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Evaluation Hardware/Software User Manual for ALS and Proximity Sensors

Introduction

The Optical Sensor Evaluation Kit (OSEK) is designed to evaluate the performance of various Optical Sensor devices. This evaluation kit includes pads (footprints) for various different Intersil Optical Sensor package types: 4/6/8/10-lead ODFN. Only one device type is mounted on the board for evaluation purposes. A fully assembled and tested evaluation board is provided.

The OSEK is accompanied by a graphical user interface (GUI) that allows real-time sensor evaluation. The GUI facilitates evaluation of parameters, such as power consumption, lux measurement and perform interrupt function. Data can be viewed on the GUI and/or saved to a text file for future analysis. The program is menu driven and offers a graphical user interface (GUI) complete with control buttons and status displays. The GUI software is compatible with Windows XP®, Windows Vista®, and Windows® 7. This provides a simple user interface for exercising the device features.

OSEK consists of a universal motherboard that can interface with multiple satellite boards. The first kit ordered must include a motherboard. Subsequently, additional product-specific satellite boards may be ordered for use with the same motherboard. Product-specific firmware and GUI are supplied for all supported products. The system (MCU, DUT, and IR LED's) is powered directly from the universal serial bus (USB) or from a single-supply voltage of 2.25V to 3.6V. The OSEK must be connected to a computer through the USB port for the system to function. The system uses a USB MCU to communicate to the DUT via I²C/SMBus interface.

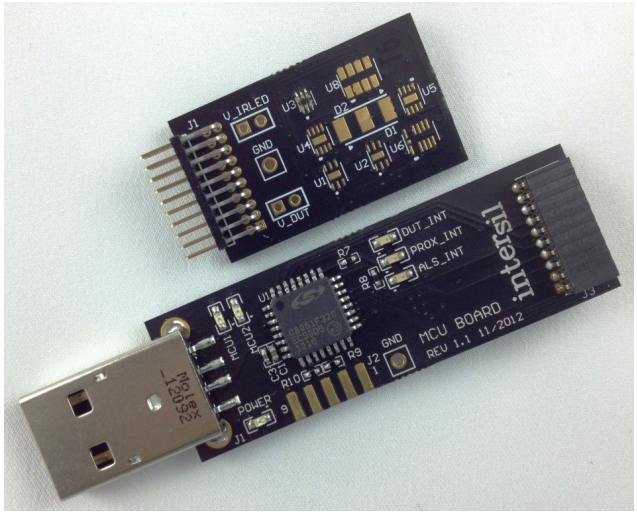


FIGURE 1. EVALUATION BOARDS

Reference Documents

Documentation for individual devices can be found in the following link:

http://www.intersil.com/en/products/optoelectronics.html

Evaluation Package (Online Order)

The OSEK consists of the hardware, software, and documentation listed in the following:

- MCU Board
- Evaluation Board (DUT Board)
- Evaluation Software (Online)
- User Guide (Online)
- Quick-Start Guide (Online)
- Product Datasheet (Online)

System Requirements

- Windows 98/NT/2000/XP/VISTA/WIN7
- Available USB Port

Installation of the Graphical User Interface (GUI) Software and USB Driver

Download the application file from the link provided in the "Reference Documents" section. Once the application is downloaded from the website, double-click the file to start installing the GUI. The user will be greeted by the screen shown in Figure 2. Continue through the installer and read the instructions. Figure 2 through Figure 7 show the complete installation process

The USB Evaluation Board should *not* be connected via the USB until after the installation has satisfactorily completed. The installation program places the user interface software in the following directory.

C:\Program Files\Intersil\Intersil_ISL29XXX_HID

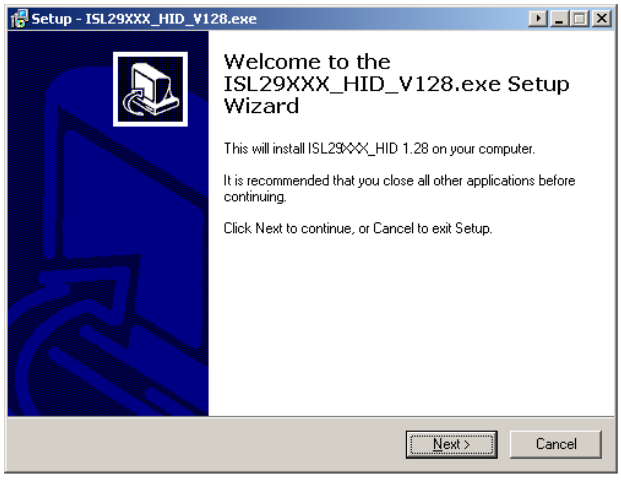


FIGURE 2. INSTALLATION WELCOME SCREEN

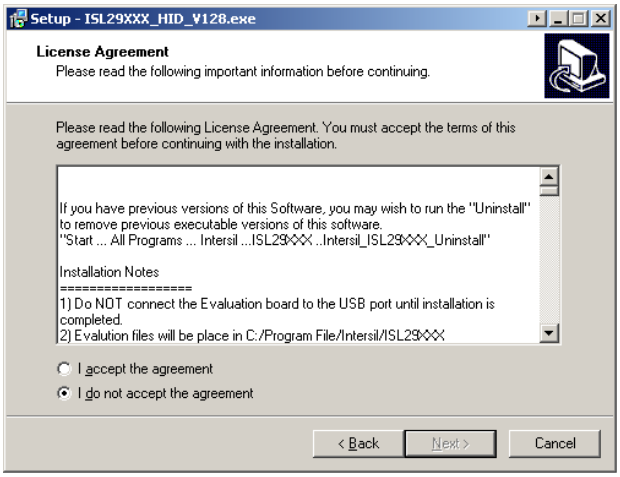


FIGURE 3. INSTALLATION LICENSE AGREEMENT SCREEN

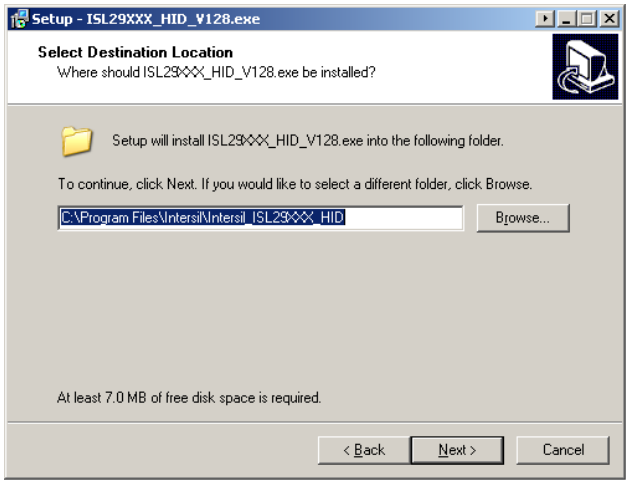


FIGURE 4. INSTALLATION FOLDER LOCATION SCREEN

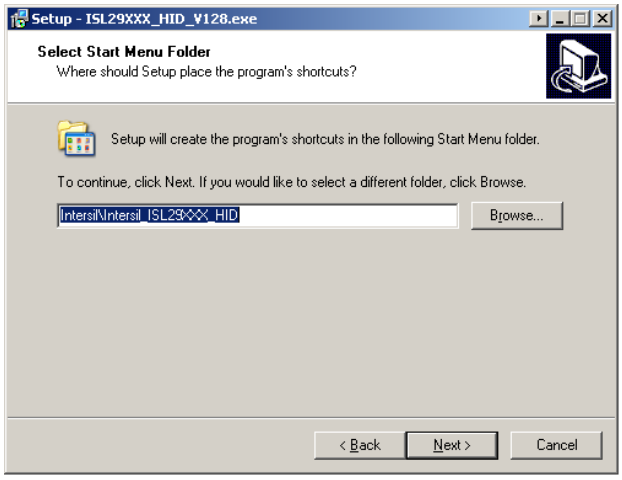


FIGURE 5. INSTALLATION START MENU SCREEN

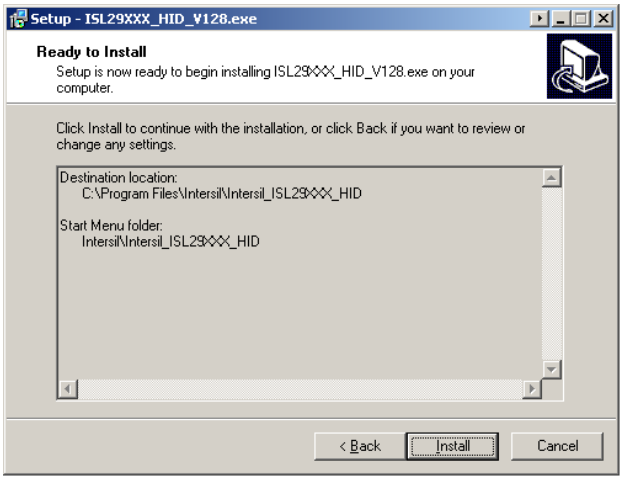


FIGURE 6. INSTALLATION READY TO INSTALL SCREEN

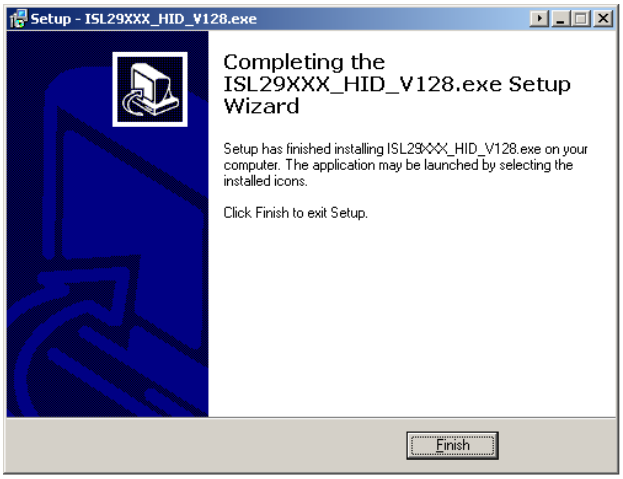


FIGURE 7. INSTALLATION READY TO INSTALL SCREEN

Running Program for ISL29011 Family

- To open the program, go to the “Start” menu, as shown in Figure 3 (Start → Intersil → Intersil_29XXX_HID → Intersil_29XXX_HID)
- Once you have double clicked the program, the window displayed in Figure 8 should open

The GUI supports multiple intersil Optical Sensors.

