Wide Range Visible Light Sensor

PRODUCTION DATA SHEET

DESCRIPTION

The LX1971 is a new technology light sensor with spectral response that emulates the human eye; it is pin to pin compatible to Microsemi's LX1970 visible light sensor however with a wider dynamic range.

This device is ideal for monitoring ambient light for the control of artificial lighting, operation of shades, LED signage and display, street lighting, automotive light sensors and control of backlight dimming. It has a unique photo diode arrangement (patents pending) with a peak response at 520nm while sharply attenuating both ultra violet and infrared wavelengths.

The photo sensor is a PIN diode array with an accurate and very repeatable current output.

Photo current is first multiplied by an integrated high gain amplifier then the square root is taken of the product of the amplifier and an internal reference current. Finally this is further multiplied converted to current and made available at two output pins; one a current source and the other a current sink.

These currents can easily be converted to voltage by adding a single resistor at either or both outputs. Voltage gain is determined by the resistor value typically in the 5KΩ to 50KΩ range.

With accurate internal gain amplifiers and square root transfer function, design complexity and cost are greatly reduced.

The LX1971 is available in the Clear 8-pin MSOP package.

IMPORTANT: For the most current data, consult *MICROSEMI*'s website: http://www.microsemi.com

Protected By U.S. Patents: 6,787,757; Patents Pending

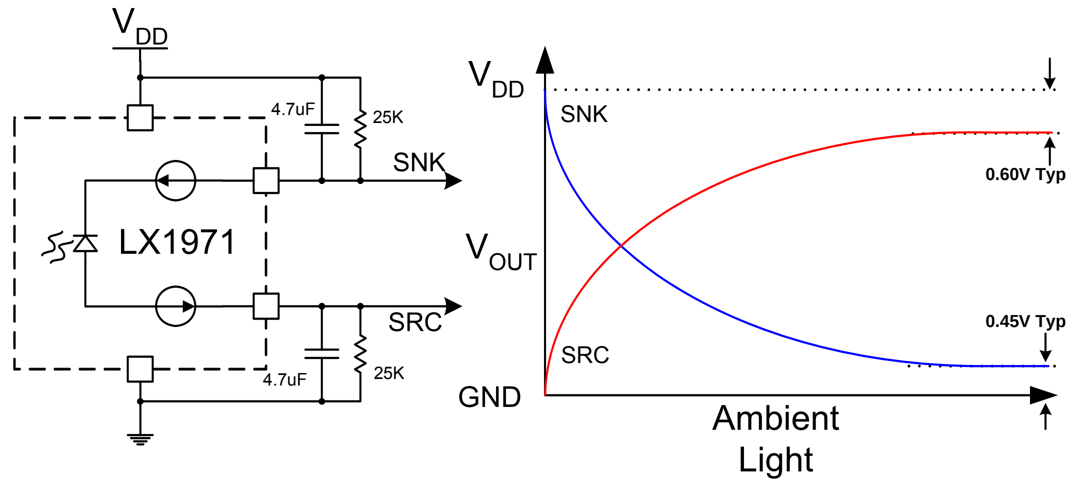
KEY FEATURES

- Approximate Human Eye Spectral Response
- Low IR Sensitivity
- Highly Accurate & Repeatable Output Current vs. Light
- Square root transfer function
- Temperature Stable
- Integrated High Gain Photo Current Amplifiers
- Complementary Current Outputs
- No Optical Filters Needed

BENIFITS

- Requires no wavelength filters
- Insensitive to UV and IR
- More than 4 decades usable light range
- Enables accurate lighting control systems

PRODUCT HIGHLIGHT



PACKAGE ORDER INFO

T_A (°C)	DU Plastic MSOP 8-Pin RoHS Compliant / Pb-free
-40 to 85	LX1971IDU

Note: Available in Tape & Reel. Append the letters "TR" to the part number. (i.e. LX1971IDU-TR)

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ABSOLUTE MAXIMUM RATINGS

V_{DD} .... -0.3 to 6 V_{DC}
SNK/SRC (Output Compliance Voltage) .... -0.3 to V_{DD} + 0.3V_{DC}
SNK/SRC (Maximum Output Current) .... Internally Limited
Operating Temperature Range .... -40 to +85°C
Storage Temperature Range .... -40 to +100°C
Solder Reflow Peak Temperature (Soldering 10 seconds) .... 240°C

