ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

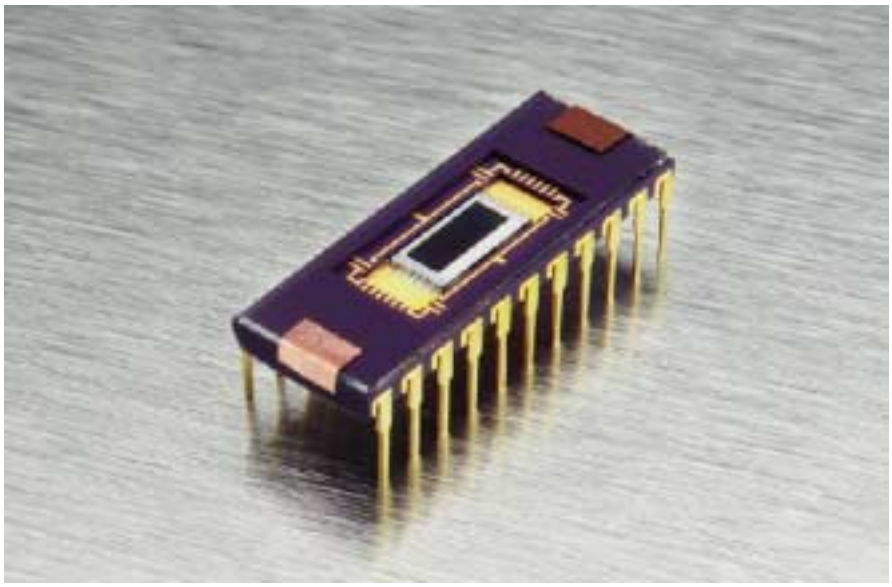
Find the *Perkin Elmer RL1210LGQ-711* at our website: *Click HERE*

DATASHEET

RETICON®

L-Series Linear CMOS Spectroscopy Sensor

25 or 50 µm pitch, 2.5 mm aperture, 128 to 1024 elements



Description

The PerkinElmer L-series of monolithic self-scanning linear photodiode arrays offers a high quality, low cost solution for spectroscopy and colorimetry applications in the 300 – 1000 nm range. The combination of high sensitivity, low dark current, low switching noise and high saturation charge of the L-series provides excellent dynamic range and great flexibility in setting integration time.

L-series sensors consist of a linear array of silicon photodiodes, each connected to a MOS switch for readout controlled by an integrated shift register scanning circuit. Under external clock control, the shift register sequentially enables each of the switches directing the charge on the associated photodiode to an output line. A dummy output provides clock noise cancellation. The L-series devices are mounted in ceramic side-brazed 22-pin dual-inline packages with ground and polished fused silica windows and are pin-compatible with earlier PerkinElmer SB and TB series sensors.

Features

- 128, 256, 512 or 1024 photodiode elements with 25 µm center-to-center spacing
- 128, 256 or 512 photodiode elements with 50 µm center-to-center spacing
- 2.5 mm photodiode aperture
- Extremely low dark leakage current
- Low power dissipation
- Clock-controlled sequential readout at rates up to 1 MHz
- Single-supply operation with HCMOS-compatible inputs
- Single shift register design
- Wide dynamic range
- Differential video output for clock noise cancellation
- High saturation charge 10 pC (25 µm) or 20 pC (50 µm)
- Antiblooming function for low crosstalk
- Line Reset Mode for simultaneous reset of all photodiodes
- Wide spectral response: 300 to 1000 nm
- Polished fused silica window
- On-chip diodes (two) for temperature monitoring

Caution: While the L-Series imagers have been designed to resist electrostatic discharge (ESD), they can be damaged from such discharges. Always observe proper ESD precautions when handling and storing these sensors.

PerkinElmer optoelectronics

Sensor Characteristics

The L-series self-scanning photodiode arrays are supplied in two versions to meet broad application requirements. The models with 25 µm diode spacing are applied primarily where a compact array is needed while the 50 µm models accommodate applications requiring the highest dynamic range. Both types are available in 128, 256 and 512 pixel lengths and the 25 µm models also include a 1024 pixel version.

The simplified equivalent circuit of an L-series sensor photodiode array is shown in Figure 1. Each cell consists of an active photodiode and a dummy photodiode, both with an associated junction capacitance. These diodes are connected through MOS multiplex switches to active and dummy video lines. The shift register is driven by complementary square wave clocks with periodic start pulses being introduced to initiate each scan. The pixel sampling rate is determined by the clock frequency. Integration time is the interval between start pulses. The output signal obtained from each scan of an N-element array is a train of N charge pulses, each proportional to the light exposure on the corresponding photodiode. In addition to the signal charge, switching transients are capacitively coupled into the active video lines by the multiplex switches. Similar transients are introduced into the dummy video lines and, therefore, can be reduced by reading out the video and dummy lines differentially.

