

**DESCRIPTION**

The LX1973 is a wide dynamic range light sensor with a very low dark current that is optimized for sensing low level light signals that typically occur under dark or darkening outdoor ambient lighting. The LX1973 has been optimized for automotive systems such as headlamp brightness control or rear view mirror contrast control. Its radical (fractional exponent) response when interfaced with an 8 bit DAC can detect levels down to 0.001 lux or levels as high as 500 lux.

The spectral response of the integrated light sensor closely emulates the human eye so it ignores light such as infrared which emits energy but doesn't aid vision. This eliminates the need for an Infrared filter required with competitor's light sensors.

The LX1973 internal circuitry consists of a diode array that provides a nearly perfect photopic light wavelength response curve. The sensor output feeds into a wide dynamic range compression amplifier that provides accurate resolution over five decades of ambient light. The integrated dark current cancellation circuit facilitates accurate sensing of light below 0.01 lux. The current source output of the LX1973 can be gain scaled using one external resistor.

The LX1973 is internally trimmed to an initial accuracy of 5% at room temperature and a light level of 10lux. Accuracy of 10% is maintained over the full temperature range (-40 to +85C).

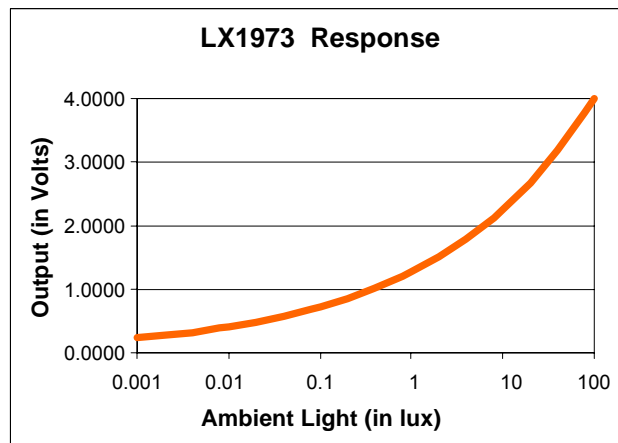
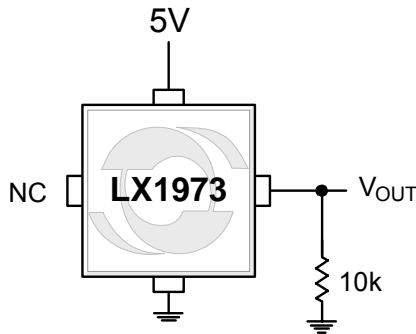
**KEY FEATURES**

- Human Eye Spectral Response
- 25C Dark Current < 0.005 lux
- 5 Decades Compressed Output
- 10% Accuracy Over Temperature
- Scalable Output Voltage
- No Optical Filters Needed

**APPLICATIONS**

- Auto Headlamp Control
- Auto Mirror Contrast Control

**IMPORTANT:** For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>  
 Protected by US Patent: 6,787,757; Patents Pending

**PRODUCT HIGHLIGHT**

**PACKAGE ORDER INFO**

<b>T<sub>A</sub></b> (°C)	<b>DU</b>	Plastic MSOP
		8-pin
		RoHS Compliant / Pb-free
-40 to 85		<b>LX1973IDU</b>

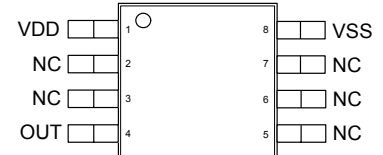
Note: Available in Tape & Reel. Append the letters "TR" to the part number. (i.e. LX1973IDU-TR)

**ABSOLUTE MAXIMUM RATINGS**

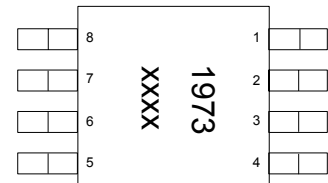
V <sub>DD</sub> .....	-0.3 to 6 V <sub>DC</sub>
SNK/SRC (Output Compliance Voltage).....	-0.3 to V <sub>DD</sub> + 0.3V <sub>DC</sub>
SNK/SRC (Maximum Output Current).....	Internally Limited
Maximum Operating Junction Temperature .....	150°C
Operating Temperature Range .....	-40 to +85°C
Storage Temperature Range.....	-55 to 125°C
Peak Package Solder Reflow Temp. (40 seconds maximum exposure).....	260° (+0, -5)