Notes: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

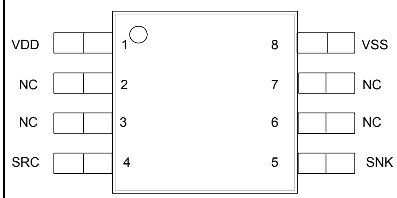
Solder reflow to follow: IPC/JEDEC J-STD-020B 7/02 Pb-SN Small Body Profile

THERMAL DATA

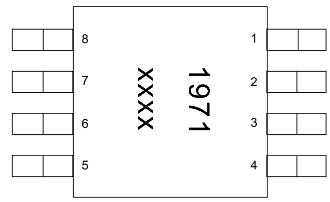
DU **Plastic MSOP 8-Pin**

THERMAL RESISTANCE-JUNCTION TO AMBIENT, θ_{JA}	206°C/W
THERMAL RESISTANCE-JUNCTION TO CASE, θ_{JC}	39°C/W

PACKAGE PIN OUT



DU PACKAGE
(Top View)



DU PACKAGE
(Bottom View)

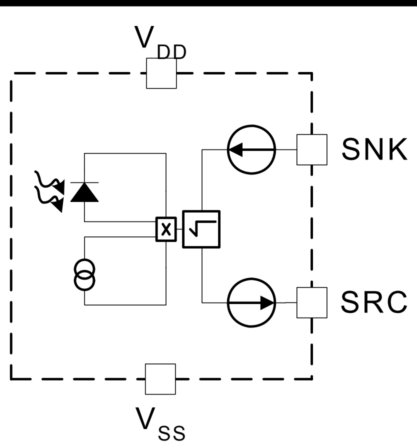
xxxx = Denotes Date Code / Lot Information

RoHS / Pb-free Gold Lead Finish
MSL 2 / 260°C / 1 Year

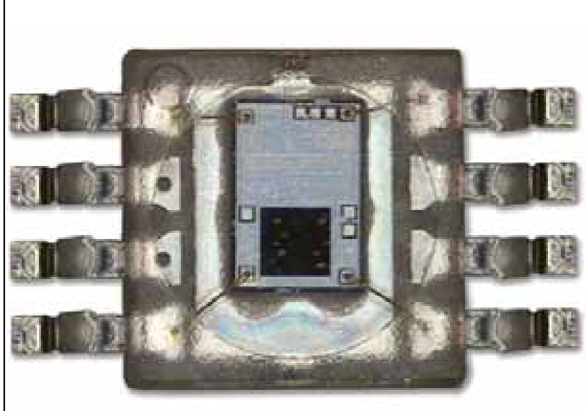
FUNCTIONAL PIN DESCRIPTION

NAME	DESCRIPTION
V_{DD}	Input Supply Voltage
V_{SS}	Ground Reference for Power and Signal Output
SNK	Output Current Sink
SRC	Output Current Source

SIMPLIFIED BLOCK DIAGRAM



PACKAGE PHOTO



PACKAGE DATA

APPLICATION EXAMPLES

The following examples present both fully automatic (no user input) and semi-automatic, to fully manual override implementations. These general guidelines are applicable to a wide variety of potential light control applications. The LX1971 can be used for the control of artificial lighting, operation of shades, LED signage and display, street lighting, automotive light sensors and control of backlight dimming.

In each specific application it is important to recognize the need to correlate the sink and source current of the LX1971 for the target environment and its ambient light conditions. The mechanical mounting of the sensor, light aperture hole size, use of a light pipe or bezel are critical in determining the response of the LX1971 for a given exposure of light.

