LX1977
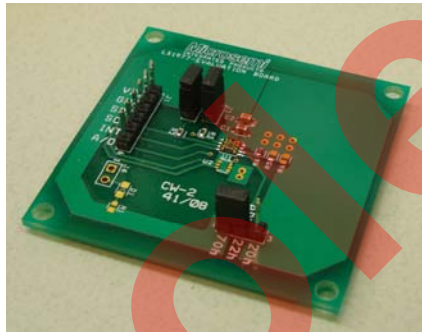# SMBUS AMBIENT LIGHT SENSOR

Microsemi

INTRODUCTION TO PRODUCT

The LX1977 Evaluation Board is available from Microsemi for evaluating the functionality and performance of the LX1977 SMBus ambient light sensor. The evaluation board includes pull-up resistors on the SDA and SCL bus lines, gain setting resistor, an LED indicator for the Interrupt output pin, and jumpers for device address setting. The LX1977 Evaluation Board can be used to interface with a μP or a SMBus 2.0 protocol device for both read and write, such as the WIN-I2CUSBDLL module. The component sizes used on the evaluation board facilitate easy probing, however, in practice, smaller component sizes are recommended to minimize the circuit physical size.

KEY FEATURES

- Nearly Perfect *Best Eye*™ Human Eye Spectral Response
- I^{2}C Compatible SMBus 2.0 Interface
- 12-bit resolution
- Very Low IR Sensitivity
- Rejection to 50/60Hz Interference
- Programmable Integration Time
- Programmable Interrupt Output
- Highly Accurate & Repeatable Output vs. Light
- No Optical Filters Needed
- Easy Processor Interface

APPLICATIONS

- Backlight Control for Notebook
- Backlight Control for TV
- Handheld Devices
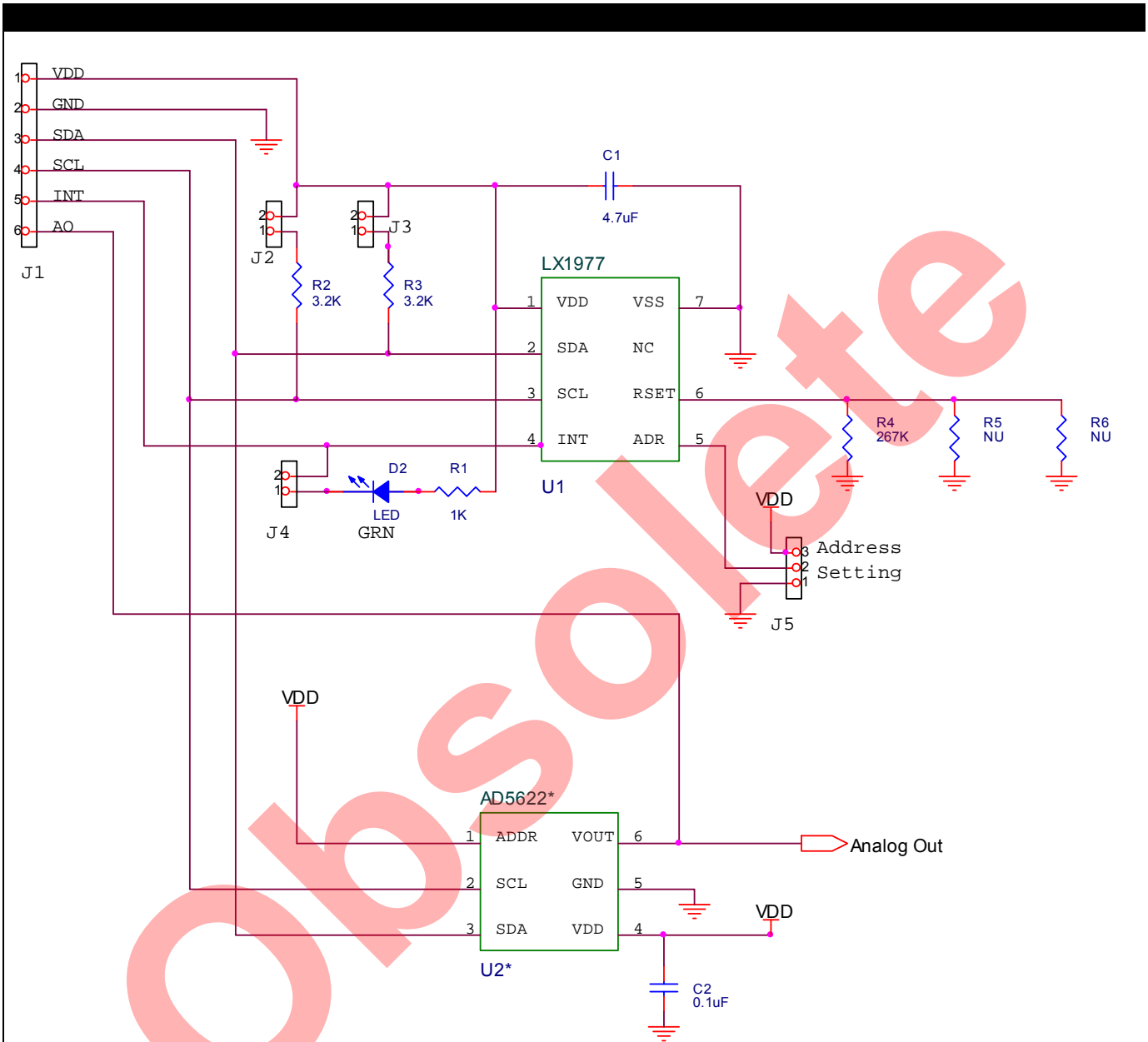- Medical Devices

