Table 2.2 Capacitive sensing hardware description

	Self capacitive
1 button	
2 buttons	

2.4 Software configuration

2.4.1 Registers to configure for capacitive sensing:

Table 2.3 Capacitive sensing settings registers

Address	Name	Description	Recommended setting
0x40 0x41	ProxFusion Settings 0	Sensor mode and configuration of each channel.	Sensor mode should be set to capacitive mode An appropriate RX and TX should be chosen
0x42 0x43	ProxFusion Settings 1	Channel settings for the ProxSense sensors	Full ATI is recommended for fully automated sensor tuning.
0x44 0x45	ProxFusion Settings 2	ATI settings for ProxSense sensors	ATI target should be more than ATI base to achieve an ATI
0x46 0x47	ProxFusion Settings 3	Additional Global settings for ProxSense sensors	None
0x48	ProxFusion Settings 4	Filter settings	Keep AC filter enabled
0x49	ProxFusion Settings 5	Advance sensor settings	None
0x50 0x52	Proximity threshold	Proximity Thresholds for all capacitive channels (except for SAR active on channel 0)	Preferably more than touch threshold
0x51 0x53	Touch threshold	Touch Thresholds for all capacitive channels	None
0x54	ProxFusion discrete UI halt time	Halt timeout setting for all capacitive channels	None

2.4.2 Registers to configure for the hysteresis UI:

Table 2.4 Hysteresis UI settings registers

Address	Name	Description
0x48	ProxFusion settings 4	Hysteresis UI enable command
0x60	Hysteresis UI Settings	Hysteresis settings for the prox and touch thresholds
0x61	Hysteresis UI filter halt threshold	Threshold setting to trigger a filter halt for on channel 1
0x62	Hysteresis UI proximity threshold	Proximity threshold used for hysteresis UI detections on channel 1
0x63	Hysteresis UI touch threshold	Touch threshold used for hysteresis UI detections on channel 1

2.4.3 Example code:

Example code for an Arduino Uno can be downloaded at:

www.azoteq.com//images/stories/software/IQS62x_Demo.zip

2.5 Sensor data output and flags

The following registers should be monitored by the master to detect capacitive sensor activations:

a) The **Global events register (0x11)** will show the IQS621's main events. Bit0 is dedicated to the ProxFusion activations.

Global events (0x11)								
Bit Number	7	6	5	4	**3**	2	1	**0**
Data Access	-	R	R	R	**R**	R	R	**R**
Name	-	POWER MODE EVENT	SYS EVENT	TEMP EVENT	**HYSTE-RESIS UI EVENT**	ALS EVENT	HALL EVENT	**PROX SENSE EVENT**

b) The **ProxFusion UI flags (0x12)** provide more detail regarding the capacitive sensor outputs. An individual prox and touch output bit for channel 0 and 1 is provided in the ProxFusion UI flags register.

ProxFusion UI flags (0x12)								
Bit Number	7	6	**5**	**4**	3	2	**1**	**0**
Data Access	-	-	**R**	**R**	-	-	**R**	**R**
Name	-	-	**CH1_T**	**CH0_T**	-	-	**CH1_P**	**CH0_P**

c) The **Hysteresis UI flags (0x12)** provide more detail regarding the capacitive sensor outputs for the Hysteresis UI. An individual prox and touch output bit for channel 1 is provided in the Hysteresis UI flags register.

Hysteresis UI flags (0x13)								
Bit Number	7	6	5	4	3	**2**	**1**	**0**
Data Access	-	-	-	-	-	**R**	**R**	**R**
Name	-	-	-	-	-	**Signed output**	**TOUCH**	**PROX**

a) The **Hysteresis UI output (0x14 & 0x15)** provide the exact Hysteresis UI output value.

Hysteresis UI output (0x14/0x15)								
Bit Number	7	6	5	4	3	2	1	0
Data Access	R	R	R	R	R	R	R	R
Name	Hysteresis UI output low byte							
Bit Number	7	6	5	4	3	2	1	0
Data Access	R	R	R	R	R	R	R	R
Name	Hysteresis UI output high byte							

3 Inductive sensing

3.1 Introduction to inductive sensing

The IQS621 provides inductive sensing capabilities in order to detect the presence of metal/metal-type objects. Prox and touch thresholds are widely adjustable and individual hysteresis settings are definable for each using the Hysteresis UI.

3.2 Channel specifications

The IQS621 requires both Rx sensing pins as well as the Tx pin for mutual inductive sensing. Channel 1 is dedicated to the Hysteresis UI.