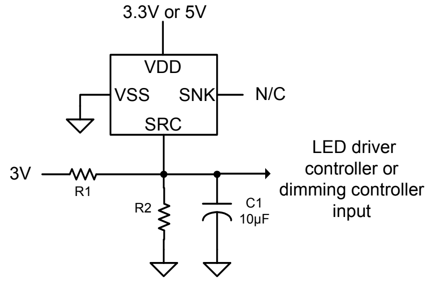


Figure 1

The example in figure one shows a fully automatic lighting control solution with no user interaction. Choose R1 and R2 values for any desired minimum brightness and slope. Choose C1 to adjust response time. As an example, let's say you wish to generate an output voltage from 0.25V to 1.25V to drive the input of an LED driver controller. The 0.25V represents the minimum LED brightness and 1.25V represent the maximum. The first step would be to determine the ratio of R1 and R2.

$R1 = R2\,[\,3.0V/0.25V - 1\,] = 11 * R2$

Next the value of R2 can be calculated based on the maximum output source current coming from the LX1971 under the application's maximum light exposure, lets say this has been determined to be about 50uA . Thus R2 can be calculated first order as follows:

$R2 = [\,1.25V / 50uA\,] = 25K\Omega \;\therefore\; R1 = 11 * R2 = 275K\Omega$

The output node will actually reach 1.25V when the source current from the LX1971 is only about 44uA since about 6uA of current will be contributed from R1.

We are assuming a high impedance input to the LED driver. In Figure 2 user adjustable bias control has been added to allow control over the minimum and maximum output voltage. This allows the user to adjust the output brightness to personal preference over a limited range. The PWM input source could of course be replaced with an equivalent DC voltage.

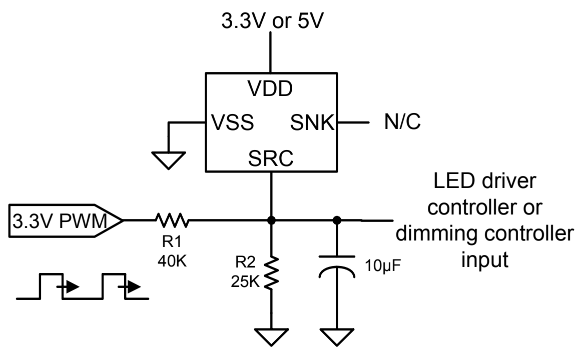


Figure 2

Figure 3 shows how a fully manual override can be quickly added to the example in figure 2. In addition to the gate to turn on and off the LX1971, a diode has been inserted to isolate the LX1971 when it is shut down.

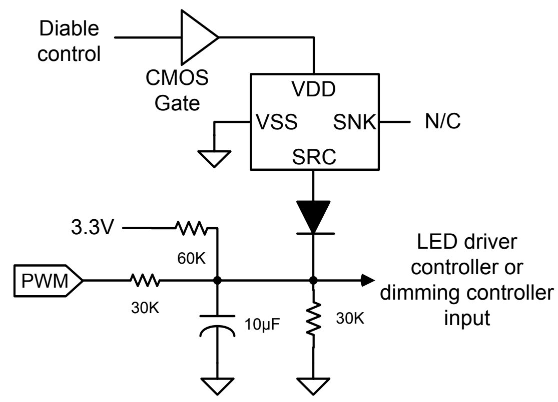
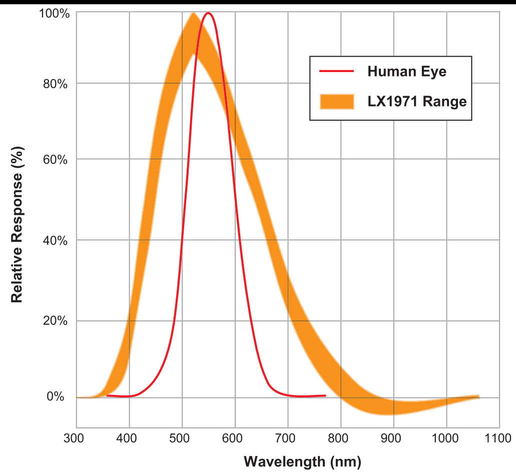


