

LX1801 SMBus TO ANALOG & DIGITAL SYSTEM INTERFACE



INTRODUCTION TO PRODUCT

The LX1801 is a SMBus controlled brightness control interface for CCFL inverters. On top of the brightness control, safety features were incorporated into this interface for safe operation, including real time lamp on detection and over current protection.

The LX1801 Evaluation Board is available from Microsemi for evaluating the functionality and performance of the LX1801 SMBus to Analog & Digital System Interface Integrated Circuit. 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.

LX1801 KEY FEATURES

- Single supply of 4.5V to 5.5V
- Fully compliant to standard SMBus specifications
- I²CBus compatible
- Adaptable SMBus speed from 10 kHz to 100 kHz
- One 8-bit ADC & three 8-bit DAC on one chip
- ±10 LSB Accuracy
- Two selectable addresses
- External reference input makes it flexible to adapt to other circuits
- Flexible output minimum and maximum limits setting
- Two addresses selectable
- Easy to program

LX1801 APPLICATIONS

- Processor and Ambient Light Sensor (ALS) Controlled LCD Panel Dimming with Intel DPST
- General Purpose SMBus I/O Control Applications
- Remote Control or Monitoring System
- Remote A/D and/or D/A Conversion

PART SPECIFIC INFORMATION

Part Number	Product
LX1801ILQ	SMBus to Analog & Digital Interface

Table 1: PART INFORMATION

IC	EVALUATION BOARDS
LX1801ILQ	LX1801 EVAL KIT

Table 2: EVALUATION BOARD INFORMATION

PACKAGE ORDER INFORMATION	
T_A (°C)	LQ Plastic 3x3 mm MLPQ 16 pin RoHS Compliant / Pb-free
-40 to 85	LX1801ILQ
Note: Available in Tape & Reel. Append the letters "TR" to the part number. (i.e. LX1801ILQ-TR)	