In all models, the diodes are contiguous to collect the maximum amount of incoming light. Charge generated by light incident on the p-type surface between two n-regions will divide between the adjacent diodes to produce the response function shown in Figure 2. The 6 µm interdiode gap is maintained in all models to provide a uniform aperture response function across the product line.

The quantum efficiency of all models is shown in Figure 3. The smooth curve is the basic response of the photodiode array showing a peak quantum efficiency approximately 60% at 650 nm.

Figure 1. Equivalent Circuit

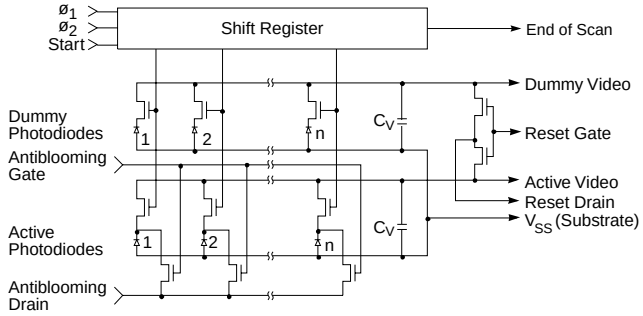
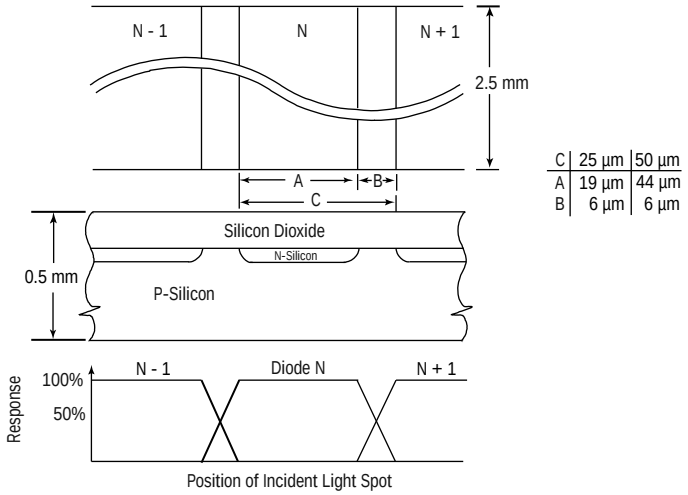
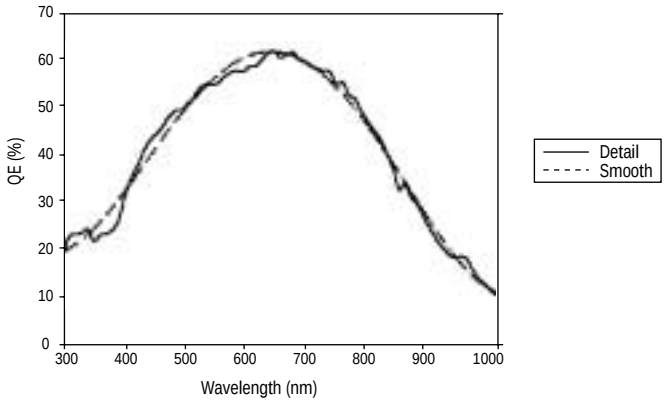


Figure 2. Sensor Geometry and Aperture Response Function



	25 µm	50 µm
C		
A	19 µm	44 µm
B	6 µm	6 µm

Figure 3. Quantum Efficiency



Sensor Characteristics (contd.)

Interference effects in the transparent passivation layer over the diodes modulate this response. Since the details of this modulation can vary from sensor to sensor, the curve shown should be taken only as representative of the short-term wavelength-dependent variation in quantum efficiency. The detail curve was taken at 10 nm intervals while the smoothed curve represents an average over a bandwidth of approximately 100 nm.

Figure 4 shows the typical output charge as a function of exposure at 650 nm wavelength for the 25 and 50 µm pitch models. Exposure in nJ/cm² is calculated by multiplying the irradiance in µW/cm² by the integration time in msec. The response is very linear up to the saturation charge - 10 pC in 25 µm models and 20 pC in the 50 µm models. The dark current of an L-series sensor at 25°C is typically 0.2 pA for the 25 µm models or 0.4 pA for the 50 µm, doubling for every 7°C increase in temperature. See Table 2 for detailed electro-optical characteristics.