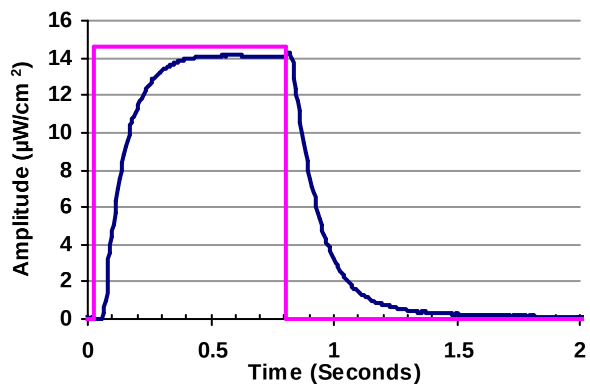
Figure 3

The preceding examples represent just a few of the many ways the sensor can be used. For example since there is also a complimentary sink output a resistor from VDD to SNK could develop a voltage that could be compared (with some hysteresis) to a fixed (or adjustable) reference voltage and develop a logic signal. In the case of street lighting or operation of shades such a signal would engage the function when reaching the correct ambient light level.

RESPONSE VS WAVELENGTH

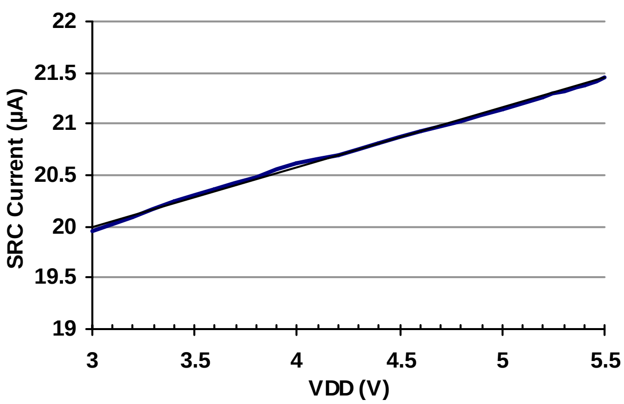


ISRC STEP RESPONSE



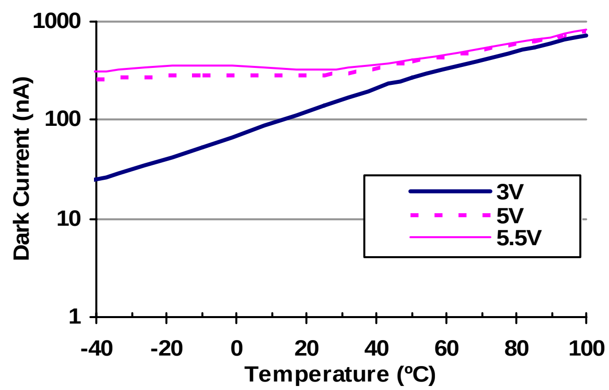
V_{DD} = 3.0V; R_{SRC} = 25K & 4.7uF