SCHEMATIC FOR LXE

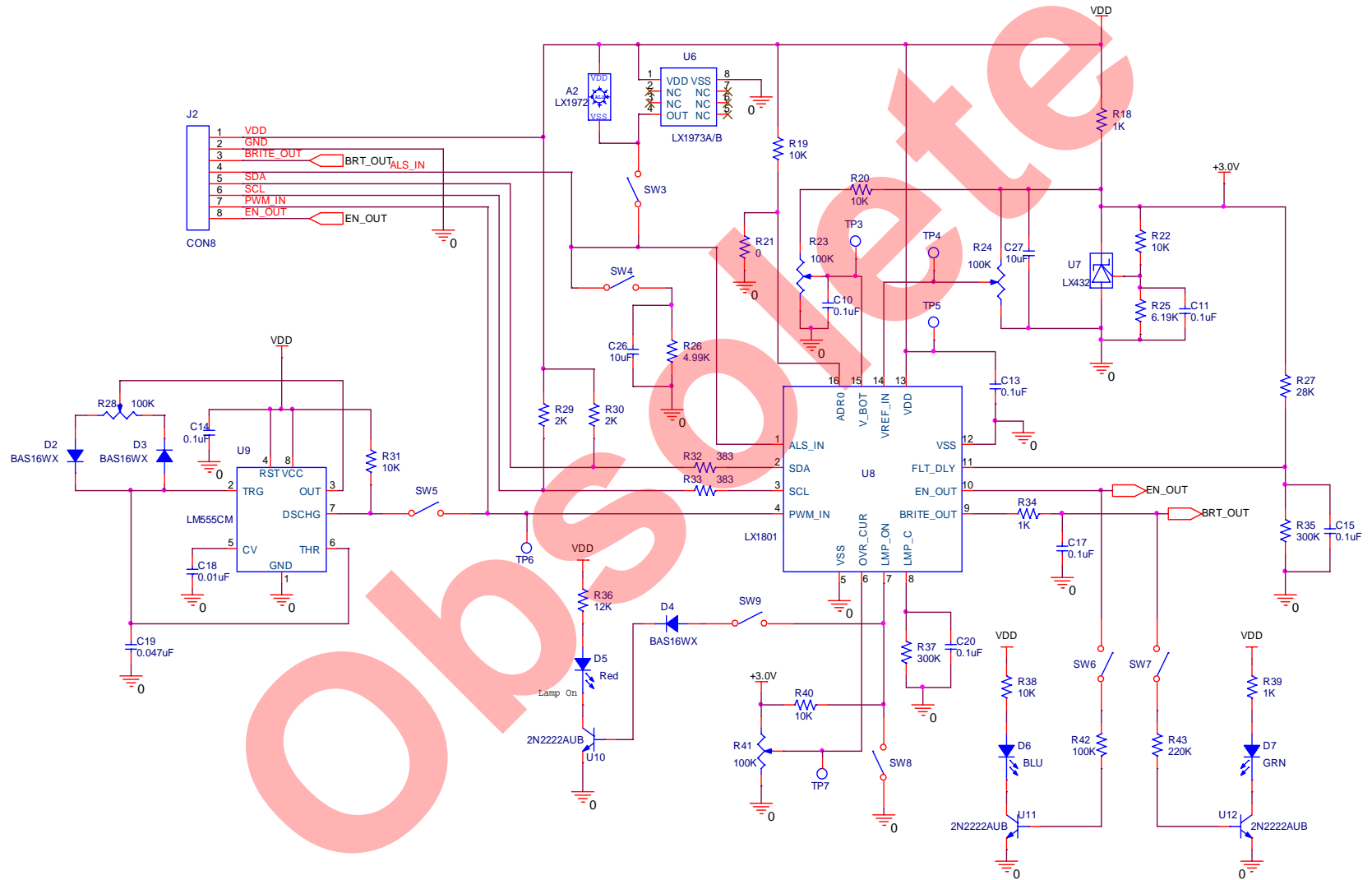


Figure 1: LX1801 Evaluation Board Schematic

IC BLOCK DIAGRAM

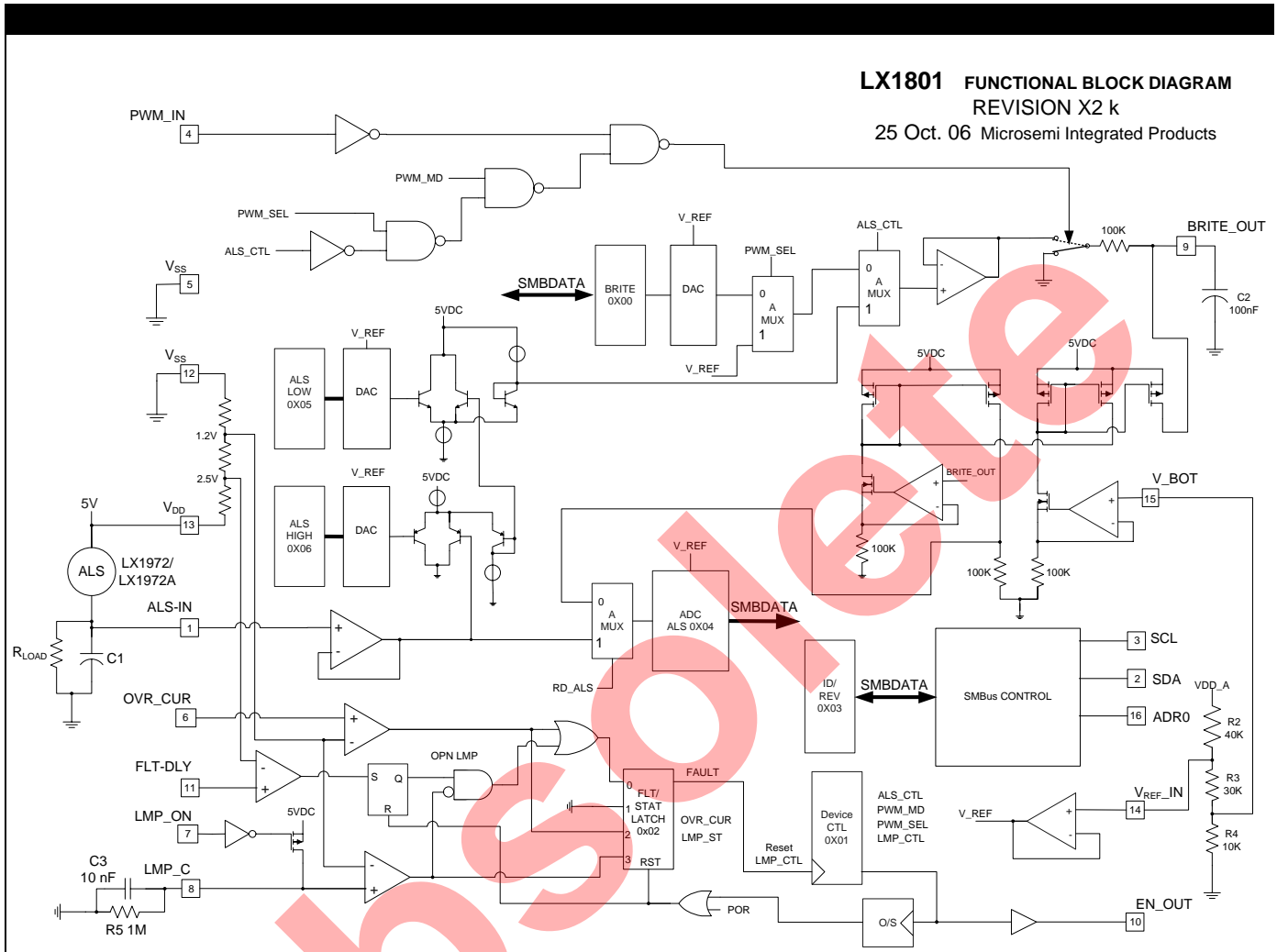


Figure 2: Simplified Block Diagram

LX1801 EVAL BOARD

PCB Layout: The LX1801 Eval board layout is shown in Figure 3. LX1801 is sensitive to noise at the analog input pins so these nodes should be a low impedance path to ground for high frequency noise. As a precaution, the BRITE_OUT and ALS_IN pins should be routed away from digital switching traces and have ceramic capacitors located close to the package pins. The V_{DD} Pin should be decoupled to ground with a 0.1uF ceramic capacitor located as close as possible to the IC.

Connections: The LX1801 Evaluation Board has a 8-pin connector connecting to outside power and signals. The connection pin names and functions are listed below. Figure 4 is a suggested test connection diagram.

PIN #	PIN NAME	FUNCTION
1	V _{DD}	+5V Power Supply
2	GND	GND
3	BRITE_OUT	Analog Output
4	ALS_IN	Sensor Analog Input
5	SDA	SMBus Data
6	SCL	SMBus Clock
7	PWM_IN	PWM Signal Input
8	EN_OUT	Enable Output to Inverter