Clock and Voltage Requirements

Scanning is achieved by means of an integrated shift register. The shift register is driven by complementary square wave clocks, $Ø_1$ and $Ø_2$. Table 1 gives rise and fall times and crossover points for these clock waveforms. The clock amplitude should be equal to $V_{DD} - V_{SS}$. With V_{DD} = 5 V and V_{SS} = 0 V, the clock inputs will be HCMOS-compatible. Since each photodiode is read out on a negative transition of $Ø_2$ (see Figure 6), the frequency of the clock signal should be set equal to the desired video data rate.

The start pulse of similar amplitude to the clocks is required to load the shift register and initiate each readout period (each scan of the array). The start pulse is loaded when $Ø_2$ is high; the start signal is pulsed high for a minimum of 10 ns during one and only one $Ø_2$ clock high cycle. A timing diagram for the start and clock signals is shown in Figure 6. Caution: $Ø_1$ and $Ø_2$ clocks need to be continuously applied to the

Table 1. Electrical Characteristics (25 C)

(All voltages measured with respect to V_{SUB})

Signal	Sym		Min	Typ	Max	Units
V_{DD}	V_{DD}		4.5	5	5.5	V
V_{DD} guard	V_{DDG}		-	V_{DD}	-	V
V_{SS}	V_{SS}		-	0	-	V
V_{SUB}	V_{SUB}		-	0	-	V
Antiblooming drain						
RL12xx	V_{ABD}		V_{DD}/2 - 0.1	-	V_{DD}/2	V
RL15xx	V_{ABD}		V_{DD} - 0.1	-	V_{DD}	V
Start	V_{SH}	High	V_{DD} - 0.1	-	V_{DD}	V
	V_{SL}	Low	V_{SS}	-	V_{SS} + 0.4	V
Clock Ø1, Ø2	V_{H1}, V_{H2}	High	V_{DD} – 0.1	-	V_{DD}	V
	V_{L1}, V_{L2}	Low	V_{SS}	-	V_{SS} + 0.4	V
Reset gate [2]	-		-	V_{SS}	-	V
Antiblooming gate						
RL12xx	V_{HABG}	High	V_{DD} – 0.1	-	V_{DD}	V
	V_{LABG}	Low	V_{SS}	-	V_{SS} + 0.4	V
RL15xx	V_{HABG}	High	V_{DD} – 0.1	-	V_{DD}	V
	V_{LABG}	Low	-3.0	-	-2.0	V
Video bias						
RL12xx	V_V		2	V_{DD}/2	V_{DD}-2	V
RL15xx	V_V		4.5	V_{DD}	5.5	V
Reset drain [2]	V_{RD}		-	V_{SS}	-	V
Clock rate	-		0.001	-	1	MHz
Start rise time	t_{RS}		-	10	50	ns
Start fall time	t_{FS}		-	10	50	ns
Start pulse width	t_{PWS}		10	-	-	ns
Ø1 Rise time	t_{R1}		-	10	20	ns
Ø1 Fall time	t_{F1}		-	10	20	ns
Ø2 Rise time	t_{R2}		-	10	20	ns
Ø2 Fall time	t_{F2}		-	10	20	ns
Video delay time	t_{VD}		-	20	-	ns
Clock crossing	X_1		0	-	50	%
	X_2		0	-	50	%
Capacitance Ø1, Ø2 at 5 V bias						
RL1201	C_C		-	9	-	pF
RL1202	C_C		-	50	-	pF
RL1205	C_C		-	77	-	pF
RL1210	C_C		-	154	-	pF
RL1501	C_C		-	30	-	pF
RL1502	C_C		-	48	-	pF
RL1505	C_C		-	93	-	pF
Capacitance, each video line at at 2.5 V bias [1]						
RL1201	C_V		-	6.7	-	pF
RL1202	C_V		-	10.2	-	pF
RL1205	C_V		-	15.4	-	pF
RL1210	C_V		-	28.7	-	pF
Capacitance, each video line at 5.0 V bias [1]						
RL1501	C_V		-	9.1	-	pF
RL1502	C_V		-	14	-	pF
RL1505	C_V		-	25	-	pF

Notes:
1. Measured.
2. Clocking of Reset Gate may decrease dynamic range.

Clock & Voltage Requirements (contd.)

sensor. The integration period should be controlled by varying the time between start pulses. For optimum performance and minimum switching noise, it is important that the clocks are exact complements and that their rise and fall times comply with Table 1. A recommended circuit for generating these clocks is shown in Figure 7.