LINE REGULATION



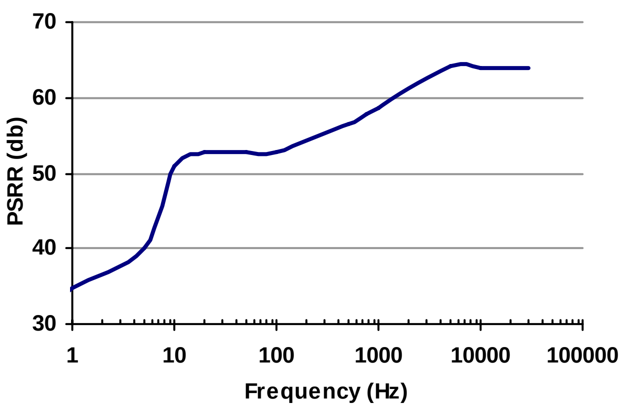
V_{DD} = 3.5V; R_{SRC} = 25K & 4.7uF

DARK CURRENT VS TEMP



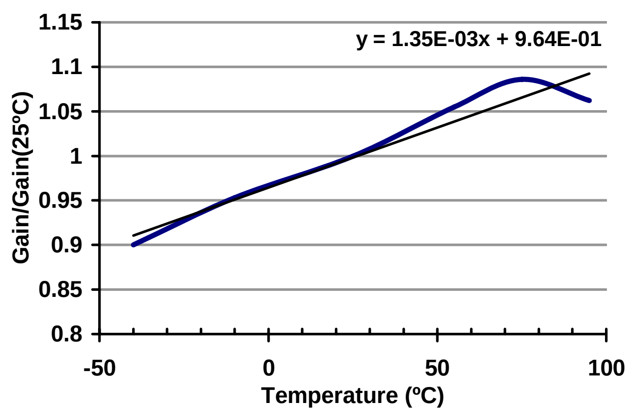
R_{SRC} = 25K & 4.7uF

SNK OUTPUT PSRR



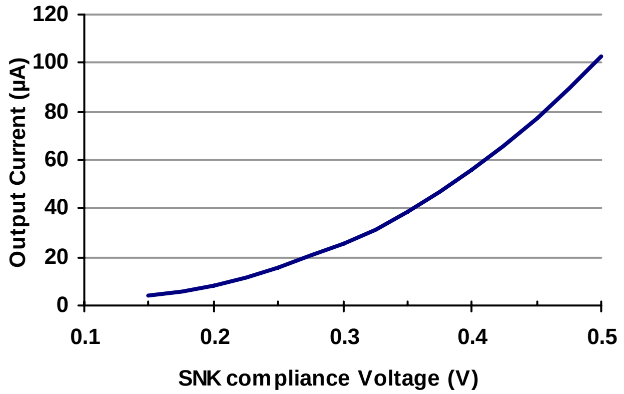
V_{DD} = 3.0V; R_{SNK} = 25K & 4.7uF

GAIN VS TEMP



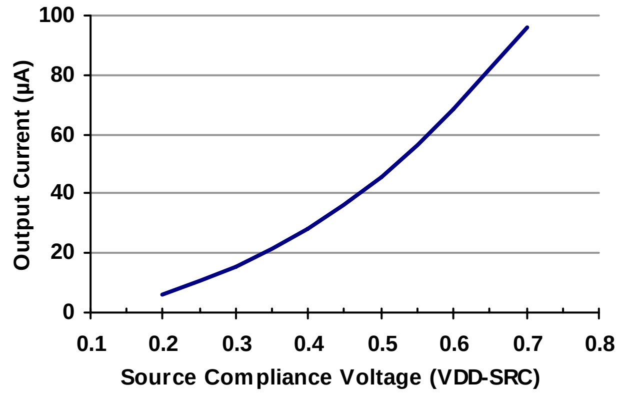
V_{DD} = 3.0V Direct Light Input of 13.14μW/cm^2

SNK COMPLIANCE VS CURRENT



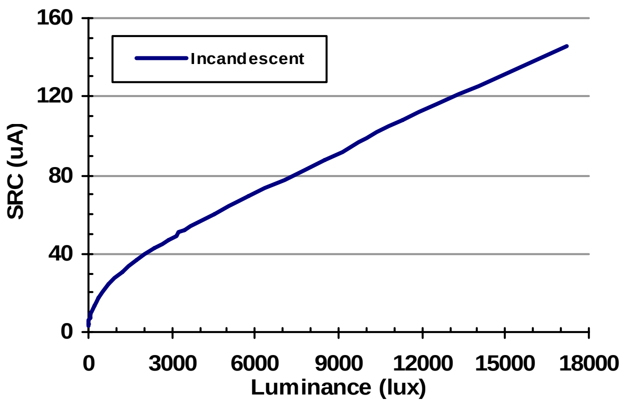
V_{DD} = 3.0V; R_{SNK} = 25K & 4.7µF

SRC COMPLIANCE VS CURRENT



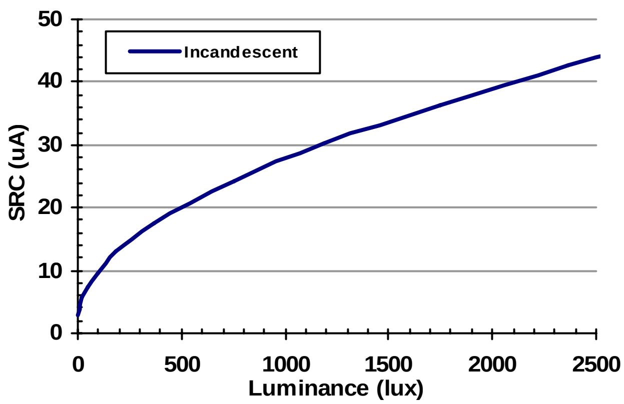
V_{DD} = 3.0V; R_{SRC} = 25K & 4.7µF

SRC OUTPUT VS LUMINANCE(LUX)