Table 3: Connector Pin Assignment

POT #	REF	FUNCTION
1	R23	Adjusting V-BOT Voltage
2	R24	Adjusting V _{REF_IN} Voltage Setting
3	R28	Adjusting PWM_IN Duty cycle
4	R41	For Over Current Simulating

Table 4: TRIM-POT Function

JMP #	REF	FUNCTION
1	SW3	For selecting internal or external light sensor. If both jumpers are on, The circuit will use onboard light sensor. If both are off, external light sensor could be connected to J2 Pin 4.
2	SW4	
3	SW5	Internal or external PWM signal selection. If it is on, PWM signal will be generated onboard. The frequency is about 400 Hz.
4	SW6	For selecting LED6, EN_OUT indicator. If it is on, D6 will be on/off according to EN_OUT value.
5	SW7	Enable or disable LED D7 display
6	SW8	Lamp on/off simulator
7	SW9	Lamp on/off indicator

Table 5: Jumper Function

LED #	REF	FUNCTION
1	D5	Lamp On indicator, when simulating lamp on/off by using SW8, this LED will indicate the lamp status.
2	D6	EN_OUT indicator. When EN_OUT is high, D6 will be on.
3	D7	For BRT_OUT signal indication, the brightness of D7 will change according to BRT_OUT voltage level. This is for simulating CCFL brightness.