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

**PACKAGE PIN OUT**


**DU PACKAGE**  
(Top View)



**PACKAGE MARKING**  
(Bottom View)

xxxx – Denotes Date Code / Lot information

RoHS / Pb-free 100% matte Tin Lead Finish

**THERMAL DATA**
**DU Plastic MSOP 8-Pin**

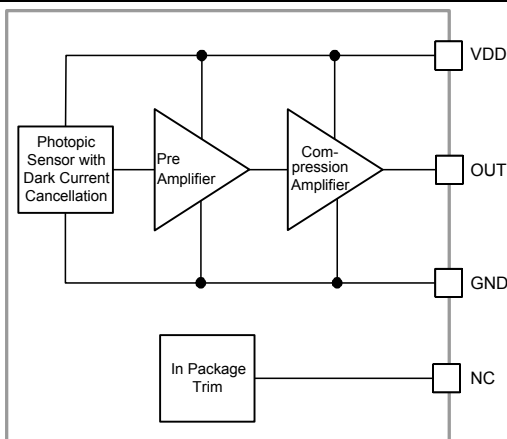
<b>THERMAL RESISTANCE-JUNCTION TO CASE, <math>\theta_{JC}</math></b>	<b>39°C/W</b>
<b>THERMAL RESISTANCE-JUNCTION TO AMBIENT, <math>\theta_{JA}</math></b>	<b>206°C/W</b>

Junction Temperature Calculation:  $T_J = T_A + (P_D \times \theta_{JA})$ .

The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

**FUNCTIONAL PIN DESCRIPTION**

Name	Description
VDD	Input Supply Voltage
VSS	Ground Reference for Power and Signal Output
OUT	Output Current
VDD	Input Supply Voltage

**SIMPLIFIED BLOCK DIAGRAM**


**Figure 1 – Simplified Block Diagram**

**PACKAGE PHOTO**


**ELECTRICAL CHARACTERISTICS**

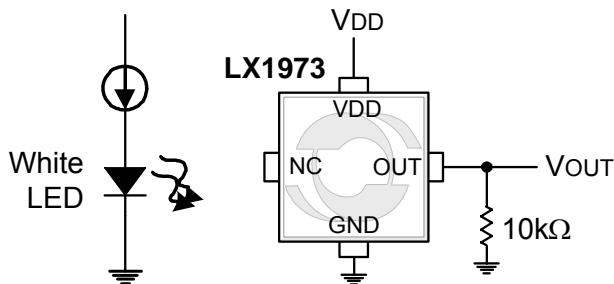
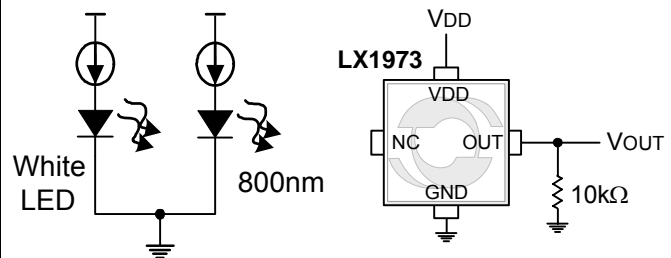
Unless otherwise specified, the following specifications apply over the operating ambient temperature  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$  except where otherwise noted and the following test conditions: See Note 1,  $V_{DD} = 5\text{V}$ ,  $R_{OUT} = 10\text{k}$ .