End of Scan

An output pulse useful primarily for test purposes is provided two clock cycles after the last photodiode is sampled by the shift register scanning circuit. The timing of the EOS output is shown in Figure 6. The voltage levels on the EOS output will be determined by the V_{DD} and V_{SS} voltage levels supplied to the photodiode array. When V_{DD} is at +5V and V_{SS} is operated at 0 V, the EOS output will be compatible with the HCMOS family of logic devices.

Amplifier Requirements

The recommended amplifier circuit for use with an L-series sensor is a simple current amplifier. A current amplifier holds the video line at a virtual ground and senses the current pulses flowing into the video line to recharge the diodes through their respective multiplex switches as they are sampled in sequence. These current pulses, which each can contain a charge up to saturation, are converted to a train of voltage pulses corresponding to the light intensity on the various diodes. In this mode of operation, the current amplifier must provide a positive bias voltage to the video line since the photodiode anode (the p-substrate) is biased to 0 V (V_{SS}). Figure 8 shows a differential recharge amplifier suitable for use with L-series sensors.

Table 2. Electro-Optical Characteristics (25°C)

Characteristic	Typ	Max	Units
Center-to-center spacing			
RL12xx	25	-	µm
RL15xx	50	-	µm
Sensitivity[1,2]			
RL12xx	2×10^{-4}	-	$C/J/cm^2$
RL15xx	4×10^{-4}	-	$C/J/cm^2$
PRNU[2,3,4]	5	10	±%
Saturation exposure (E_{SAT})[1,2]			
RL12xx	50	-	nJ/cm^2
RL15xx	50	-	nJ/cm^2
Saturation charge (Q_{SAT})[5]			
RL12xx	10	-	pC
RL15xx	20	-	pC
Dynamic range (Q_{SAT} / $Q_{NOISE(RMS)}$)			
RL12xx	70,000	-	-
RL15xx	100,000	-	-
Average dark current[6]			
RL12xx	0.20	0.50	pA
RL15xx	0.40	1.0	pA
Spectral response peak	650	-	nm
Spectral response range	300-1000	250-1050	nm

Notes:
1. Measured at specified video line bias.
2. Average 600-700 nm, includes 8% window loss.
3. Photo response non-uniformity (PRNU) is defined as:
   a. $+\% = (V_{MAX} - V_{AVG}) / V_{AVG} \times 100\%$
   b. $-\% = (V_{AVG} - V_{MIN}) / V_{AVG} \times 100\%$ where
      i. V_{MAX} is the output of the pixel closest to saturation level.
      ii. V_{MIN} is the output of the pixel closest to the dark level.
      iii. V_{AVG} is the average of all array pixel outputs.

   The first and last pixels are not counted in this measurement.
4. Measured at an exposure level of $E_{SAT}/2$.
5. Minimum Q_{SAT} for RL15xx is 15 pC; RL12xx is 8 pC.
6. Maximum dark current ≤ 1.5 x average dark current.

Table 3. Absolute Maximum Ratings

	Min	Max	Units
Voltage applied to any terminal with respect to V_{SS}	0	+10	V
Storage or operating temperature	-78	+85	°C

Line Reset / Antiblooming Control

Under certain operating conditions, it may be desirable to control integration time independent of the line scan time (time between start pulses). This can be accomplished by the use of the antiblooming gate control input. When the antiblooming gate is held high, all photodiodes are simultaneously reset to the bias voltage on the antiblooming drain (typically $V_{DD}/2$). Conversely, when the antiblooming gate is held low, the antiblooming transistor is off and the photodiodes can then integrate photocurrent. Thus, when an active high pulse is applied to VABG, the integration time for diode "N" then becomes the time between the negative-going transition of the antiblooming gate to the time in which diode "N" is read out through the diode multiplex switch. Under normal operating conditions, the L-series sensors do not require antiblooming control due to excellent antiblooming characteristics. However, under extremely high exposure conditions, antiblooming control can be implemented to further enhance this performance. In this mode of

Line Reset / Antiblooming Control (contd.)

operation, a bias voltage (the same voltage as the video line bias, typically $V_{DD}/2$) is applied to the antiblooming drain. The antiblooming drain is then biased to 1 - 3 V above V_{LABG}. By adjusting the bias level on the antiblooming gate, excess charge present on the video line is shunted to the antiblooming drain.