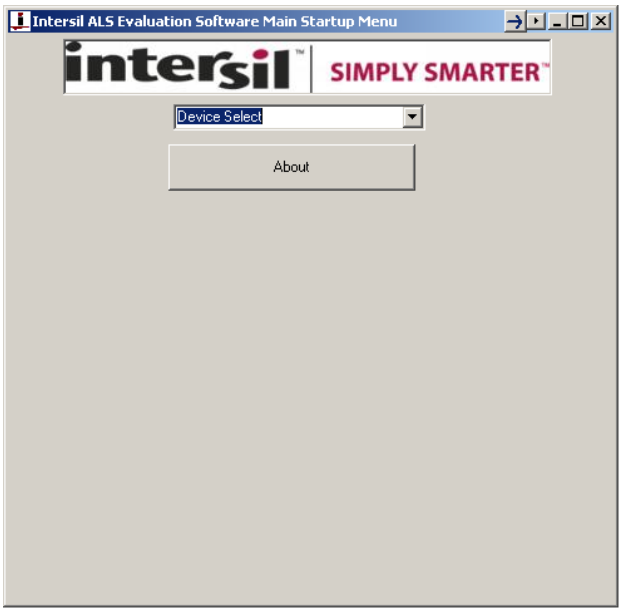


FIGURE 8. IGUI WELCOME WINDOW

- Go to “Device Select” tab and select whichever Device you have connected to your computer; for this example we will use “ISL29023”, as shown in Figure 8. The “ALS/ IR Sensor Evaluation Software” window should open. This is the main window in which all demonstrations will be done for this specific Sensor.
- **USB Communication** (Hardware) - Once the evaluation board is connected to the PC, J1 on the PCB “Power” should light up. If the LED is not ON, please check your connection.
- **USB Communication** (Software) - Check to make sure the LED on the GUI next to “USB COMM” is green, as shown in Figure 9. If it is not green, please check your connection.

FIGURE 9. USB CONNECTION VERIFICATION WINDOW

- **Test Communication** with the IC by clicking the button on the GUI shown in Figure 9; if it shows “Good”, then the Hardware and Software are properly set up; if it says “fail”, then check your connections. If the problem still persists, then you may want to restart the software. Figure 10 shows the error message that displays if the evaluation board is improperly attached.

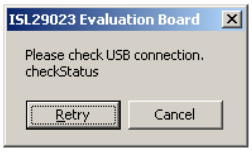


FIGURE 10. USB CONNECTION ERROR

- From the menu shown in Figure 11 on the left of the GUI, choose a specific device **“Operation”** in which you would like the device to operate. Detailed explanation of the operating modes can be found in the datasheets of the individual devices. Table 1 summarizes the different modes.

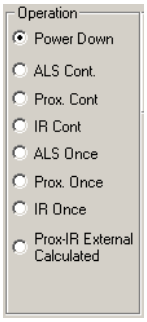


FIGURE 11. OPTICAL SENSOR OPERATING MODE SELECTION

TABLE 1. OPERATING MODES

MODE	EXPLANATION
Power-down	Turn off and keep data in registers.
ALS Cont.	Ambient Light Sense continuously and continue to refresh registers.
Prox. Cont.	Proximity Infrared Sense continuously and continue to refresh registers; Flagging is triggered by Interrupt (Scheme1).
IR Cont.	Infrared Sense continuously and continue to refresh registers.
ALS Once	Ambient Light Sense for one conversion then Power-down.
Prox. Once	Proximity Infrared Sense for one conversion then Power-down; Flagging is triggered by Interrupt.
IR Once	Infrared Sense for one conversion then Power-down.
Prox-IR. External Calculation	Proximity Infrared Sense continuously and continue to refresh registers; Flagging is triggered by Interrupt (Scheme0).

- **Integration Time** in Figure 12, corresponds to the resolution of the internal ADC and the number of bits allocated to representing Count. Higher resolution (more bits) requires a large number of counts and will need longer acquisition (integration) time.

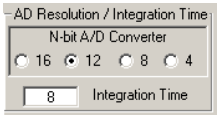


FIGURE 12. ADC RESOLUTION AND INTEGRATION TIME

- **Sensitivity-Range Select** (Figure 13) allows us to choose the sensitivity of the sensor based on external conditions/object detection. For example, a really bright object would require a higher range (i.e. 64000), versus a dark object, which would require a low range (i.e. 1000). Higher range reduces photo detector sensitivity

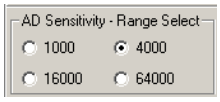


FIGURE 13. SENSITIVITY RANGE SELECTION

The section shown in Figure 14 allows the user to choose either external prox or internal prox calculation.

- Scheme0(external prox): Not recommended because subtraction is done by the software.
- Scheme1(internal prox): Recommended because subtraction performed by system on chip.

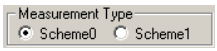


FIGURE 14. EXTERNAL AND INTERNAL PROXIMITY SCHEME SELECTION

The section shown in Figure 15 is for proximity mode:

- **Source Current** allows you to adjust the IR LED driving current. A greater current allows for the detection of objects at farther distances.
- **IR Modulation Frequency** allows you to modulate the IR LED driving current. Increasing the frequency parameter allows for better noise immunity.

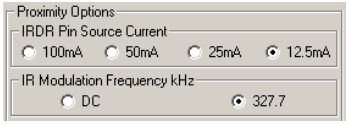


FIGURE 15. PROXIMITY SOURCE SELECTION

This section shown in Figure 16 displays data of Device Registers:

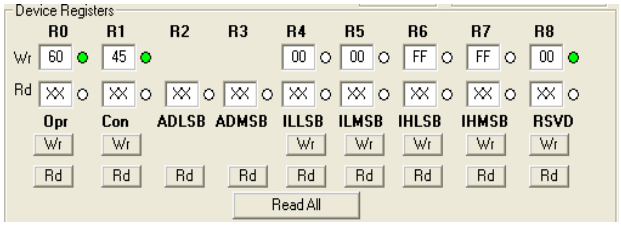


FIGURE 16. WRITE AND READ INDIVIDUAL DEVICE REGISTER

- Register 0x00 – Configure Mode I

IC register 0x01 controls the modes such as ALS/IR/Prox and Interrupt flag and Interrupt persistence of the part, which are explained in detail in the data sheet.

- Register 0x01 – Configure Modes II

IC register 0x02 controls the ranges and resolutions of the part and also Scheme for Proximity.

- Register 0x02 and 0X03

Data will be stored to these registers.

- Registers 0x03 to 0x07 – Interrupt Thresholds

The PROX interrupt and ALS thresholds are stored in registers 0x03 to 0x07. They can be edited by writing values to the “Interrupt Limits” box and clicking “write”. See the IC data sheet for more information on interrupt limits.

The section shown in Figure 17 allows the user to set the interrupt trip-point, which acts as an alarm/monitoring function to determine whether the ADC count exceeds the upper/lower limit.

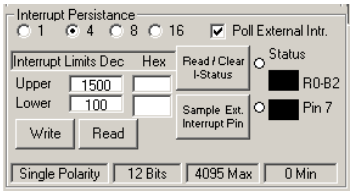


FIGURE 17. PERSISTANCE SELECTION

Interrupt Persistence	Sets the number of times the upper limit needs to be exceeded or lower limit needs to be subceeded. Once the allotted number of times is achieved, an alarm/interrupt will flag
Interrupt Limits	Type the upper threshold for the interrupt in the top box (Max = 65535 for Int. Time = 16; Max = 4095 for Int. Time = 12) Type the lower threshold for the interrupt in the bottom box (Min = 0, for either Int. Time)
Write	Stores value to memory in Registers 4-7
Read	Read limit values stored in Registers 4-7
Read/Clear I-Status	Checks the 2nd bit of Register 0 to determine Interrupt status, whether interrupt thresholds have been triggered or not. It then displays the results in the “Status” section. The R0-B2 box displays the status of the interrupt. To clear the interrupt status, click 2 times on “Read/Clear” button. - Green light means the button is on and value from bit 2 from R0 has been read - Square light displays status; if black then interrupt is off/not triggered yet; if red then interrupt has been triggered
Sample Ext. Interrupt Pin	Samples the external Pin 7 on package of the IC - Green light means, button is on and is displaying output of Interrupt pin (7th pin) - Square light displays the status; black means trigger hasn’t been triggered yet - Red means interrupt has just been triggered
Poll External Intr.	Allows for checking of External Interrupt Status while sampling data.

To use:

1. Choose Interrupt Persistence value (we recommend 8)
2. Enter a decimal number for the Upper Limit. Enter a decimal number for the Lower Limit.
3. The Upper Limit must be greater than the Lower Limit. The values for the limits depend on the application, the configuration of other options, and the distance at which you choose to flag.
4. Click on “Write” and then click on “Read” and verify that the desired limit values are correct (verify that the values entered for intended limits are the same values in the field box after clicking on “Read”). If not, repeat Steps 2 and 3.
5. Double click “Read/Clear I-Status” to clear status.
6. Now you may choose to manually poll the Interrupt pin (pin 7 on package), or for it to happen automatically. To do it manually, simply click on “Sample Ext. Interrupt Pin” when desired. To do it automatically, ensure that the “Poll External Intr.” box is selected.
7. Interrupt is set up now and you may begin collecting data. Data is collected within the Upper Limit and Lower Limit. The black box means unflagged status. On the other hand, if the data is collected either above the Upper Limit or the lower of the Lower Limit, then the black block will be red, which means the flag has been triggered.

- **Collect Data Graphical Real Time Data** allows you to sample data (whether ALScont, IRcont, ALS Once or IR Once). Samples are now being taken and are being plotted, and appropriate values are displayed on the right in the corresponding box.
  - “**Stop Data Acquisition**” stops sampling of data.

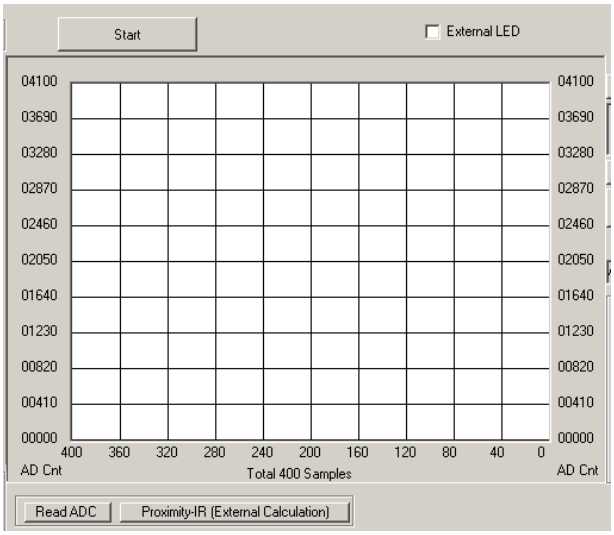


FIGURE 18. LIVE UPDATE WINDOW

Here the scale can be adjusted to meet your sampling needs. “**Manual Re-Scale**” allows you to type in the Maximum and Minimum values for the scale (vertical axis) in the appropriate boxes. The “**Automatic Re-Scale**” button is useful if the sampled data is out of the range of the graph or you need to zoom-in on data. It will rescale the vertical axis to an appropriate field of view.

- **Exit** - this button closes the entire program
- The value in the “**ADC Reading**” and/or “**Lux Reading**” fields are the appropriate output coming out of the sensor according to which Mode is engaged (Figure 19).
- **Max Min Count** – This is the maximum value that can be measured based on the resolution chosen (Integration Time). Max count increases with more Integration Time.

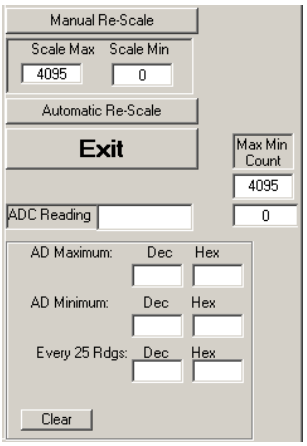


FIGURE 19. SINGLE DATA VIEW WINDOW

Saving Measurements to File

To save a series of ALS and PROX measurements to disk, see the “Save Measurements to File” box at the very bottom of the GUI. The user may click “Browse” to select a filename/file path and click “Write to Disk” to write the current graph data to disk.