PART SPECIFIC INFORMATION

Part Number	Product
LX1977IDU	SMBus Ambient Light Sensor, DFNL 8-Pin Package

Table 1 - PART INFORMATION

IC	EVALUATION BOARDS
LX1977IDU	LX1977 EVAL KIT

Table 2 - EVALUATION BOARD INFORMATION

SCHEMATIC AND PCB LAYOUT

Figure 1 - LX1977 Evaluation Board Schematic

*Note: Device AD5622 is a 12 bit DAC for converting the LX1977 digital output to an analog signal. For factory use only. Not included on evaluation board.

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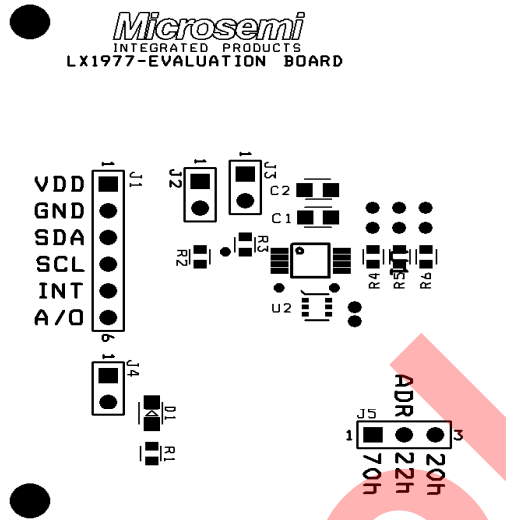11861 Western Avenue, Garden Grove, CA. 92841, 714-898-8121, Fax: 714-893-2570

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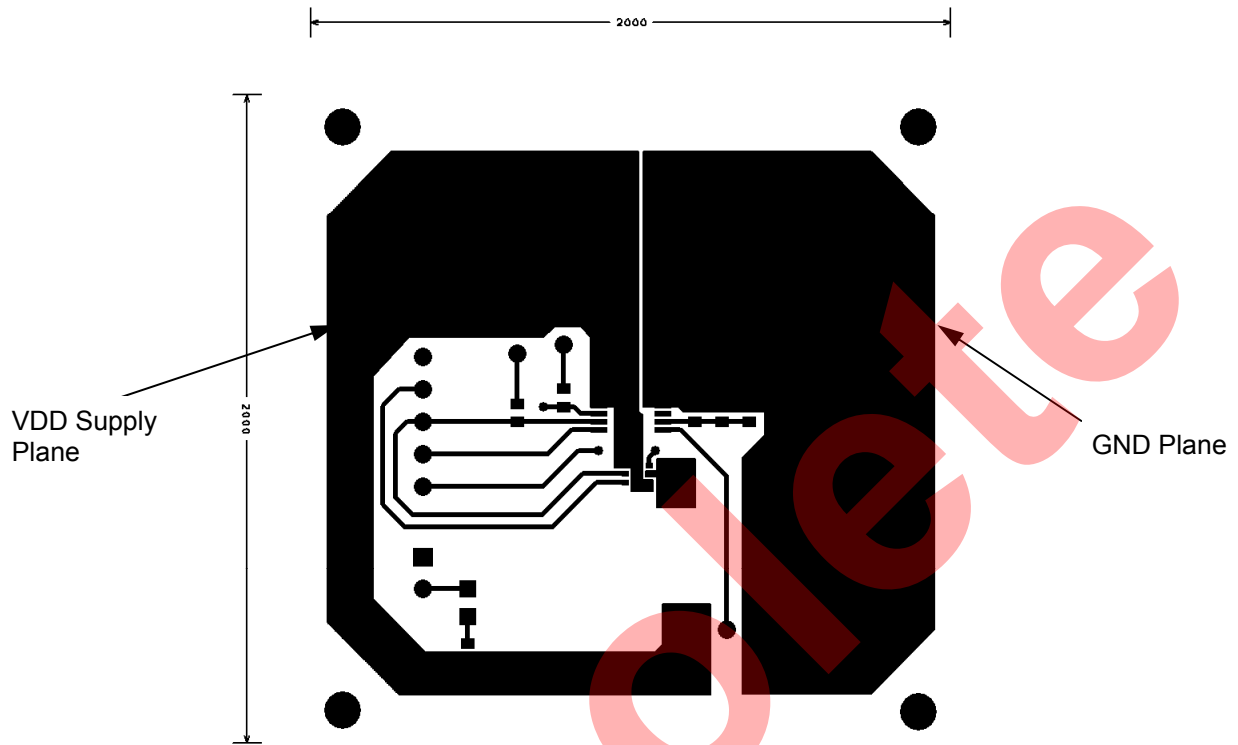**Figure 2 –** LX1977 Evaluation Board Top Silkscreen & Solder Mask