Table 6: LED Function

Jumpers: The LX1801 Evaluation Board has seven jumper blocks. The jumpers can be removed or put on to select different configurations of the circuit. Detail descriptions are shown below.

Test Steps: The following is a demonstration scenario that can be used to evaluate the LX1801. Here, LED D7 brightness will represent LX1801 BRITE_OUT. Before doing the following tests, make sure $V_{TP7} < 1V$, $V_{TP4}=2.04V$ & $V_{TP3} < 0.5V$.

- 1) Make connections as shown in Figure 4. Apply 5V power source to the board. Measure Pin 1 and Pin 2 on connector J1 to verify +5V power is supplied to the board.
- 2) Make sure Jumpers SW3, SW4, SW6, SW7 & SW9 are at ON position.
- 3) By using SMBus tester or other SMBus interface, send "58H, Write, 01, 0DH, [STOP]" to LX1801. By doing this, LX1801 will be set to ALS mode and EN_OUT pin is enabled. At this time, LED D6 should be on, meaning EN_OUT is high; And LED D7 brightness should change with the light input to ALS A2 change. This can be verified by covering A2 with hand, the LED D7 will change brightness accordingly; BRITE_OUT pin voltage will also change.
- 4) Send "58H, Write 04" and "58H, Read, [STOP]" to LX1801. The current ALS reading (in Register 0x04) will be sent back by LX1801.
- 5) Put jumper SW8 ON while observing LED D5 & D6. Both LEDs should be off if you put jumper SW8 on. SW8 is for simulating Lamp On signal from CCFL lamp. LED D5 is the lamp status. SW8 jumper On means CCFL lamp is not on. Since previously, LX1801 sent a turn on lamp command and at this time, the lamp is not on, at this situation, LX1801 will generate an open lamp error and turn off EN_OUT. Open lamp error can be reset by enabling EN_OUT again. This can be done by sending "58H, Write, 01, 0DH, [STOP]" to LX1801 again. Lamp will be turned off by sending "58H, Write, 01, 0CH, [STOP]" to LX1801. Remove jumper SW8 after this step test.
- 6) Trim Pot R23 is for adjusting V_BOT voltage, it will set the minimum output brightness. Adjusting R23 will change D7 brightness.
- 7) Send "58H, Write, 01, 09H, [STOP]" to LX1801. This will set the LX1801 to ALS mode with DPST. At this time, put jumper SW5 on and then adjust Trim Pot R28, the brightness of D7 will change with both ALS and PWM duty cycle. The

minimum brightness is determined by V-BOT voltage.

- 8) Sending "58H, Write, 01, 03H" to LX1801 will set it to PWM mode. The D7 brightness will change with PWM duty cycle and V_{REF_IN} voltage. Adjust R28 and R24 will change PWM duty cycle and V_{REF_IN} voltage. R23 will also set D7 minimum brightness.
- 9) Sending "58H, Write, 01, 05H" to LX1801 will set it to SMBus mode. D7 brightness will change according to the setting of register 0x00. This can be done by sending "58H, Write, 00, *value*" to LX1801. "*value*" is the brightness control value, 0 ~ 255. Adjust R28 and R23 will change D7 brightness. The minimum brightness is determined by V-BOT voltage.
- 10) Sending "58H, Write, 01, 01H" to LX1801 will set it to SMBus mode with DPST. D7 brightness will

change according to the setting of register 0x00 and current PWM duty cycle. Refer to datasheet for detailed explanation. Adjust R23, R24 & R23 will also change D7 brightness. The minimum brightness is determined by V-BOT voltage.