Running the Program for ISL29020

The GUI starts up the same way for all devices by selecting the device number from the pull-down menu. Check the USB connection and than the Device connection. Once these are verified, the GUI is ready to evaluate the device.

The section shown in Figure 20 allows the ADC-Core to be enabled. The user needs to check “Enable ADC-Core” in order to enable the devices..

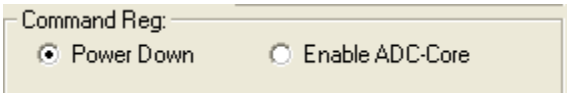


FIGURE 20. ISL29020 ADC CORE ENABLE

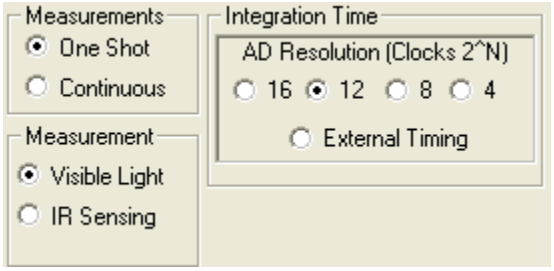


FIGURE 21. ISL29020 OPERATING MODE SELECTION

The section shown in Figure 21 allows the user to choose either one shot or continuous measurement for visible or IR sensing and change our ADC resolution for 16-bit or 12- or 8-bit or even 4-bit ADC. However, Intersil recommends to run 12-bit ADC or 16-bit ADC for better 50/60Hz reject. The “External Timing” check box is another option to run when using external customer supplied timing.

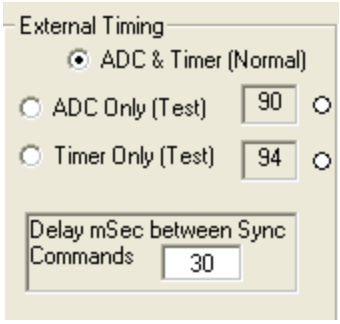


FIGURE 22.

The External timing allows ADC or Timer tests to be read and is able to choose the timing between pulses (~2 pulses). For more information about external timing, refer to the data sheet.

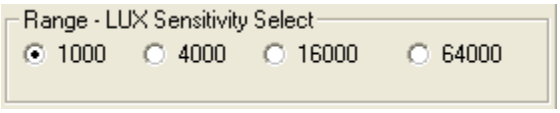


FIGURE 23. SENSITIVITY (RANGE) SELECTION

Range-LUX Sensitivity Select allows the user to choose the sensitivity of the sensor based on external conditions/object detection. For example, a really bright object would require a higher range (i.e., 64000), versus a dark object, which would require a low range (i.e., 1000). Higher range reduces photo detector sensitivity.

FIGURE 24. EXTERNAL RESISTOR USED

The section shown in Figure 24 allows the user to choose REXT to fix its internal oscillator frequency. 500kΩ is recommended for the devices.

Collect Data Graphical Real Time Data allows you to sample data (whether ALScont, IRcont, ALS Once or IR Once). Samples are now being taken and are being plotted, and appropriate values are displayed on the right in the corresponding box.

- **Stop Data Acquisition** stops sampling of data. Here the scale can be adjusted to meet your sampling needs.
- **Manual Re-Scale** allows you to type in the Maximum and Minimum values for the scale (vertical axis) in the appropriate boxes.
- **Automatic Re-Scale** button is useful if the sampled data is out of the range of the graph or you need to zoom-in on data. It will rescale the vertical axis to an appropriate field of view.
- **Exit** - this button closes the entire program
- The value in the “**ADC Reading**” and/or “**Lux Reading**” fields are the appropriate output coming out of the sensor according to which Mode is engaged.

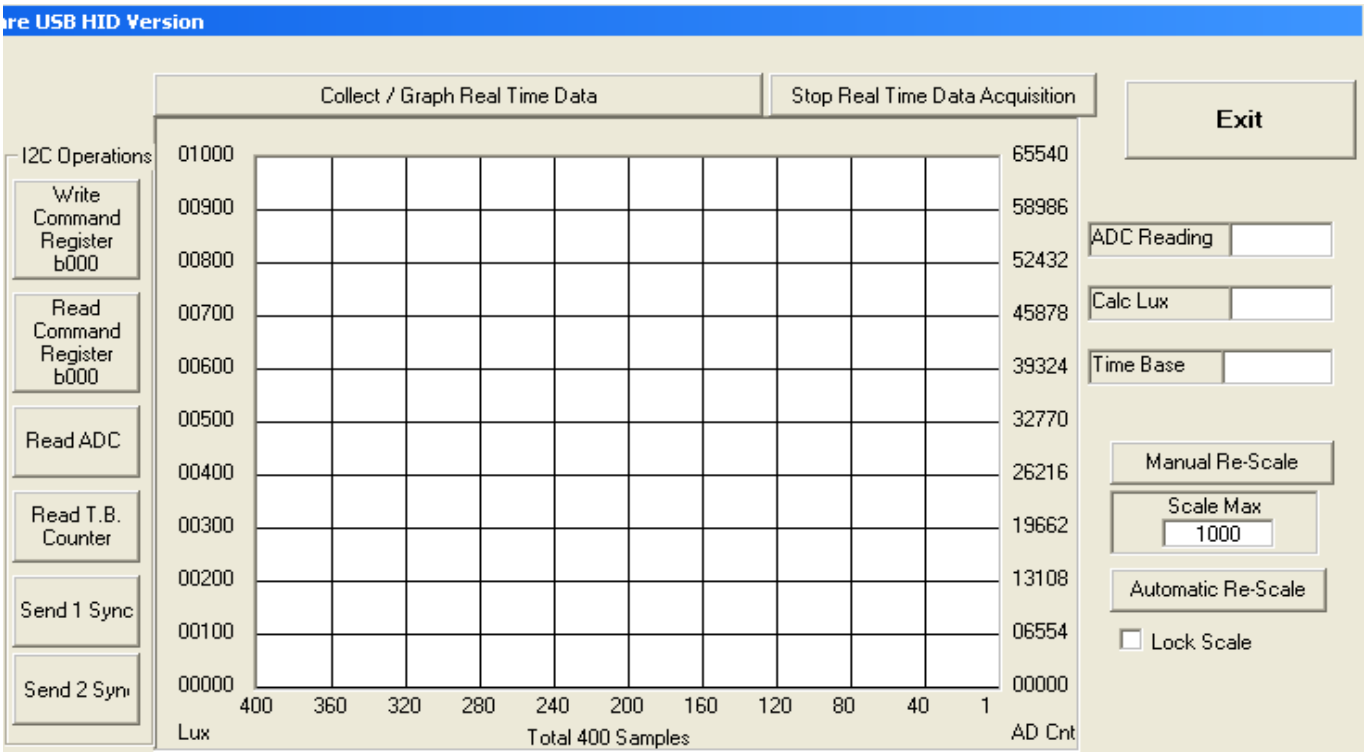


FIGURE 25. DATA COLLECTION WINDOW

FIGURE 26. SAVE FILE LOCATION

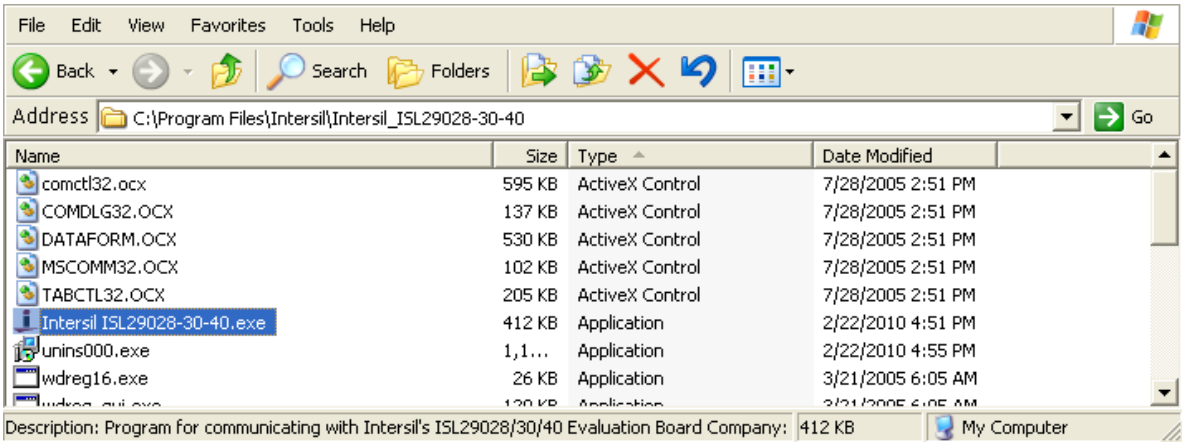


FIGURE 27. LOCATION OF EXECUTABLE ON USER'S HARD DRIVE

Saving Measurements to File

To save a series of ALS and PROX measurements to disk, see the "Save Measurements to File" box at the very bottom of the GUI. (Figure 26). The user may click "Browse" to select a filename/file path and click "Write to Disk" to write the currently graph data to disk.

Hardware Setup ISL29028 Family

Connecting the PCB to PC

Insert the USB-B plug into the Intersil evaluation PCB, and the USB-A plug into the user's PC. As shown in Figure 29, the status of the PC↔PCB communication link is displayed in the colored box next to "Attached".

Jumpers on PCB

The "rev B" evaluation board has 4 jumpers, which control various aspects of the part. By default, the jumpers *JP_IC*, *JP_MISC*, and *JP_IRLED* need not be connected due to the 0Ω resistors *R6*, *R7*, and *R8*, which connect to a 3.3V rail. If the user desires to test part performance at voltages other than $V_{DD} = V_{IR-LED} = V_{I2C} = 3.3V$, unsolder these resistors, use the installed test points, and power any of the 3 rails as desired.

TABLE 2. JUMPER OVERVIEW

DESIGNATOR	FUNCTION
JP_PIN1	ISL29028: Changes I^2C address ISL29030: Leave open (see below)
JP_IC	Connects 3.3V rail to VDD
JP_MISC	Connects 3.3V rail I^2C pull-up, INT, PIN1
JP_IRLED	Connects 3.3V rail to the IR-LED D1

JP_PIN1

The jumper *JP_PIN1* is connected to pin 1 of the ODFN and should be **disconnected for ISL29030** usage, and **will work in either state for the ISL29028**. The ISL29030 has a current source on pin 1. The ISL29028 has an I^2C address select line tied to pin 1.

Running the Program for ISL29028 Family

If the user has selected the default installation path, the software will install in the following folder: *C:\Program Files\Intersil\Intersil_ISL29028-30-40* as seen in Figure 27.

Double-click the highlighted executable shown in Figure 27 to start the evaluation software. A shortcut to this file is also provided via the Windows Start Menu under *All Programs → Intersil → Intersil ISL29028-30-40.*

Connect the PC to the evaluation PCB via a USB cable. When this connection is made, the "Attached" box displayed in Figure 28 should turn green.

The ISL29028 has a selectable I^2C address (see pin *ADDR0*). By changing the input logic signal (via jumper *JP_PIN1*), the I^2C address can be set to either 0x88 or 0x8A (see the PCB schematic/IC data sheet for more information). This board is shipped with jumper *JP_PIN1* removed, so by default the part will respond to I^2C address 0x88.