Figure 3 – LX1977 Evaluation Board Top Layer
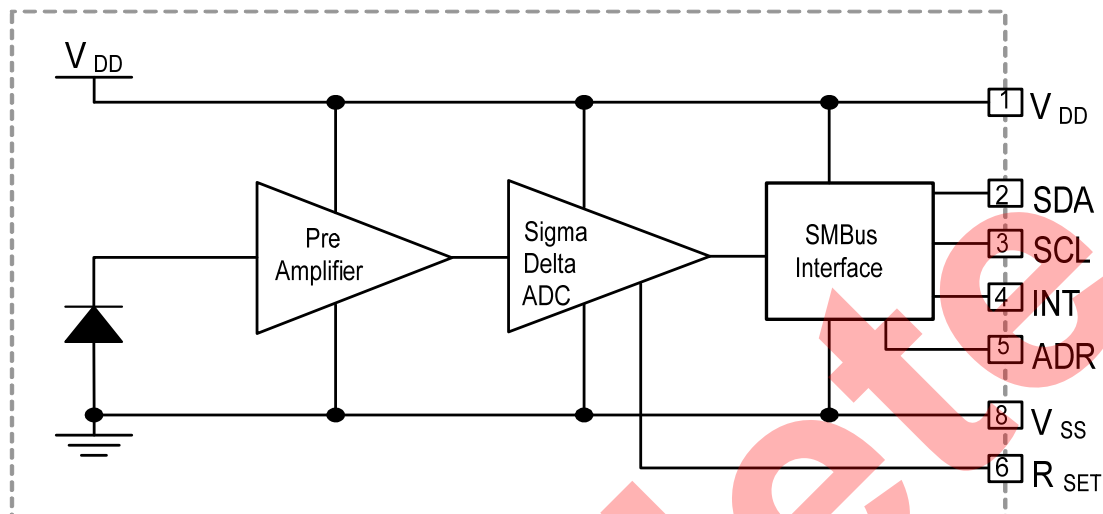
IC BLOCK DIAGRAM

Figure 4 - Simplified Block Diagram

LX1977 EVAL BOARD

Schematic: The LX1977 Eval board schematic is shown in Figure 1.

PCB Layout: The LX1977 Eval board layout is shown in Figure 2 and Figure 3.

Connections: The LX1977 Evaluation Board has a J1 connector for connecting to an outside power source and system interface. The connection pin names and functions are listed below.

Pin #	Pin Name	Function
1	V_{DD}	+3.3V Power Supply
2	GND	Power Return
3	SDA	SMBus Data
4	SCL	SMBus Clock
5	INT	Interrupt Output
6	AO	Analog Out

Table 3 – Connector J1 Pin Assignment

Jumper Setting: Jumper J2 and J3 is available for disconnecting the on-board pull-up resistors on the SCL and SDA bus line, respectively. Jumper J5 allows for the LX1977 address select. Please refer to Table 4 for the desired address selection.

Option #	ADR	Hex Address
1	GND	20h
2	OPEN	22h
3	V_{DD}	70h

Table 4 – LX1977 Device Address Select

Basic Test Steps: The following is a demonstration scenario that can be used to evaluate the LX1977.