- 11) With EN_OUT enabled, turn R41 counterclockwise until D6 turns off. This simulates the over current situation. After this test, turn R41 clockwise until $V_{TP7} < 1V$.
- 12) When using external ALS input is desired, jumper SW3 & SW4 should be removed and the external ALS signal can be connected to J2 pin 4. When using external PWM signal is desired, jumper SW5 should be removed to disconnect LX1801 PWM input from on board PWM circuit. The minimum brightness is determined by V-BOT voltage.

Obsoleted

LX1801 PRINTED CIRCUIT BOARD LAYOUT

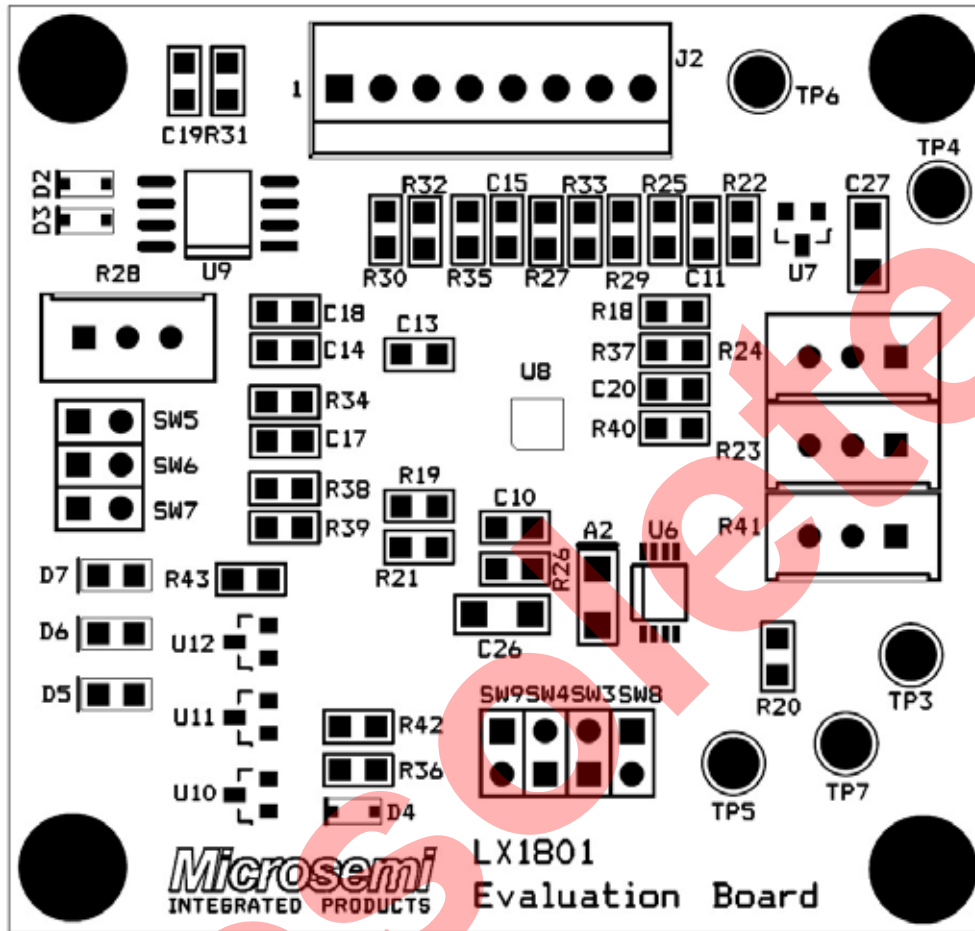


Figure 3: LX1801 Evaluation Board Layout

PCB LAYOUT RECOMMENDATIONS

It is recommended that C1 and C2 be located within 1cm of the LX1801. The CMP capacitor should be located close to the IN and CMP pins. Also the high impedance summing node connecting to the TMP pin should be kept relatively short to prevent the coupling of noise into this node. It is important that the LX1801 have a good thermal path to ambient to dissipate heat. The simplest way to do this is to heat sink the LX1801 bottom pad directly to the ground plane by placing 4 or more Vias in the ground pad directly under the LX1801 footprint.