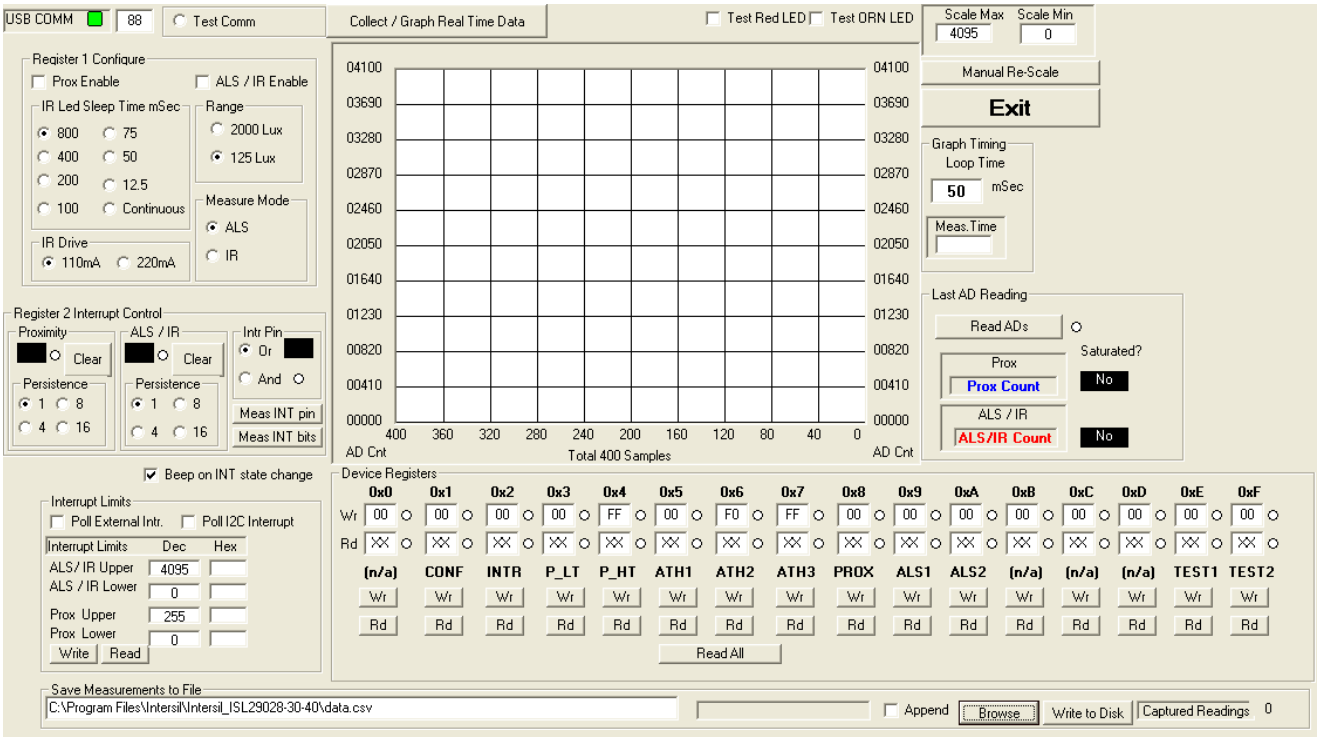


FIGURE 29. SOFTWARE MAIN SCREEN

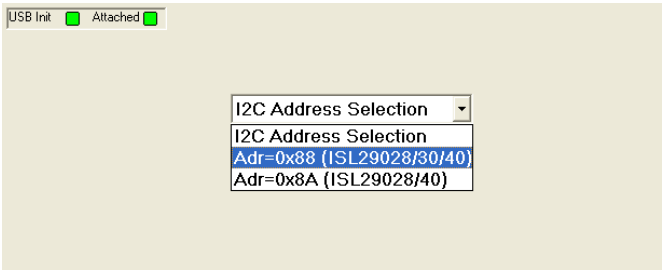


FIGURE 28. SOFTWARE START-UP SCREEN

Main Window

The main evaluation software window can be seen in Figure 29.

If the user desires to change the I^2C address the GUI communicates with, see the upper-left box containing “88” in Figure 29. Change the number as desired and click the “Test Comm” box to test for a valid communication link between the PC and Light Sensor at the specified I^2C address.

REGISTER 0X01 – CONFIGURE MODES

IC register 0x01 controls the range and modes of the part. “Sleep time”, “Range” and “Measure Mode” bits are explained in detail in the data sheet. All control bits *not* related to the interrupt function are located in this register.

REGISTER 0X02 – INTERRUPT BEHAVIOR

IC register 0x02 contains the interrupt flags and controls the interrupt modes. Interrupt persistence, and AND/OR (see bit 0) functionality is contained in this register.

REGISTERS 0X03 TO 0X07 – INTERRUPT THRESHOLDS

The PROX interrupt thresholds and ALS thresholds are stored in registers 0x03 to 0x07. They can be edited by writing values to the “Interrupt Limits” box and clicking “write”. See the IC data sheet for more information on interrupt limits.

EXTERNAL INTERRUPT AND INTERRUPT LEDS

To poll the status of the hardware *INT* pin, select the “Poll External Intr” check box and the on-PCB microcontroller will continuously check the logic state of the *INT* line. To poll the status of *ALS_FLAG* and *PROX_FLAG* interrupt bits (in register 0x02), select the “Poll I^2C Interrupt” check box - the GUI will perform an I^2C read and then instruct the microcontroller to turn D3/D4 on or off depending on the state of *ALS_FLAG* and *PROX_FLAG*.

COMPLETE REGISTER LISTING

The “Device Registers” box at the bottom of the GUI displays a complete listing of all registers in hex format and should automatically update based on the options selected by the user. Users can individually write to or read from these registers using the “Wr”/”Rd” buttons.

REAL-TIME DATA ACQUISITION GRAPH

To graphically display the results of ALS and proximity conversions, first click the check boxes “ALS /IR Enable” and “Prox Enable” and select the mode of operation by using the radio buttons in the “Register 1 Configure” area. After this register is configured, click the “Collect Data” button shown in the upper-left of Figure 32. Both ALS and Proximity conversions can happen (and are displayed) at once because the ISL29028 architecture has two concurrent ADCs.

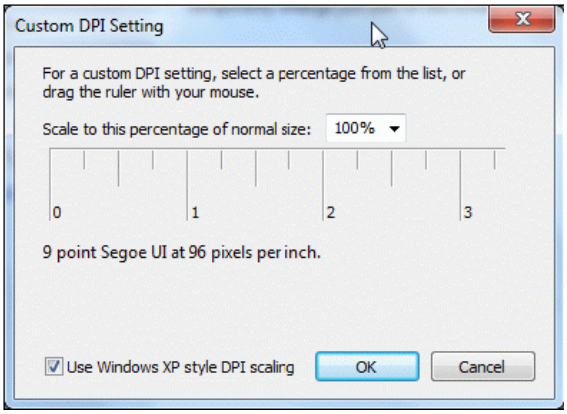
ADC RESOLUTION AND GRAPH RESCALING

Because the ALS conversions are inherently 12-bit (2^{12}-1 = 4095 count maximum), and the proximity conversions are inherently 8-bit (2^{8}-1= 255 count maximum), the graph may require rescaling to view both results on the same curve at once. To set a new maximum and minimum graphical scale, change the numbers in the “Scale Max” and “Scale Min” boxes, then click “Manual Re-Scale”.

SAVING MEASUREMENTS TO FILE

To save a series of ALS and PROX measurements to disk, see the “Save Measurements to File” box at the very bottom of the GUI. The user may click “Browse” to select a filename/filepath and click “Write to Disk” to write the currently graphed data to disk.

The following screen shown may be caused by the PC monitor. The solution is to resize the set custom text size (DPI) by going to Control Panel → Appearance and Personalization → Display → Set custom text size (DPI) and choose “Scale to this percentage of normal size: 100%” (96 pixels/inch).



For other questions, comments, and feedback, contact the local Intersil FAE/Sales team. (http://www.intersil.com/cda/Support/contacts/)