1) Connect and interface a µP, or SMBus 2.0 / I²C protocol generator such as the WIN-I2CUSBDLL module, via the SDA and SCL connections. Note to use a common ground connection between the evaluation board and the system interface.

2) J2 and J3 are jumpers for pull up resistors on the SCL and SDA bus, respectively. If pull up

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resistors are already present on the I²C generator, such as on the WIN-I2CUSBDLL module, disconnect jumpers J2 and J3.

3) Apply a power supply to VDD on pin 1, and ground to pin 2, of the J1 connector.

4) Turn ON the power source for VDD=3.3V. Initiate an acknowledge from the LX1997 slave device by writing the set address depending on the configuration of J5.

Note that upon device power up, the register 00h will be set to 00h by default and thus the ambient light sensor (ALS) and A/D converter will be disabled. To enable the ALS and to set the A/D converter for continuous mode, write data byte 70h to register 00h using a write byte protocol (see figure 5 for an example of a write byte format). Confirm for a

successful acknowledge from the LX1977 slave device.

5) Upon power up, the ALS will be programmed for an input light range of 0 to 500 lux, with an integration time of 6.25mS. Write data byte 18h to register 01h to set the integration time to 100mS. Apply a light source (i.e. white LED) of 200 lux to the device.

6) Register 06h contains the lower byte of the 12 bits generated by the internal A/D, while bits 0 to 3 of register 07h contains the four MSB of the 12 bit word. Both 06h and 07h are read only registers. Perform a read byte protocol on both registers (figure 5 shows an example of a read byte format). Confirm that the 12 bit word is between 1403 and 1575 decimal.

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SMBus Protocol Format Diagram

SMBus Packet Protocol Diagram Element Key

S	Start Condition	**Rd**	Read (bit value of 1)
Wr	Write (bit value of 0)	**A**	Acknowledge ('0' for an ACK, or '1' for a NACK)
P	Stop Condition	**Command Code**	Register Address
☐	Master-to-Slave	▨	Slave-to-Master

Grey shading represents cycles during which the LX1977 "owns" or "drives" the Data line. All other cycles are driven by the host.

Write Byte Protocol Example of Writing 07h to register 00h:

1	7	1	1	8	1	8	1	1
S	Slave Address	Wr	A	Command Code	A	Data Byte	A	P
	22h	0b	1b	00h	1b	07h	1b	

Above format programs the LX1977's ADC for continuous conversion mode.

Write Byte Protocol Example of Writing 18h to register 01h:

1	7	1	1	8	1	8	1	1
S	Slave Address	Wr	A	Command Code	A	Data Byte	A	P
	22h	0b	1b	01h	1b	18h	1b	