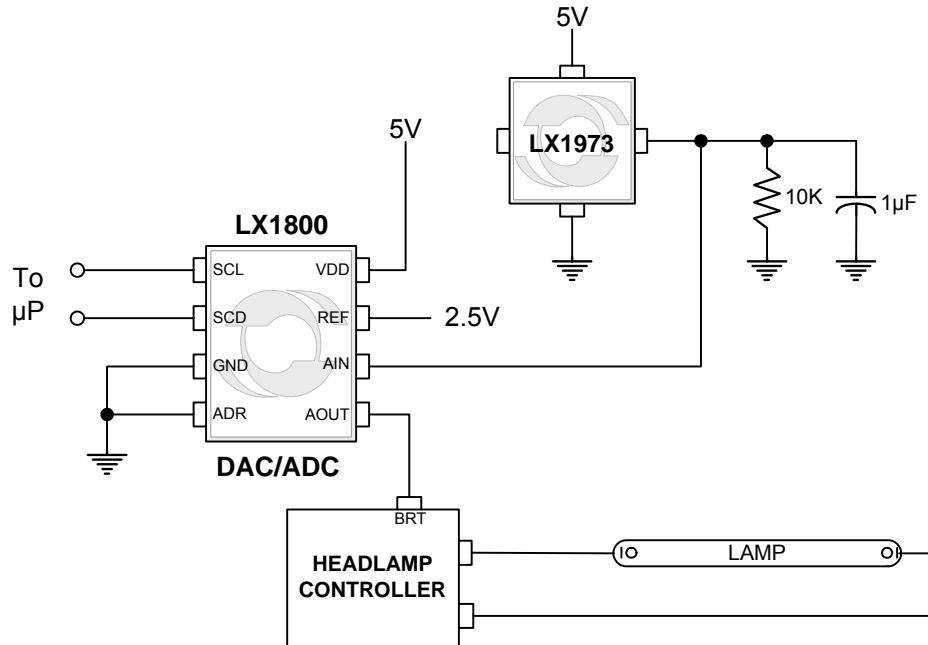
Parameter	Symbol	Test Conditions	LX1973			Units
			Min	Typ	Max	
Operational Voltage	$V_{DD}$		4.5		5.5	V
Supply Current	$I_{DD}$	$E_V = 1 \text{ lux}$		0.2	0.25	mA
Power Supply Rejection Ratio	PSRR	$V_{RIPPLE} = 100\text{mV}_{P-P}$ , $f = 10\text{kHz}$ ; $C_{OUT} = 0.1\mu\text{F}$	30	35		dB
Peak Spectral Response	$\lambda_{PR}$			550		nm
Infrared Response	$\frac{I_{DD}(\lambda)}{I_{DD}(\lambda_{PR})}$	$E_V(550\text{nm}) = E_V(800\text{nm}) = 146\text{nW}/\text{cm}^2$ , Note 3	-5	1	5	%
Light to Current Gain	$G_L$	See application section for equation				
Output Current	$I_{OUT(0.01)}$	$E_V = 0.01 \text{ lux @ } 25^{\circ}\text{C}$	34	38	42	$\mu\text{A}$
Output Current	$I_{OUT(1.0)}$	$E_V = 1 \text{ lux}$ , Note 2	108	120	132	$\mu\text{A}$
Output Current	$I_{OUT(100)}$	$E_V = 100 \text{ lux}$ , Note 2	342	380	418	$\mu\text{A}$
Saturation Current	$I_{SAT}$		650			$\mu\text{A}$
Dark Current (Equivalent lux)	$I_{OUT(DARK)}$	$E_V = 0 \text{ lux}$ , $T_A = 20^{\circ}\text{C}$ , Note 4		450	900	$\mu\text{Lux}$
		$E_V = 0 \text{ lux}$ , $T_A = 50^{\circ}\text{C}$ , Note 4		2100	10000	
Dynamic Response Time	$T_{DR}$	10% settling error ( $146 \text{ nW}/\text{cm}^2$ to $1.46 \text{ nW}/\text{cm}^2$ step response)		1.5	3	sec
Radiant Sensitive Area				0.20		$\text{mm}^2$

**Notes:**

- The input irradiance ( $E_V$ ) is supplied from a white light-emitting diode (LED) optical source adjusted to impose the specified  $E_V$  at  $\lambda = 550\text{nm}$ .
- See Figure 1.
- See Figure 2.