Optical Sensor MCU Board Schematic

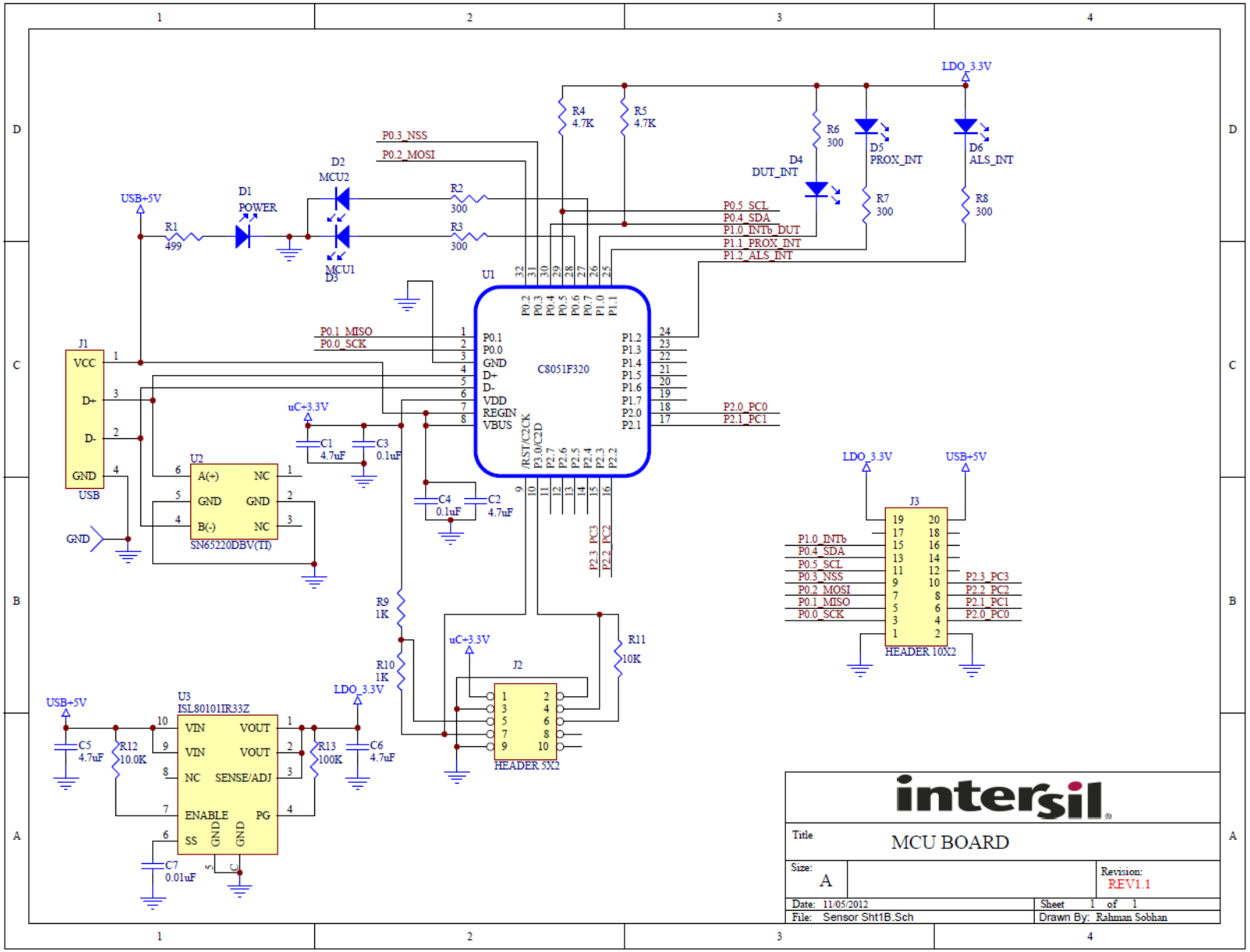


FIGURE 30. ISL29011, ISL29018, ISL29021 EVALUATION BOARD SCHEMATIC

TABLE 3. MCU BOARD BILL OF MATERIALS

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	USB Micro Controller	C8051F320 - LQFP32	QUAD32	Digi-Key	336-1259-ND	Silicon Labs	C8051F320LQFP32	U1
2	1	Linear Regulator	ISL80101 - 3.3V	DFN10	Digi-Key	ISL80101IR33Z-T-ND	Intersil Corp	ISL80101IR33Z-T	U3
3	6	LED	Green Red	0603	Digi-Key	160-1446-2-ND 67-1551-2-ND	Lite-On Inc Lumex Opto/Component	LTST-C191KGKT SML-LX0603SRW-TR	D1, D2, D3, D4, D5, D6
4	2	Capacitor	0.1µF	0402/X7R/16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel	C0402X7R160104KNE	C3, C4
5	1	Capacitor	0.01µF	0402/X7R/50V/±10	Garrett Electronics	500R07W103KV4T	Johanson Dielectric	500R07W103KV4T	C7
6	4	Capacitor	4.7µF	0402/X5R/6.3V/±20	Digi-Key	587-2787-1-ND	Taiyo Yuden	JMK105BBJ475MV-F	C1, C2, C5, C6
7	5	Resistor	300Ω	0402/1/16W/1%	Garrett Electronics	RK73H1ETTP3010F	KOA	RK73H1ETTP3010F	R2, R3, R6, R7, R8
8	1	Resistor	499Ω	0402/1/16W/1%	Digi-Key	311-499LRCT-ND	Yageo	RC0402FR-07499RL	R1
9	2	Resistor	1kΩ	0402/1/16W/1%	Digi-Key	311-1.00KLRTR-ND	Yageo	RC0402FR-071KL	R9, R10
10	2	Resistor	10kΩ	0402/1/16W/1%	Venkel LTD	C0402-16W-1002FT	Venkel	C0402-16W-1002FT	R11, R12
11	2	Resistor	100kΩ	0402/1/16W/1%	Digi-Key	311-100KLRTR-ND	Yageo	RC0402FR-07100KL	R13
12	2	Resistor	4.7kΩ	0402/1/16W/1%	Garrett Electronics	CRCW04024K75FKED	Vishay-Dale	CRCW04024K75FKED	R4, R5
13	1	Board to Board-Headers, Female	10-Pin Female Header	Through Hole, Right Angle	Digi-Key	952-1380-5-ND	HARWIN Inc	M50-3201045	J3
14	1	USB Port Transient Suppressors	SINGLE USB PORT TVS	SOT-23-6	Digi-Key	296-9694-1-ND	Texas Instruments	SN65220DBVR	U2
15	1	USB Connector	USB Connector	USB A	Digi-Key	WM3983TR-ND	MOLEX	0480372200	J1
16	1	Test Point	Test Point	Through hole-0.1”/0.05”	Digi-Key	5001K-ND	Keystone Electronics	5001	GND

Optical Sensor Carrier Board Schematic

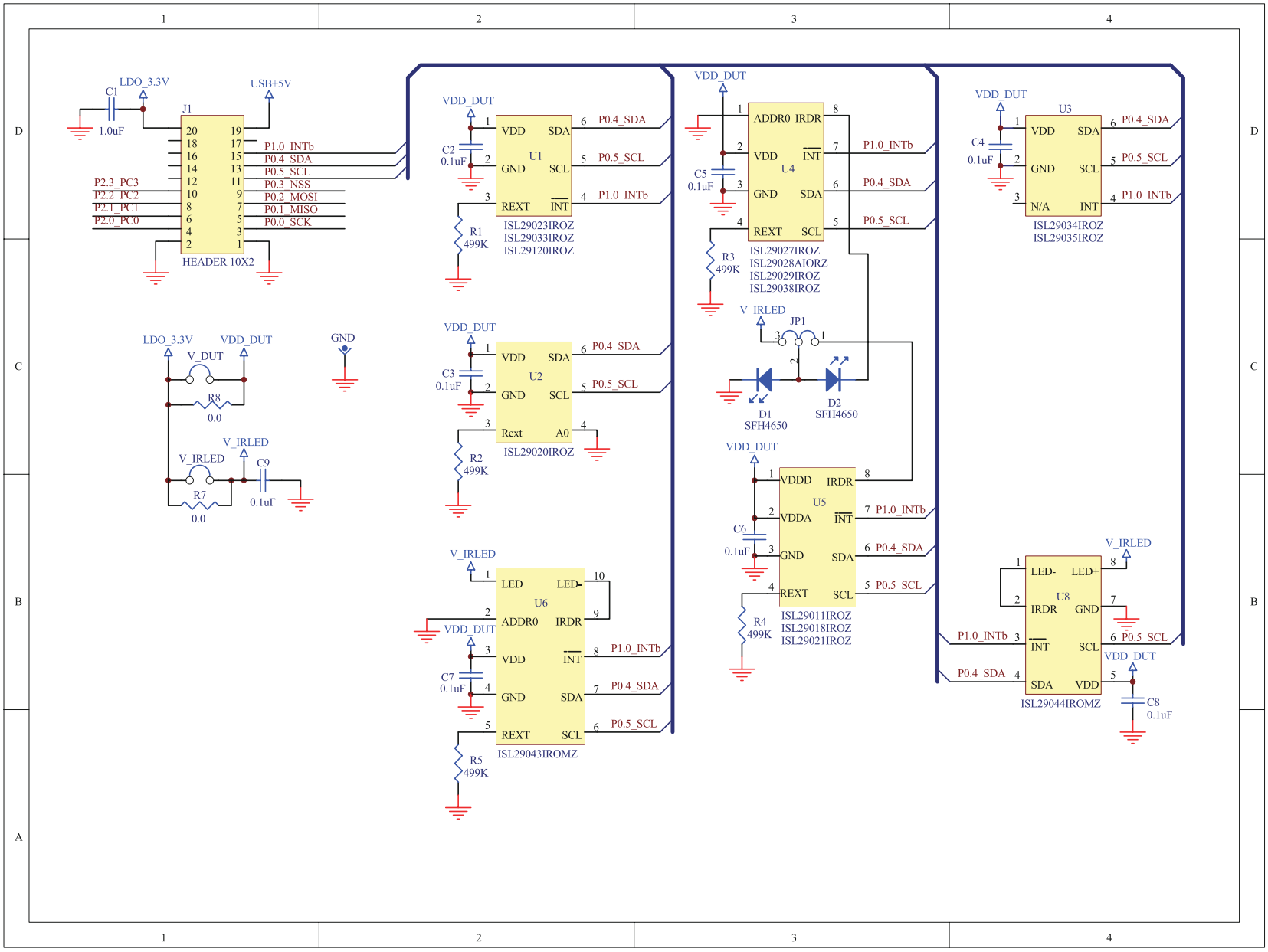


FIGURE 31. OPTICAL SENSOR CARRIER EVALUATION BOARD SCHEMATIC

TABLE 4. OPTICAL SENSOR CARRIER EVALUATION BOARD BILL OF MATERIALS

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	Light Sensor	540nm ALS	6-Pin ODFN	Digi-key	ISL29023IROZ-T7CT-ND ISL29033IROZ-T7-ND ISL29120IROZ-T7-ND	Intersil Corp	ISL29023IROZ-T7 ISL29033IROZ-T7 ISL29120IROZ-T7	U1
2	1	Light Sensor	540nm	6-Pin ODFN	Digi-Key	ISL29020IROZ-T7CT-ND	Intersil Corp	ISL29020IROZ-T7	U2
3	1	Light Sensor	540nm	6-Pin ODFN	Intersil Corp	ISL29034 ISL29035	Intersil Corp	ISL29034IROZ-T7 ISL29035IROZ-T7	U3
4	1	Light Sensor	540nm	8-Pin ODFN	Digi-Key	ISL29027IROZ-T7-ND ISL29028AIROZ-T7CT-ND ISL29029IROZ-T7CT-ND ISL29038IROZ-T7CT-ND	Intersil Corp	ISL29027IROZ-T7 ISL29028AIROZ-T7 ISL29029IROZ-T7 ISL29038IROZ-T7	U4
5	1	Light Sensor	540nm	8-Pin ODFN	Digi-Key	ISL29011IROZ-T7CT-ND ISL29018IROZ-T7-ND ISL29021IROZ-T7-ND	Intersil Corp	ISL29011IROZ-T7 ISL29018IROZ-T7 ISL29021IROZ-T7	U5
6	1	Light Sensor	540nm ALS	10-Pin ODFN	Digikey	ISL29043IROMZ-T7-ND	Intersil Corp	ISL29043IROMZ-T7	U6
7	1	Light Sensor	540nm ALS	6-Pin ODFN	Intersil Corp	ISL29044IROZ-T7TR-ND	Intersil Corp	ISL29044IROZ-T7TR-ND	U8
8	7	Capacitor	0.1µF	0402/X7R/16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel	C0402X7R160-104KNE	C2, C3, C4, C5, C6, C7, C8
9	5	Resistor	499kΩ	0402/1/16W/1%	Digi-Key	P499KLCT-ND	Panasonic	ERJ-2RKF4993X	R1, R2, R3, R4, R5
10	1	Capacitor	1µF	0402/Y5V/6.3V/±10	Digi-Key	490-1320-2-ND	Murata	GRM155R60J105KE19D	C1
11	2	Resistor	0Ω	0402/1/16W/1%	Venkel LTD	CR0402-16W-000T	Venkel LTD	CR0402-16W-000T	R7, R8
12	1	Board to Board-Headers, Male	10-Pin Male Header	Through Hole, Right Angle	Digi-Key	952-1398-ND	HARWIN Inc	M50-3901042	J1