Above format programs the device for an input light range between 0 to 500lux, and sets the ADC integration time to 100mS.
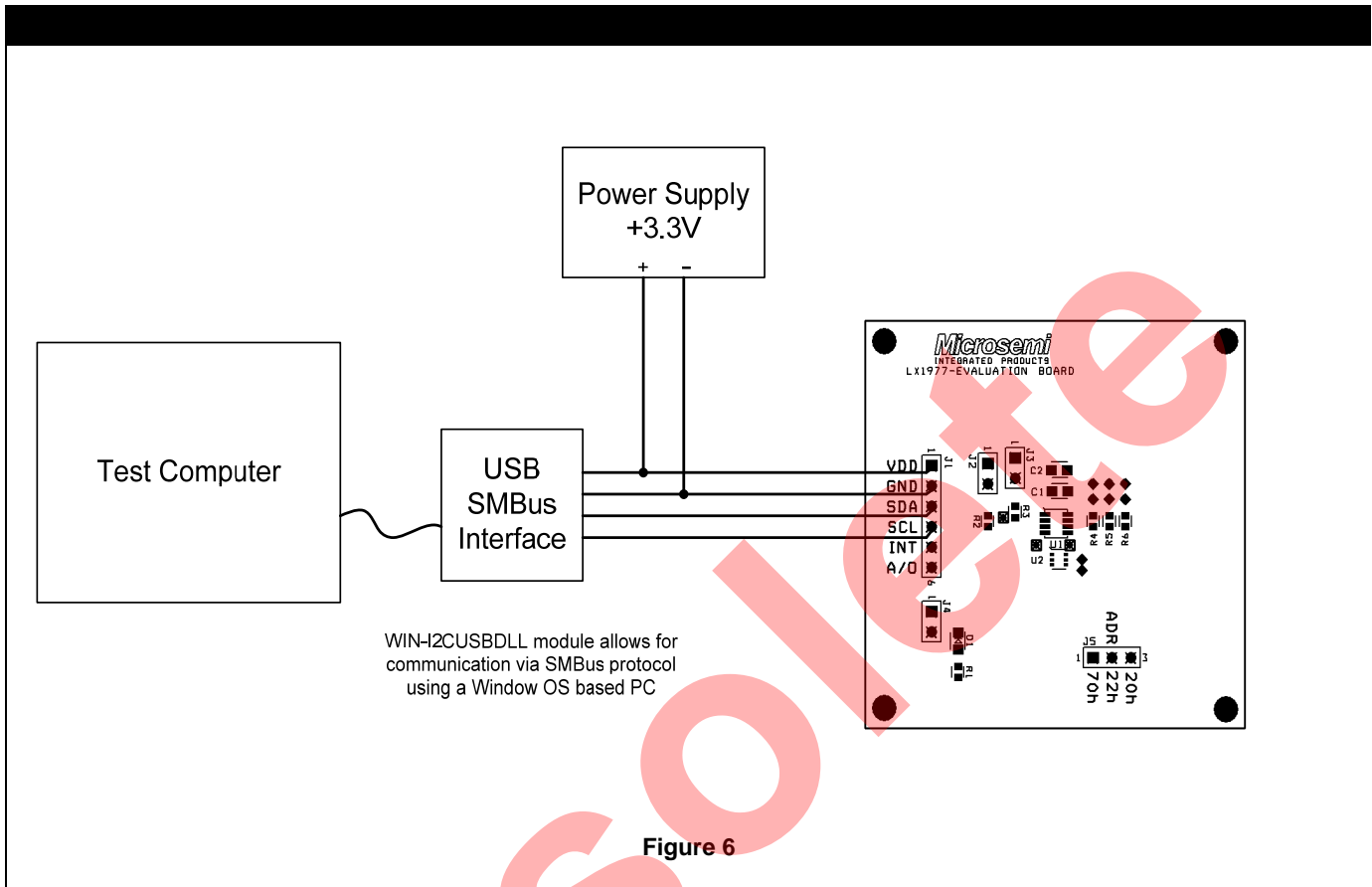
Read Byte Protocol Example of Reading register 06h:

1	7	1	1	8	1	1	7	1	1	8	1	1
S	Slave Address	Wr	A	Command Code	A	S	Slave Address	Rd	A	Data Byte	A	P
	22h	0b	1b	06h	1b		22h	1b	1b	xxh	1	

Format reads register 06h. Register 07h can be read by changing the command code to 07h.

Figure 5 – SMBus Protocol Example

Typical Test Connection

Figure 6

LX1977 Evaluation Board Bill of Materials

MISCELLANEOUS COMPONENTS					
Line Item	Part Description	Manufacturer & Part #	Case	Reference Designators	Qty
1	Microsemi IC – SMBus Ambient Light Sensor	Microsemi, LX1977IDU	MSOP 8 Pin	U1	1
2	Analog Device IC – I^{2}C Compatible 12 Bit DAC	Analog Devices, AD5622 (not included, used only for factory evaluation)	SC70	U2	0
3	LED – Green	Lite On, LTST-C170KGKT	0805	D1	1
4	Header, 6 Positions, Vertical Mount, 0.1 Center	3M, 929647-02-36-I	Through Hole	J1	1
5	Header, 2 Positions, Vertical Mount, 0.1 Center	3M, 929647-02-36-I	Through Hole	J2, J3,J4	3
6	Header, 3 Positions, Vertical Mount, 0.1 Center	3M, 929647-02-36-I	Through Hole	J5	2

CAPACITORS					
Line Item	Part Description	Part Description	Case	Reference Designators	Qty
1	Capacitor, 4.7µF, 6.3V, ±20%	Panasonic, ECJ-1VB0J4752	0603	C1	1
2	Capacitor, 0.1µF, 6.3V, ±20%	Panasonic, ECJ-1VB0J1042	0603	C2	1

RESISTORS					
Line Item	Part Description	Part Description	Case	Reference Designators	Qty
1	Resistor, 1K, 5%, 1/10W	Panasonic, ERJ-3EGYJ102V	0603	R1	1
2	Resistor, 3.2k, 5%, 1/10W	Panasonic, ERJ-3EGYJ322V	0603	R2, R3	2
3	Resistor, 267k, 1%, 1/16W	Panasonic, ERJ-3EKF2673V	0603	R4	1
4	Not used		0603	R5, R6	0

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