- Dark Current equivalent lux at 0 lux:  $EL = \left[ \frac{I_{OUT}}{6163\mu\text{A}} \right]^4 \div 146 \times 10^{-9}$

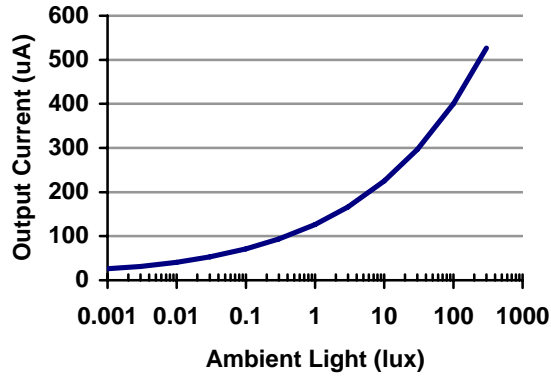
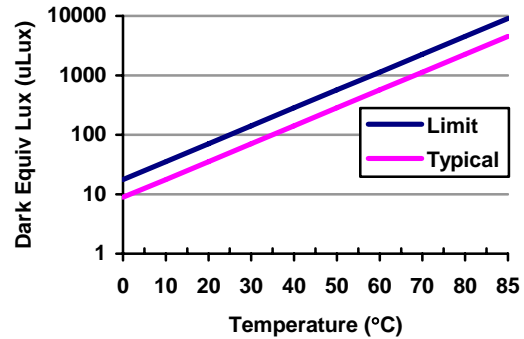
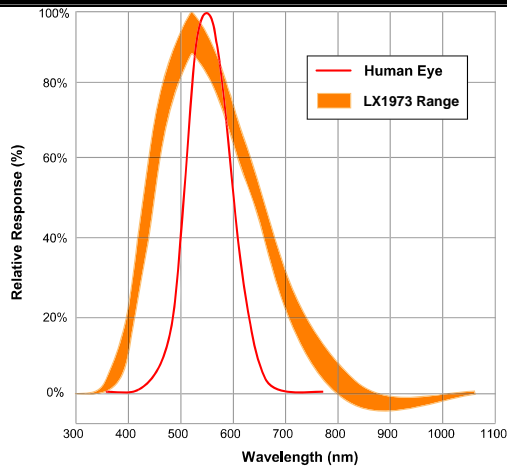
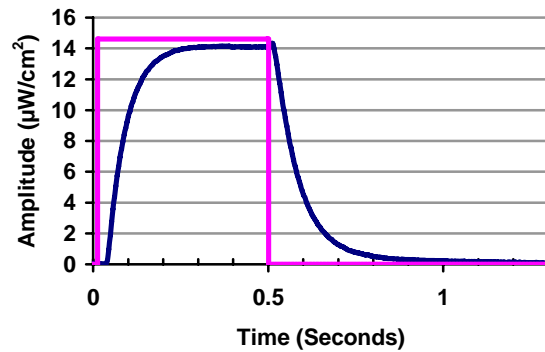
**TEST CIRCUITS**

**Figure 2 – Operational Voltage Measurement Circuit**

**Figure 3 – IR Sensitivity Measurement Circuit**

**APPLICATION CIRCUITS**

**Figure 4 – Typical Application**
**APPLICATION CIRCUITS**
**GENERAL DESCRIPTION**

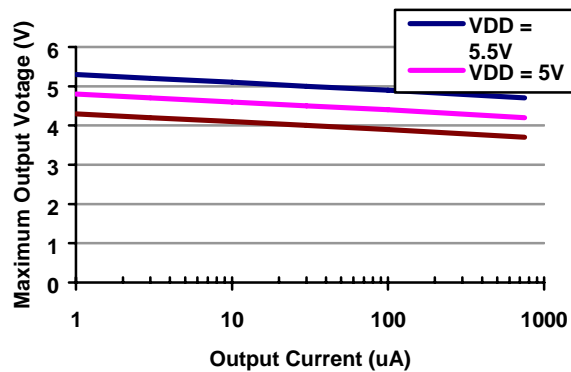
The LX1973 produces an output current that is sensitive to the level of ambient light that falls onto the photosensitive area of the IC package. The sensitivity is amplified and compressed to provide ratio metric accuracy across several decades. The sensitivity function is:

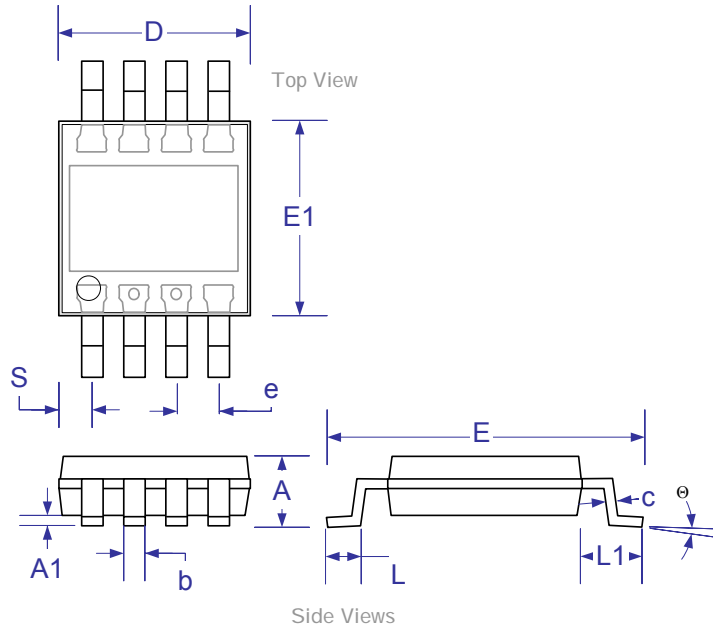
$$I_{OUT}(P) = \frac{6163\mu A}{\left(\frac{W}{cm^2}\right)^{0.25}} \times [P_{DARK} + P_{AMBIENT}]^{0.25}$$

where  $P_{DARK}$  is the dark current equivalent power and  $P_{AMBIENT}$  is the ambient illumination both expressed in  $W/cm^2$  at a 555nm wavelength.  $P_{DARK}$  is approximately  $7pW/cm^2$  at  $25^\circ C$ .

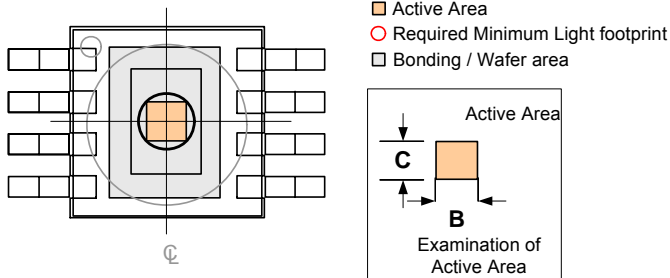
**SENSITIVITY**

**DARK CURRENT VS TEMP**

**RESPONSE VS WAVELENGTH**

**I<sub>OUT</sub> STEP RESPONSE**


Load = 3.8kΩ and 1μF  
Photo Step = Direct Light Input of 14.6μW/cm<sup>2</sup>

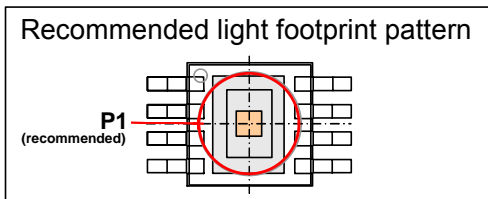
**MAXIMUM OUTPUT VOLTAGE**


**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
a	0.85	0.033
B	0.60	0.024
C	0.60	0.024



P1	2.5	0.98
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**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.



**Microsemi**<sup>®</sup>

**LX1973**

**Automotive Light Sensor**

**PRODUCTION DATA SHEET**

**NOTES**

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