Optical Sensor Device Board Schematic

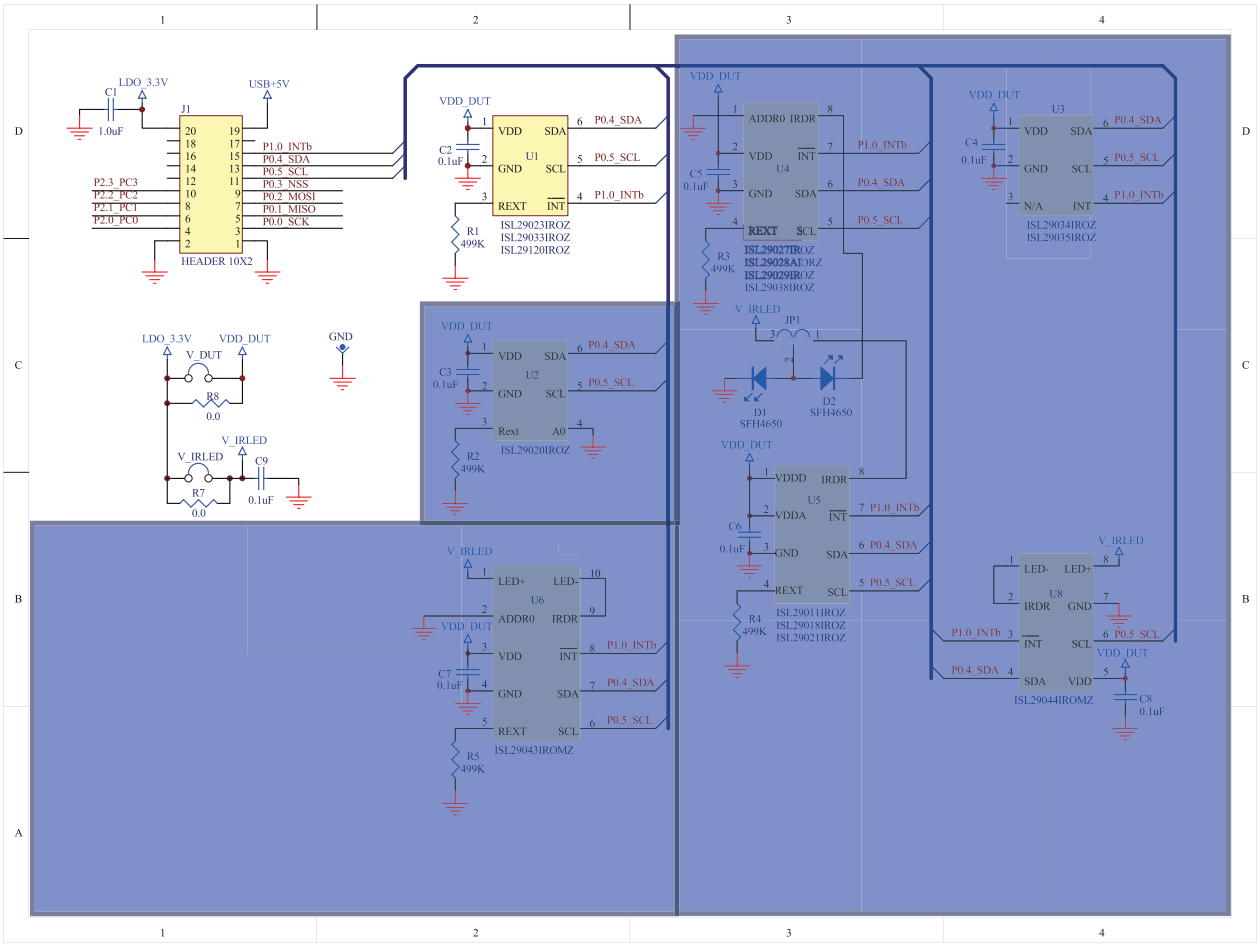


FIGURE 32. ISL29023, ISL29033, AND ISL29120 EVALUATION BOARD SCHEMATIC - U1

TABLE 5. ISL29023, ISL29033, AND ISL29120 BILL OF MATERIALS - U1

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	Ambient Light Sensor	540nm ALS	6-Pin ODFN	Digi-key	ISL29023IROZ-T7CT-ND ISL29033IROZ-T7-ND ISL29120IROZ-T7-ND	Intersil Corp	ISL29023IROZ-T7 ISL29033IROZ-T7 ISL29120IROZ-T7	U1
2	1	Capacitor	0.1µF	0402/X7R/16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel	C0402X7R160-104KNE	C2
3	1	Resistor	499kΩ	0402/1/16W/1%	Digi-Key	P499KLCT-ND	Panasonic	ERJ-2RKF4993X	R1
4	1	Capacitor	1µF	0402/Y5V/ 6.3V/±10	Digi-Key	490-1320-2-ND	Murata	GRM155R60J105KE19D	C1
5	2	Resistor	0Ω	0402/1/16W/1%	Venkel LTD	CR0402-16W-000T	Venkel LTD	CR0402-16W-000T	R7, R8
6	1	Board to Board-Headers, Male	10-Pin Male Header	Through Hole, Right Angle	Digi-Key	952-1398-ND	HARWIN Inc	M50-3901042	J1

Optical Sensor Device Board Schematic

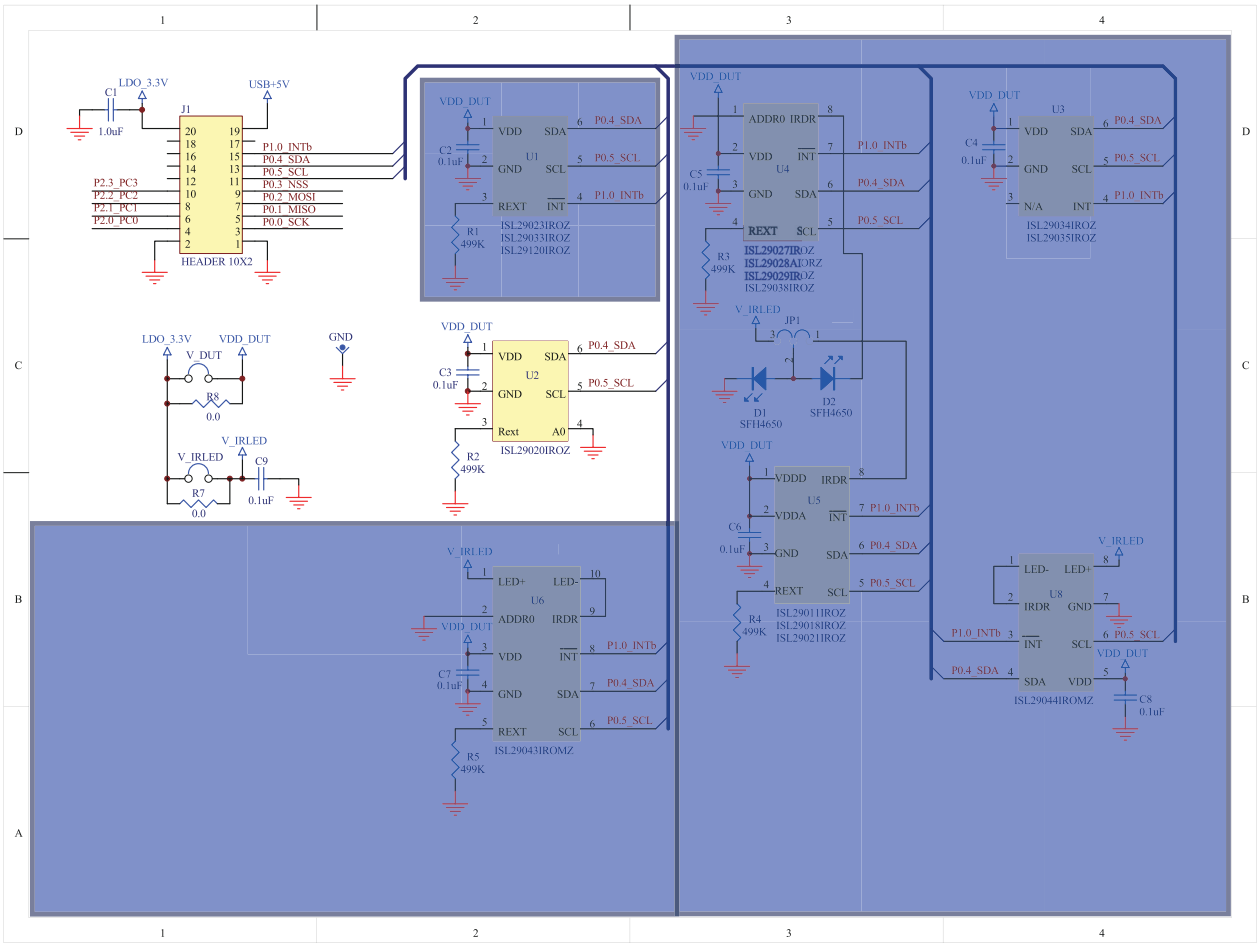


FIGURE 33. ISL29020 EVALUATION BOARD SCHEMATIC - U2

TABLE 6. ISL29020 BILL OF MATERIALS - U2

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	Ambient Light Sensor	540nm	6-Pin ODFN	Digi-Key	ISL29020IROZ-T7CT-ND	Intersil Corp	ISL29020IROZ-T7	U2
2	1	Capacitor	0.1µF	0402/X7R /16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel	C0402X7R160-104KNE	C3
3	1	Resistor	499kΩ	0402/1/ 16W/1%	Digi-Key	P499KLCT-ND	Panasonic	ERJ-2RKF4993X	R2
4	1	Capacitor	1µF	0402/Y5V/ 6.3V/±10	Digi-Key	490-1320-2-ND	Murata	GRM155R60J105KE19D	C1
5	2	Resistor	0Ω	0402/1/ 16W/1%	Venkel LTD	CR0402-16W-000T	Venkel LTD	CR0402-16W-000T	R7, R8
6	1	Board to Board-Headers, Male	10-Pin Male Header	Through Hole, Right Angle	Digi-Key	952-1398-ND	HARWIN Inc	M50-3901042	J1