There are two distinct inductive user interfaces available to be used.

- Discreet button UI (always enabled):
  - Fully configurable 2 level threshold Prox & Touch activation.
  - Customizable UI halt time.
- Hysteresis UI:
  - Fully configurable 2 level threshold Prox & Touch activation.
  - 4 Hysteresis selection options
  - Customizable UI halt time.
  - Configurable filter halt threshold.

Table 3.1 Mutual inductive sensor – channel allocation

Mode	CH0	CH1	CH2	CH3	CH4	CH5	CH6
Mutual inductive	o	o					
Hysteresis UI		•					

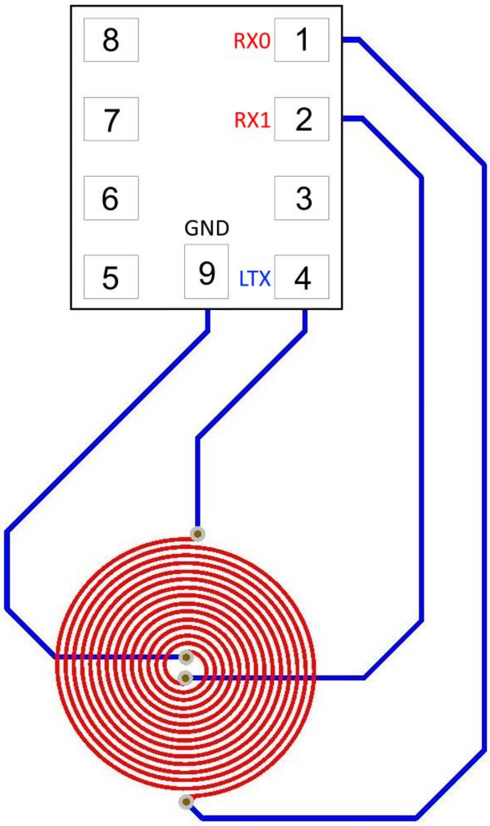
Key:

o - Optional implementation
• - Fixed use for UI

3.3 Hardware configuration

Table 3.2 Mutual inductive hardware description

Mutual inductive



3.4 Software configuration

3.4.1 Registers to configure for inductive sensing:

Table 3.3 Inductive sensing settings registers

Address	Name	Description	Recommended setting
0x41	ProxFusion Settings 0	Sensor mode and configuration of channel 1.	Sensor mode should be set to inductive mode Both RX0 and RX1 should be active on channel 1
0x43	ProxFusion Settings 1	Channel 1 settings for the inductive sensor	Full ATI is recommended for fully automated sensor tuning.
0x45	ProxFusion Settings 2	ATI settings for the inductive sensor	ATI target should be more than ATI base to achieve an ATI
0x47	ProxFusion Settings 3	Additional settings for the inductive sensor	None
0x48	ProxFusion Settings 4	UI enable command and filter settings	Enable the Hysteresis UI. Filter according to application.

3.4.2 Registers to configure for the hysteresis UI:

Table 3.4 Hysteresis UI settings registers

Address	Name	Description
0x48	ProxFusion settings 4	Hysteresis UI enable command
0x60	Hysteresis UI Settings	Hysteresis settings for the prox and touch thresholds
0x61	Hysteresis UI filter halt threshold	Threshold setting to trigger a filter halt for on channel 1
0x62	Hysteresis UI proximity threshold	Proximity threshold used for hysteresis UI detections on channel 1
0x63	Hysteresis UI touch threshold	Touch threshold used for hysteresis UI detections on channel 1

3.4.3 Example code:

Example code for an Arduino Uno can be downloaded at:

www.azoteq.com//images/stories/software/IQS62x_Demo.zip

3.5 Sensor data output and flags

The following registers can be monitored by the master to detect inductive sensor related events.

a) **Global events (0x11)** to prompt for inductive sensor activation. Bit3 denoted as **HYSTERESIS UI EVENT** will indicate the detection of a metal object using the inductive sensing.

Global events (0x11)								
Bit Number	7	6	5	4	**3**	2	1	0
Data Access	-	R	R	R	**R**	R	R	R
Name	-	POWER MODE EVENT	SYS EVENT	TEMP EVENT	**HYSTE-RESIS UI EVENT**	ALS EVENT	HALL EVENT	PROX SENSE EVENT

b) The **Hysteresis UI flags (0x13)** register provides the classic prox/touch two level activation outputs as well as a **signed output** bit to distinguish between whether the counts have risen or fallen below the LTA (direction of counts).