LX1801 TYPICAL TEST HOOKUP

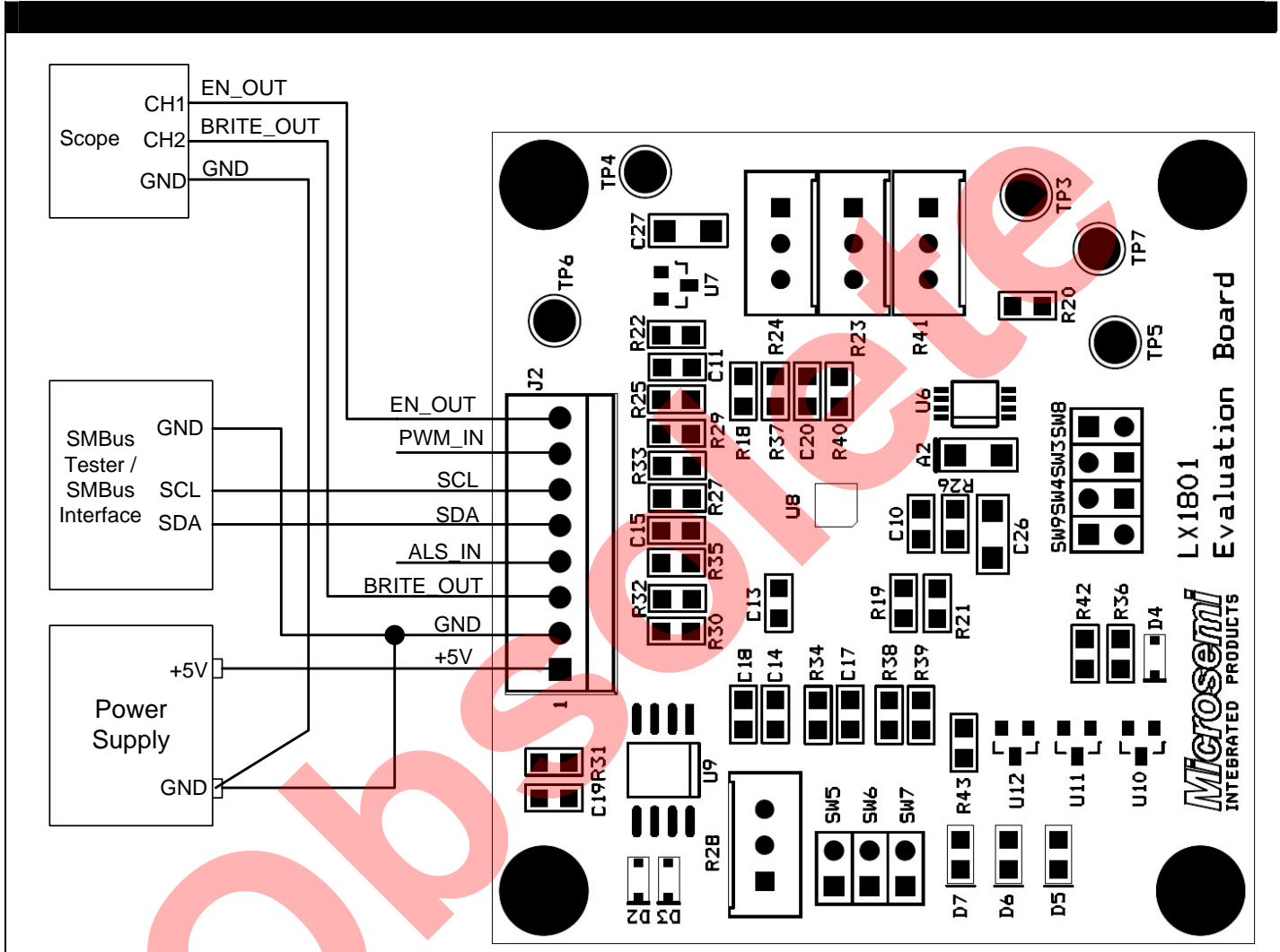


Figure 4: LX1801 Typical Test Hookup

LX1801 EVALUATION BOARD BILL OF MATERIALS

MISCELLANEOUS COMPONENTS

Line Item	Part Description	Manufacturer & Part #		Case	Reference Designators	Qty
1	Microsemi IC – Ambient Light Sensor	MICROSEMI	LX1972IBC	1206	A2	1
2	Microsemi IC – SMBus to Analog Interface	MICROSEMI	LX1801ILQ	3x3 MLPQ	U8	1
3	LED – Red	Lite On	LTST-C170KRKT	0805	D5	1
4	LED – Blue	Lite On	LTST-C170KBKT	0805	D6	1
5	LED – Green	Lite On	LTST-C170KGKT	0805	D7	1
6	CONN HEADER RTANG 8POS .100	AMP	640457-8	Through Hole	J2	1
7	Jumper	AMP	382811-6	Through Hole	SW3,4,5,6,7,8,9	7
8	Test Point	Keystone	5007	Through Hole	TP3,4,5,6,7	5
9	Voltage Reference	MICROSEMI	LX432ISC	SOT23_123	U7	1
10	Light Sensor (not mounted)	MICROSEMI	LX1973AIDU	MSOP 8pin	U6	0
11	555 Timer	National Semi	LM555CM	SO8	U9	1
12	NPN Transistor	Diodes	MMBT2222A-7	SOT23_123	U10,11,12	3
13	Diode	Micro Commercial	BAS16WX-TP	SOD323	D2,3,4	3

CAPACITORS

Line Item	Part Description	Part Number		Case	Reference Designators	Qty