Optical Sensor Device Board Schematic

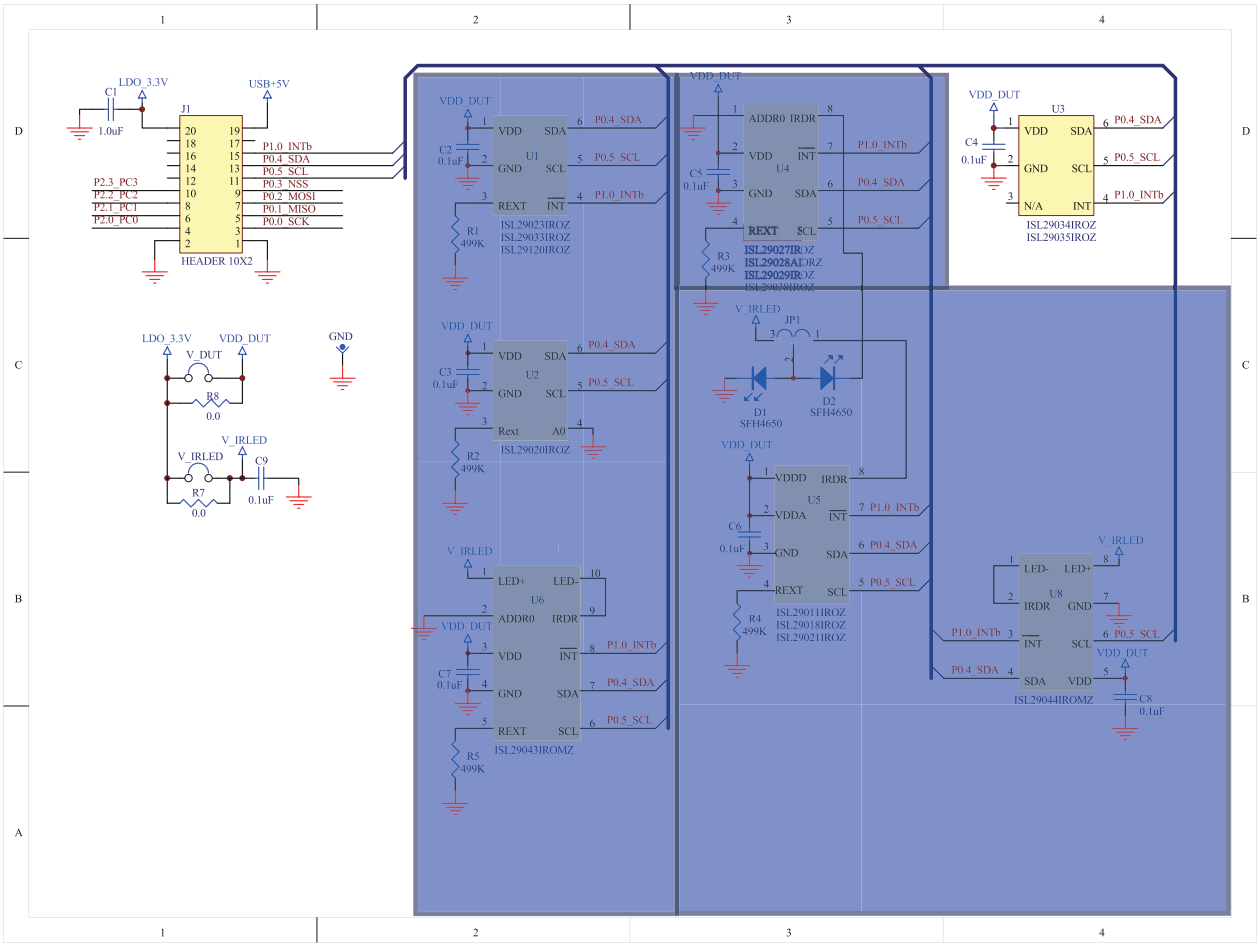


FIGURE 34. ISL29034, AND ISL29035 EVALUATION BOARD SCHEMATIC - U3

TABLE 7. ISL29034, AND ISL29035 BILL OF MATERIALS - U3

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	Ambient Light Sensor	540nm	6-Pin ODFN	Intersil Corp	ISL29034 ISL29035	Intersil Corp	ISL29034 ISL29035	U3
2	1	Capacitor	0.1µF	0402/X7R/ 16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel	C0402X7R160-104KNE	C4
3	1	Capacitor	1µF	0402/Y5V/ 6.3V/±10	Digi-Key	490-1320-2-ND	Murata	GRM155R60J105KE19D	C1
4	2	Resistor	0Ω	0402/1/ 16W/1%	Venkel LTD	CR0402-16W-000T	Venkel LTD	CR0402-16W-000T	R7, R8
5	1	Board to Board-Headers , Male	10-Pin Male Header	Through Hole, Right Angle	Digi-Key	952-1398-ND	HARWIN Inc	M50-3901042	J1

Optical Sensor Device Board Schematic

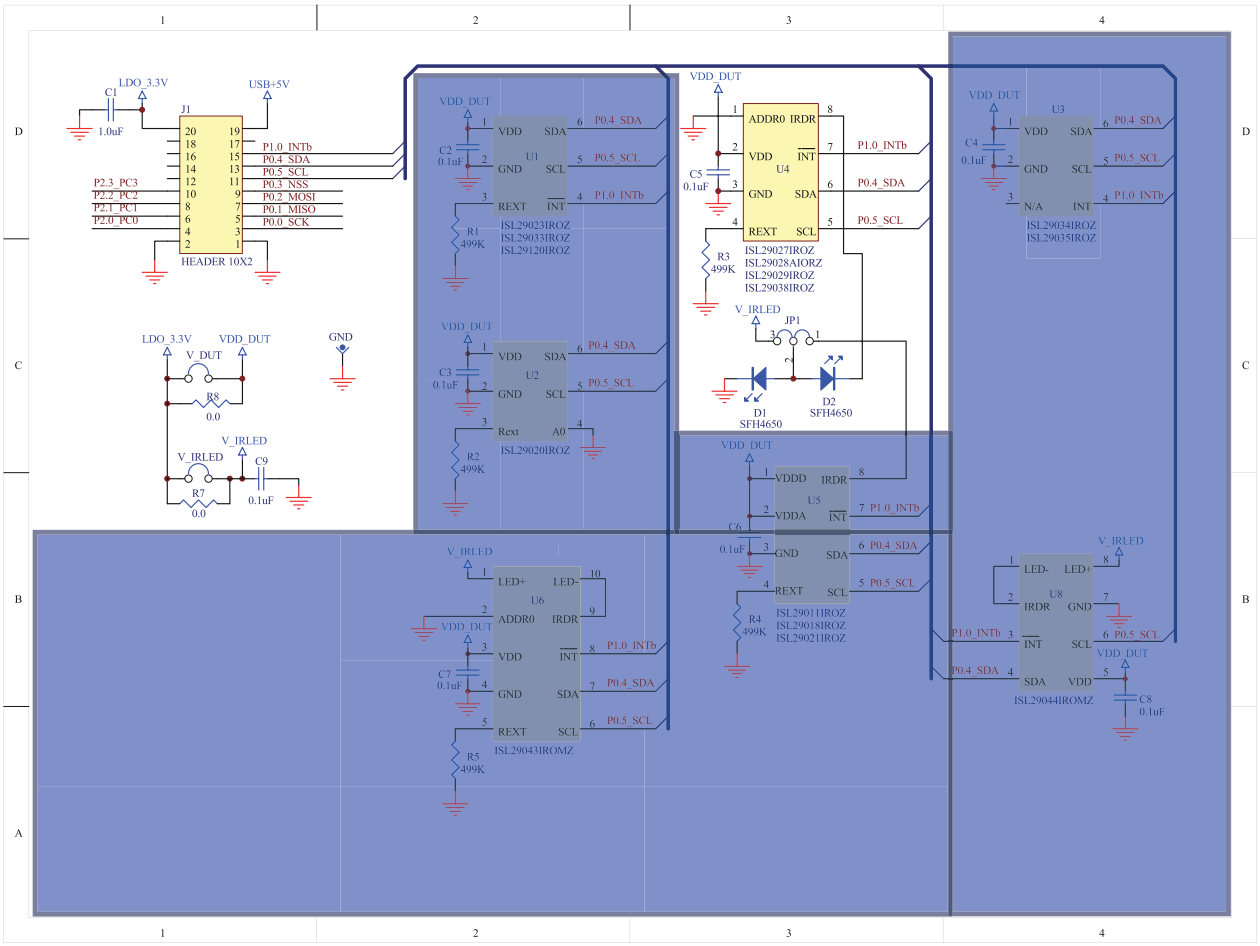


FIGURE 35. ISL29027, ISL29028A, ISL29029, AND ISL29038 EVALUATION BOARD SCHEMATIC - U4

TABLE 8. ISL29027, ISL29028A, ISL29029, ISL29038 BILL OF MATERIALS - U4

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	Ambient Light Sensor	540nm	8-Pin ODFN	Digi-Key	ISL29027IROZ-T7-ND ISL29028AIROZ-T7CT-ND ISL29029IROZ-T7CT-ND ISL29038IROZ-T7CT-ND	Intersil Corp	ISL29027IROZ-T7 ISL29028AIROZ-T7 ISL29029IROZ-T7 ISL29038IROZ-T7	U4
2	1	Capacitor	0.1µF	0402/X7R/ 16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel	C0402X7R160-104KNE	C6
3	1	Resistor	499kΩ	0402/1/ 16W/1%	Digi-Key	P499KLCT-ND	Panasonic	ERJ-2RKF4993X	R4
4	1	Capacitor	1µF	0402/Y5V/ 6.3V/±10	Digi-Key	490-1320-2-ND	Murata	GRM155R60J105KE19D	C1
5	2	Resistor	0Ω	0402/1/ 16W/1%	Venkel LTD	CR0402-16W-000T	Venkel LTD	CR0402-16W-000T	R7, R8
6	1	Board to Board - Headers, Male	10-Pin Male Header	Through Hole, Right Angle	Digi-Key	952-1398-ND	HARWIN Inc	M50-3901042	J1

Optical Sensor Device Board Schematic

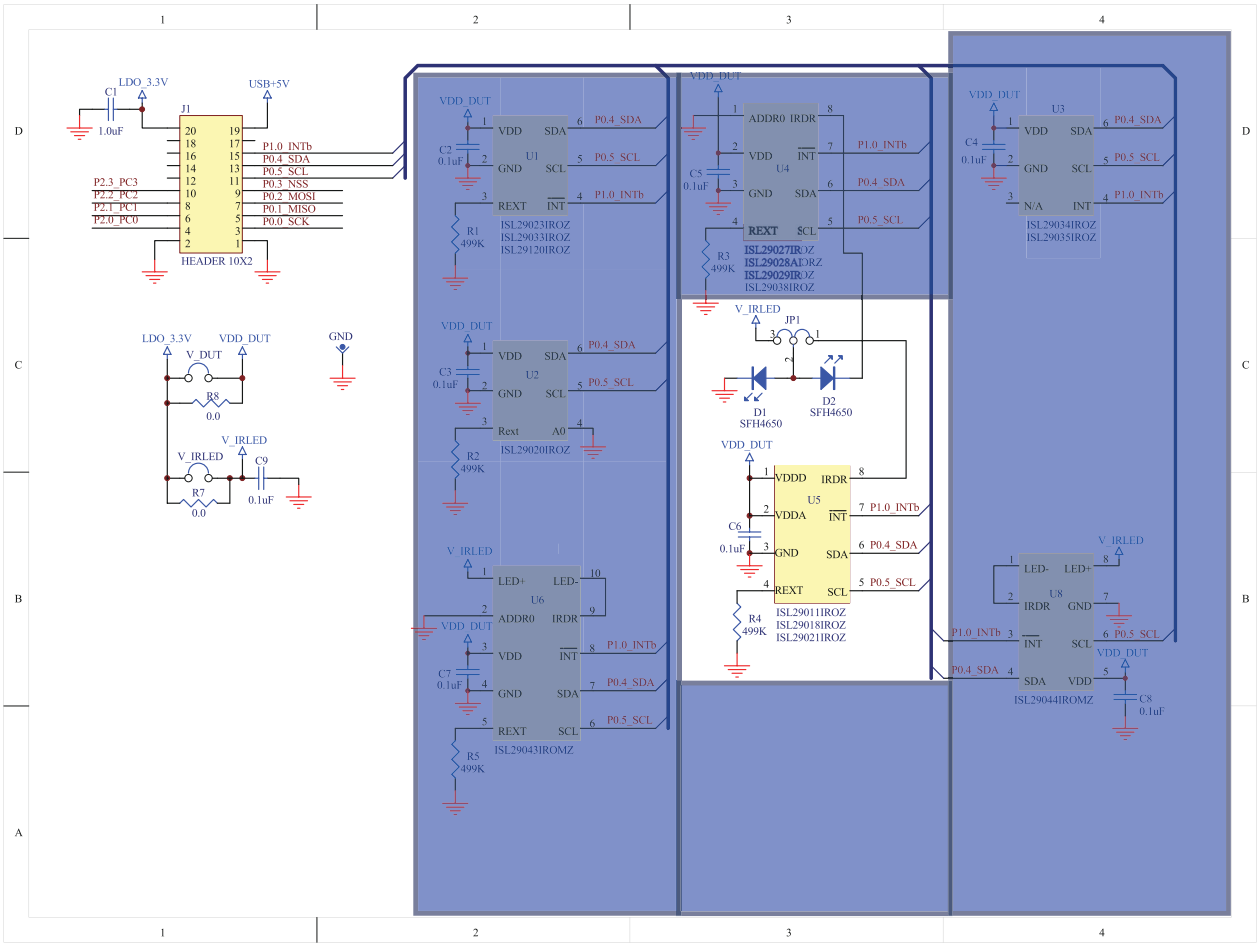


FIGURE 36. ISL29011, ISL29018, AND ISL29021 EVALUATION BOARD SCHEMATIC - U5

TABLE 9. ISL29011, ISL29018, AND ISL29021 BILL OF MATERIALS - U5

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	Ambient Light Sensor	540nm	8-Pin ODFN	Digi-Key	ISL29011IROZ-T7CT-ND ISL29018IROZ-T7-ND ISL29021IROZ-T7-ND	Intersil Corp	ISL29011IROZ-T7 ISL29018IROZ-T7 ISL29021IROZ-T7	U5
2	1	Capacitor	0.1µF	0402/X7R/16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel	C0402X7R160-104KNE	C6
3	1	Resistor	499kΩ	0402/1/16W/1%	Digi-Key	P499KLCT-ND	Panasonic	ERJ-2RKF4993X	R4
4	1	Capacitor	1µF	0402/Y5V/6.3V/±10	Digi-Key	490-1320-2-ND	Murata	GRM155R60J105KE19D	C1
5	2	Resistor	0Ω	0402/1/16W/1%	Venkel LTD	CR0402-16W-000T	Venkel LTD	CR0402-16W-000T	R7, R8
6	1	Board to Board-Headers, Male	10-Pin Male Header	Through Hole, Right Angle	Digi-Key	952-1398-ND	HARWIN Inc	M50-3901042	J1