Hysteresis UI flags (0x13)								
Bit Number	7	6	5	4	3	**2**	**1**	**0**
Data Access	-	-	-	-	-	**R**	**R**	**R**
Name	-	-	-	-	-	**Signed output**	**TOUCH**	**PROX**

c) **Hysteresis UI output (0x14 - 0x15)** registers will provide a combined 16-bit value to acquire the magnitude of the inductive sensed object.

Hysteresis UI output (0x14 - 0x15)								
Bit Number	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Data Access	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Name	**Hysteresis UI output low byte**							
Bit Number	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Data Access	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Name	**Hysteresis UI output high byte**							

4 Ambient light sensing (ALS)

4.1 Introduction to ambient light sensing

The IQS621 employs two light sensitive semi-conductor areas on chip to realise an ambient light sensor. The sensor capabilities include:

- Absolute Lux output value
- 4-bit ALS range output (0 – 10)
- Human eye response and IR compensated
- Dual threshold detection for day/night indication with hysteresis
  - 8-bit individual definable light and dark trigger thresholds
  - Dark threshold range: 0 – 1020 Lux in steps of 4 Lux.
  - Light threshold range: 0 – 4080 Lux in steps of 16 Lux.
- CS size, multipliers and charge frequency fully adjustable.
- **Ch3 – ALS channel 1:**
  - Assigned to Wide spectrum ALS.
- **Ch4 – ALS channel 2:**
  - Assigned to narrow spectrum ALS.

4.2 Channel specifications

The IQS621 provides 2 dedicated channels to ALS conversions.

Table 4.1 Ambient light sensing - channel allocation

Sensor/UI type	CH0	CH1	CH2	CH3	CH4	CH5	CH6
ALS				•	•		

Key:

○ - Optional implementation

● - Fixed use for UI

4.3 Hardware configuration

No external hardware required. Package placement and lens clearance required.

4.4 Software configuration

4.4.1 Registers to configure for ALS sensing:

Table 4.2 ALS sensing settings registers

Address	Name	Description	Recommended setting
0x70	ALS Settings 0	ALS conversion settings and filter configuration settings	None
0x71	ALS Settings 1	ALS channel ATI target and multiplier calibration value	None

4.4.2 Registers to configure for the ALS UI:

Table 4.3 ALS UI settings registers

Address	Name	Description
0x80	ALS dark threshold	Threshold setting value to detect a dark condition
0x81	ALS light threshold	Threshold setting value to detect a light condition
0x82	ALS to Lux divider	Calibration value used to provide an absolute Lux output from ALS measurements
0x83	ALS IR divider	Calibration value used to compensate for the influence of IR spectrum radiation in ALS measurements

4.4.3 Example code:

Example code for an Arduino Uno can be downloaded at:

www.azoteq.com//images/stories/software/IQS62x_Demo.zip

4.5 Sensor data output and flags

The following registers can be monitored by the master to detect ALS related events.

a) The **ALS EVENT (bit 2)** in the **Global events (0x11)** register are dedicated to ALS related events. This bit will toggle when any change in ALS flags occurs and is automatically cleared after reading the registers.

Global events (0x11)								
Bit Number	7	6	5	4	3	**2**	1	0
Data Access	-	R	R	R	R	**R**	R	R
Name	-	POWER MODE EVENT	SYS EVENT	TEMP EVENT	HYSTE-RESIS UI EVENT	**ALS EVENT**	HALL EVENT	PROX SENSE EVENT

b) The **ALS UI flags (0x16)** register provides a 4-bit ALS Range value to indicate the current ALS reading **(ALS range value bit 0-3)**. An additional **LIGHT/DARK** bit **(bit 7)** is used to indicate the ALS sensor status measured against the two-configurable light/dark threshold values in registers 0x80 and 0x81. The user can thus setup his own triggering thresholds for light and dark perceived readings and incorporate a hysteresis using this UI.

ALS UI flags (0x16)								
Bit Number	**7**	6	5	4	**3**	**2**	**1**	**0**
Data Access	**R**	-	-	-	**R**	**R**	**R**	**R**
Name	**LIGHT/ DARK**	Reserved			**ALS range value**			

c) The **ALS UI output (0x17 - 0x18)** registers provide a 16-bit value of the ALS amplitude in units of Lux as obtained by the current sensor measurement.

ALS UI output (0x17 - 0x18)								
Bit Number	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Data Access	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Name	**ALS UI output low byte**							
Bit Number	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Data Access	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Name	**ALS UI output high byte**							

5 Hall-effect sensing

5.1 Introduction to Hall-effect sensing

The IQS621 has two internal Hall-effect sensing plates (on chip). No external sensing hardware is required for Hall-effect sensing.