V_{DD} = 4.0V; R_{SNK} = 10K & 4.7µF

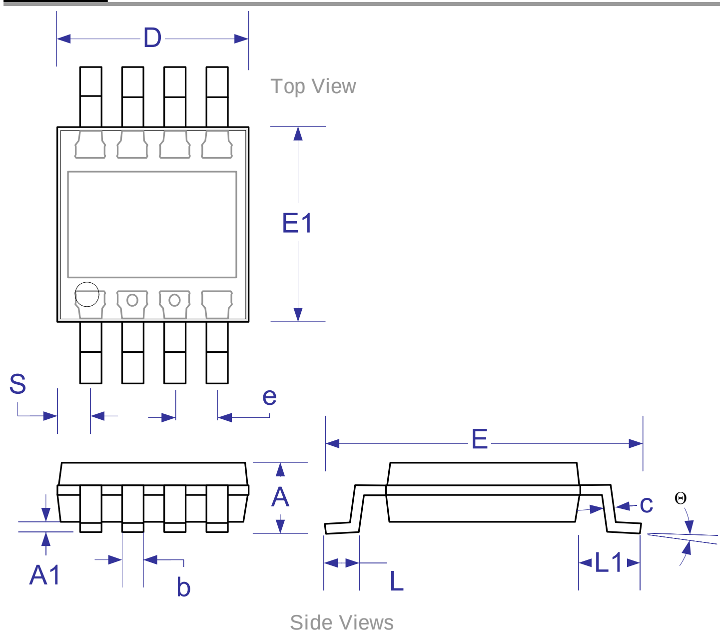
SRC OUTPUT VS LUMINANCE(LUX)



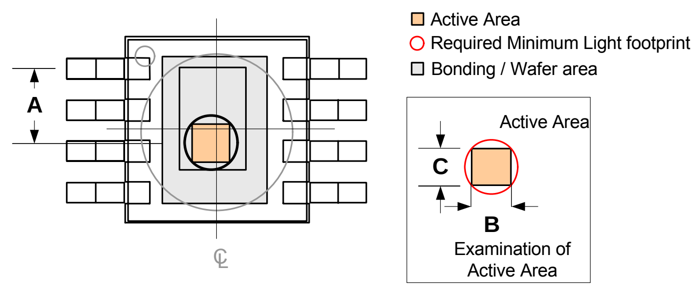
V_{DD} = 4.0V; R_{SNK} = 10K & 4.7µ

PACKAGE DIMENSIONS

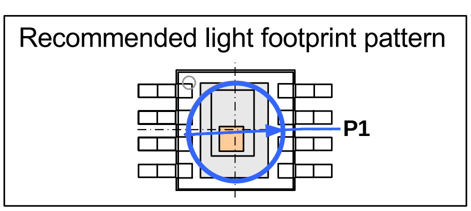
DU 8-Pin Miniature Shrink Outline Package (MSOP)



Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	–	1.10	–	0.043
A1	0.05	0.15	0.002	0.006
b	0.26	0.41	0.010	0.016
c	0.13	0.23	0.005	0.009
D	2.90	3.10	0.114	0.122
e	0.65 BSC		0.025 BSC	
E	4.75	5.05	0.187	0.198
E1	2.90	3.10	0.114	0.122
L	0.41	0.71	0.016	0.028
L1	0.95 BSC		0.037 BSC	
S	0.525 BSC		0.021 BSC	
Θ	3°		3°	



Dim	MILLIMETERS	INCHES
A	1.22	0.048
B	0.60	0.024
C	0.60	0.024
P1	2.5	0.98



Note:
P1 represents a possible light footprint and its dimensions are not subject to strict tolerances. Only the active area of the device is required to be covered with light. This larger footprint is designed to ensure coverage of the device's active area.

NOTES