Optical Sensor Device Board Schematic

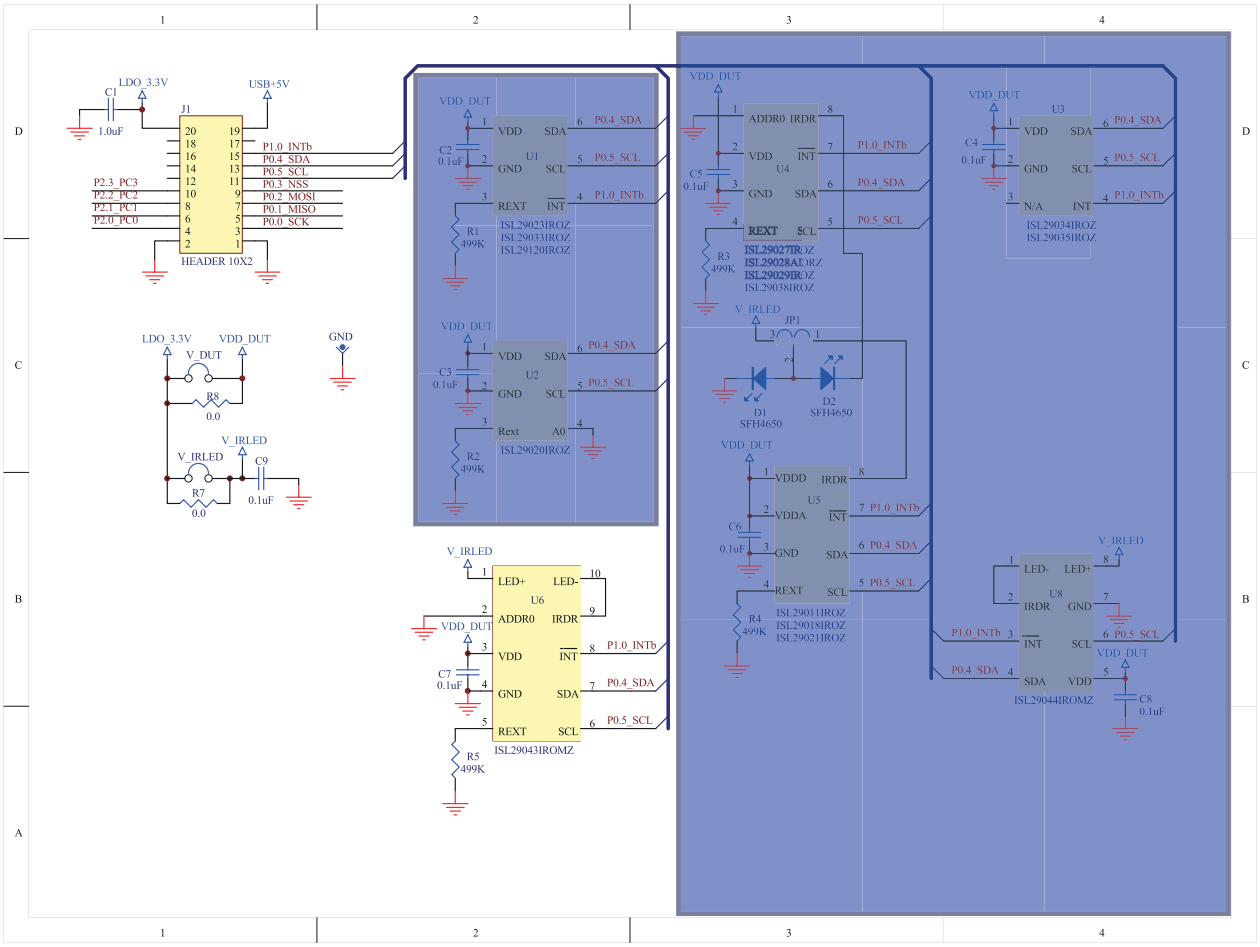


FIGURE 37. ISL29043 EVALUATION BOARD SCHEMATIC - U6

TABLE 10. ISL29043 BILL OF MATERIAL - U6

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	Ambient Light Sensor	540nm ALS	10-Pin ODFN	Digikey	ISL29043IROMZ-T7-ND	Intersil Corp	ISL29043IROMZ-T7	U6
2	1	Capacitor	0.1µF	0402/X7R/ 16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel LTD	C0402X7R160-104KNE	C7
3	1	Resistor	499kΩ	0402/1/ 16W/1%	Digi-Key	P499KLCT-ND	Panasonic	ERJ-2RKF4993X	R5
4	1	Capacitor	1µF	0402/Y5V/ 6.3V/±10	Digi-Key	490-1320-2-ND	Murata	GRM155R60J105KE19D	C1
5	2	Resistor	0Ω	0402/1/ 16W/1%	Venkel LTD	CR0402-16W-000T	Venkel LTD	CR0402-16W-000T	R7, R8
6	1	Board to Board-Headers, Male	10-Pin Male Header	Through Hole, Right Angle	Digi-Key	952-1398-ND	HARWIN Inc	M50-3901042	J1

Optical Sensor Device Board Schematic

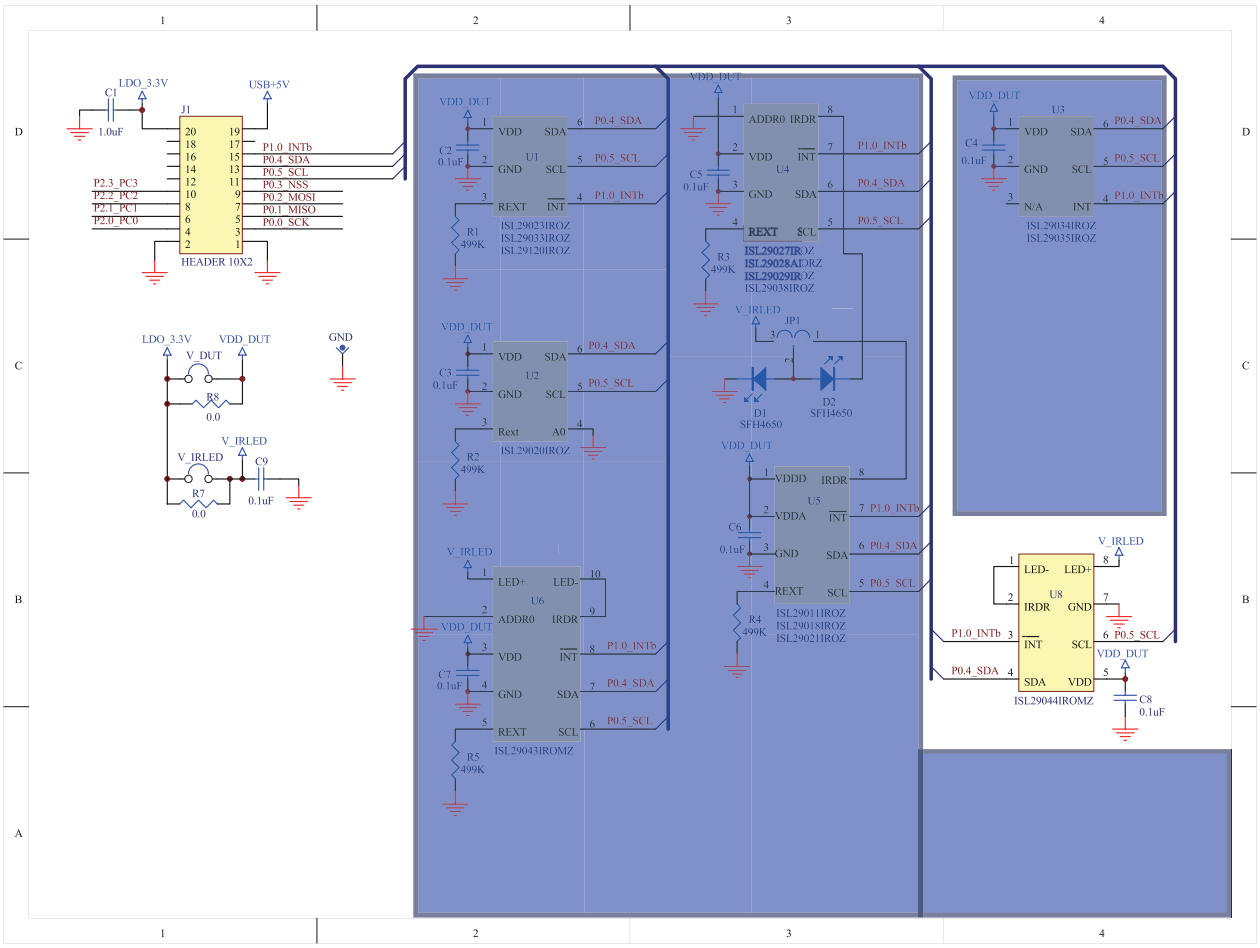


FIGURE 38. ISL29044 EVALUATION BOARD SCHEMATIC - U8

TABLE 11. ISL29044 BILL OF MATERIALS - U8

ITEM#	QTY	PART NAME	PART VALUE	FOOTPRINT	VENDOR NAME	VENDOR P/N	MANUFACTURER NAME	MANUFACTURER P/N	REFERENCE DESIGNATOR
1	1	Ambient Light Sensor	540nm ALS	6-Pin ODFN	Intersil Corp	ISL29044IR0Z-T7TR-ND	Intersil Corp	ISL29044IR0Z-T7TR-ND	U8
2	1	Capacitor	0.1µF	0402/X7R /16V/±10	Venkel LTD	C0402X7R160-104KNE	Venkel LTD	C0402X7R160-104KNE	C8
3	1	Capacitor	1µF	0402/Y5V /6.3V/±10	Digi-Key	490-1320-2-ND	Murata	GRM155R60J105KE19D	C1
4	2	Resistor	0Ω	0402/1 /16W/1%	Venkel LTD	CR0402-16W-000T	Venkel LTD	CR0402-16W-000T	R7, R8
5	1	Board to Board - Headers, Male	10-Pin Male Header	Through Hole, Right Angle	Digi-Key	952-1398-ND	HARWIN Inc	M50-3901042	J1