The Hall-effect measurement is essentially a current measurement of the induced current through the Hall-effect-sensor plates produced by the magnetic field passing perpendicular through each plate.

Advanced digital signal processing is performed to provide sensible output data.

- Two threshold levels are provided (proximity & touch).
- Hall-effect output is linearized by inverting signals.
- North/South field direction indication provided.
- Differential Hall-effect sensing:
  - Removes common mode disturbances
  - North-South field indication

5.2 Channel specifications

Channels 5 and 6 are dedicated to Hall-effect sensing. Channel 5 performs the positive direction measurements and channel 6 will handle all measurements in the negative direction. These two channels are used in conjunction to acquire differential Hall-effect data and will always be used as input data to the Hall-effect UI's.

There is a dedicated Hall-effect user interface:

a) Hall-effect switch UI

Table 5.1 Hall-effect sensor – channel allocation

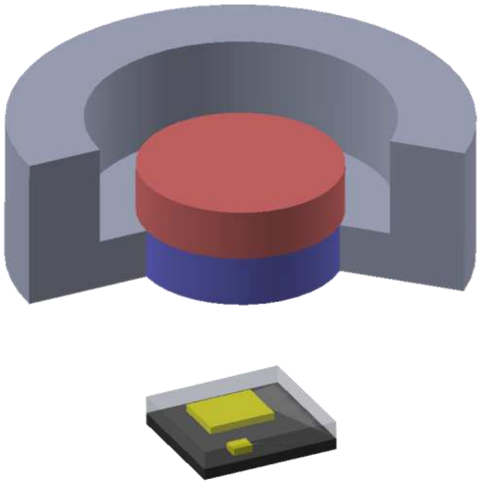
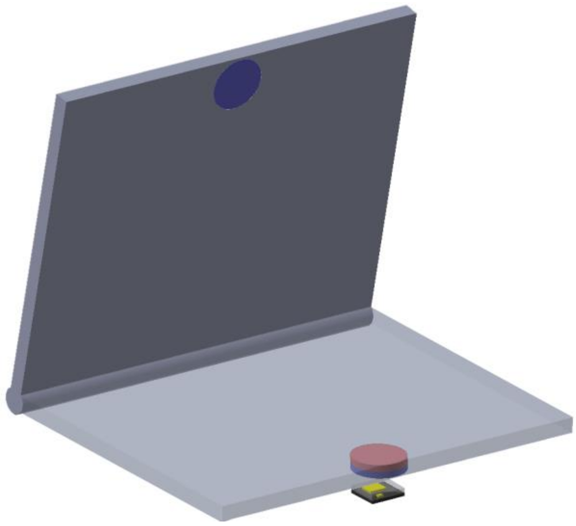
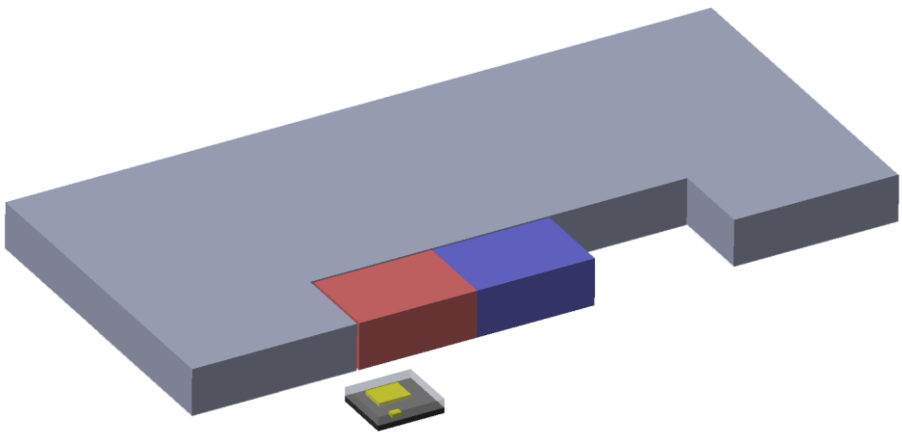
Sensor/UI type	CH0	CH1	CH2	CH3	CH4	CH5	CH6
Hall-effect switch UI						• Positive	• Negative

Key:

○ - Optional implementation
• - Fixed use for UI

5.3 Hardware configuration

Rudimentary hardware configurations.