1	Capacitor, 0.1 μ F, 50V, \pm 20%	Panasonic,	ECJ-2VF1H104Z	0805	C10,11,13,14,15, C17,20	8
2	Capacitor, 0.01 μ F, 50V, \pm 20%	Panasonic,	ECJ-2VF1H103Z	0805	C18	1
3	Capacitor, 0.047 μ F, 50V, \pm 20%	Panasonic,	ECJ-2VF1H473Z	0805	C19	1
4	Capacitor, 10 μ F, 16V, \pm 20%	Panasonic,	ECJ-MFF1C106Z	1206	C26,27	2

RESISTORS

Line Item	Part Description	Part Number		Case	Reference Designators	Qty
1	Resistor, 0K, 5%, 1/8W	Panasonic,	ERJ-6GEY0R00V	0805	R20	1
2	Resistor, 383, 1%, 1/8W	Panasonic,	ERJ-6ENF3830V	0805	R32,33	2
3	Resistor, 1K, 1%, 1/8W	Panasonic,	ERJ-6ENF1001V	0805	R18,34	2
4	Resistor, 2K, 1%, 1/8W	Panasonic,	ERJ-6ENF2001V	0805	R29,30	2
5	Resistor, 4.99K, 1%, 1/8W	Panasonic,	ERJ-6ENF4991V	0805	R26	1
6	Resistor, 6.98K, 1%, 1/8W	Panasonic,	ERJ-6ENF6981V	0805	R25	1
7	Resistor, 10K, 1%, 1/8W	Panasonic,	ERJ-6ENF1002V	0805	R19,20,22,31,36, 38,39,40,42,43	10
8	Resistor, 28K, 1%, 1/8W	Panasonic,	ERJ-6ENF2802V	0805	R27	1
9	Resistor, 301K, 1%, 1/8W	Panasonic,	ERJ-6ENF3013V	0805	R35,37	2
10	Trim Pot, CERM 100K OHM 25TRN TOP	Panasonic,	PV36W104C01B00	Through Hole	R23,24,28,41	4