	Axially polarized magnet (linear movement or magnet presence detection)
Hall-effect push switch	
Smart cover	
	Bar magnet (linear movement and magnet field detection)
Slide switch	

5.4 Software configuration

5.4.1 Registers to configure for Hall-effect sensing:

Table 5.2 Hall-effect sensing settings registers

Address	Name	Description	Recommended setting
0x90	Hall-effect settings 0	Charge frequency divider and ATI mode settings	Charge frequency adjusts the conversion rate of the Hall-effect channels. Faster conversions consume less current. Full ATI is recommended for fully automated sensor tuning.
0x91	Hall-effect settings 1	ATI base and target selections	ATI target should be more than ATI base to achieve an ATI
0xA0	Hall-effect switch UI settings	Various settings for the Hall-effect switch UI	None
0xA1	Hall-effect switch UI proximity threshold	Proximity Threshold for UI	Less than touch threshold
0xA2	Hall-effect switch UI touch threshold	Touch Threshold for UI	None

5.4.2 Example code:

Example code for an Arduino Uno can be downloaded at:

www.azoteq.com//images/stories/software/IQS62x_Demo.zip

5.5 Sensor data output and flags

The following registers can be monitored by the master to detect Hall-effect related events.

d) The **HALL_EVENT (bit 1)** in the **Global events (0x11)** register are dedicated to Hall-effect related events. This bit will toggle when either one of the three Hall flags is set and is automatically cleared after reading the registers.

Global events (0x11)								
Bit Number	7	6	5	4	3	2	**1**	0
Data Access	-	R	R	R	R	R	**R**	R
Name	-	POWER MODE EVENT	SYS EVENT	TEMP EVENT	HYSTE-REISIS UI EVENT	ALS EVENT	**HALL EVENT**	PROX SENSE EVENT

e) The **Hall UI flags (0x19)** register provides the standard two level activation output (prox and touch) as well as a **HALL_N/S** bit to indicate the magnet polarity orientation.

Hall-effect UI flags (0x19)								
Bit Number	7	6	5	4	3	**2**	**1**	**0**
Data Access	-	-	-	-	-	**R**	**R**	**R**
Name	-	-	-	-	-	**HALL TOUT**	**HALL POUT**	**HALL N/S**

f) The **Hall UI output (0x1A - 0x1B)** registers provide a 16-bit value of the Hall-effect amplitude detected by the sensor.

Hall-effect UI output (0x1A - 0x1B)								
Bit Number	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Data Access	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Name	**Hall-effect UI output low byte**							
Bit Number	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**
Data Access	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
Name	**Hall-effect UI output high byte**							

6 Temperature monitoring

6.1 Introduction to temperature monitoring

The IQS621 provides temperature monitoring capabilities which can be used for temperature change detection in order to ensure the integrity of other sensing technology. The use of the temperature sensor is primarily to reseed other sensor channels to account for sudden changes in environmental conditions.

The IQS621 uses a linearly proportional to absolute temperature sensor for temperature data. The temperature output data is given by,

$$T = \frac{a.2^{19}}{b.CH_2} + c$$

Where a, b and c are constants that can be determined to provide a required output data as a function of device temperature. Additionally, the channel setup must be calculated during a testing process.

Table 6.1 Temperature calibration setting registers and ranges

Parameter		IQS621		
Name	**Description**	**Register**		**Range**
a	$Multiplier$	0xC2	Higher nibble	1 – 16
b	$Divider$		Lower nibble	1 – 16
c	$Offset$	0xC3		0 – 255

6.2 Channel specifications

The IQS621 requires only external passive components to do temperature monitoring (no additional circuitry/components required). The temperature UI will be executed using data from channel 2.

Table 6.2 Temperature monitoring – channel allocation

Sensor / UI type	CH0	CH1	CH2	CH3	CH4	CH5	CH6
Temperature trip and output			•				

Key:
- ○ - Optional implementation
- • - Fixed use for UI

6.3 Hardware configuration

No additional hardware required. Temperature monitoring is realized on-chip.

6.4 Software configuration

6.4.1 Registers to configure for temperature sensing:

Table 6.3 Temperature sensing settings registers

Address	Name	Description	Recommended setting
0xC0	Temperature UI settings	Channel reseed settings	Reseed enable should be set
0xC1	Multipliers channel 2	Temperature sensor channel multiplier selection	Dependent on calibration step
0xC2	Temperature calibration data 0	4-bit Multiplier (a+1) and divider (b+1) calibration values	Requires sample calibration
0xC3	Temperature calibration data 1	8-bit Offset (c) calibration value	Requires sample calibration