Figure 4. Typical Signal Charge vs. Exposure at 600 nm

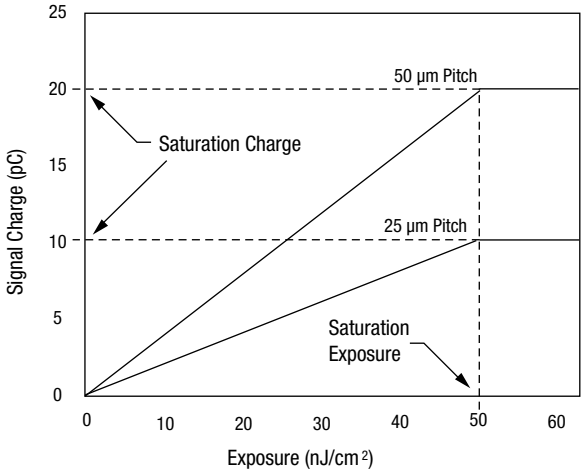


Figure 5. Temperature Diode Read Mode

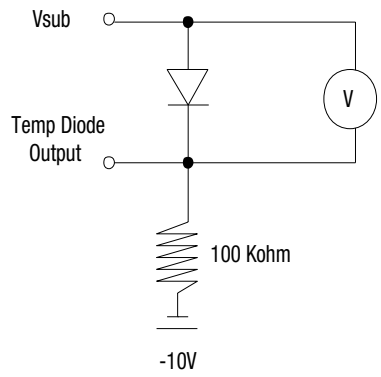


Figure 6. Timing Diagram

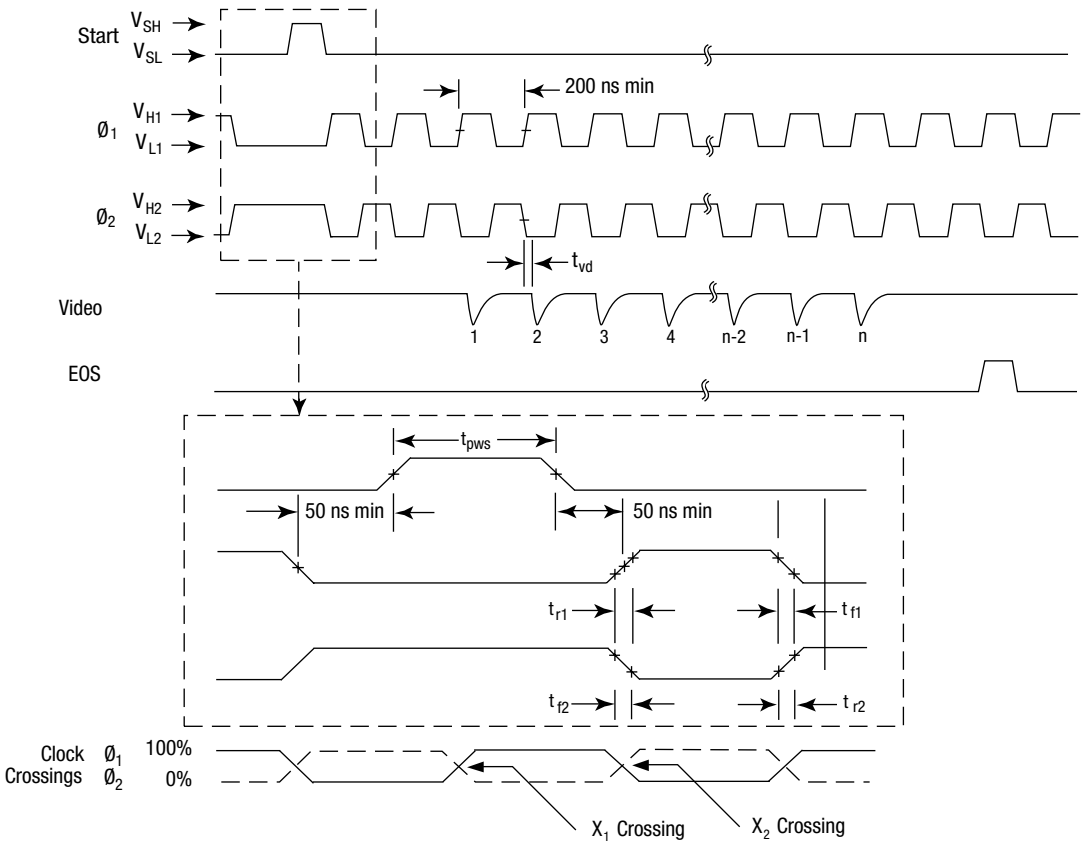
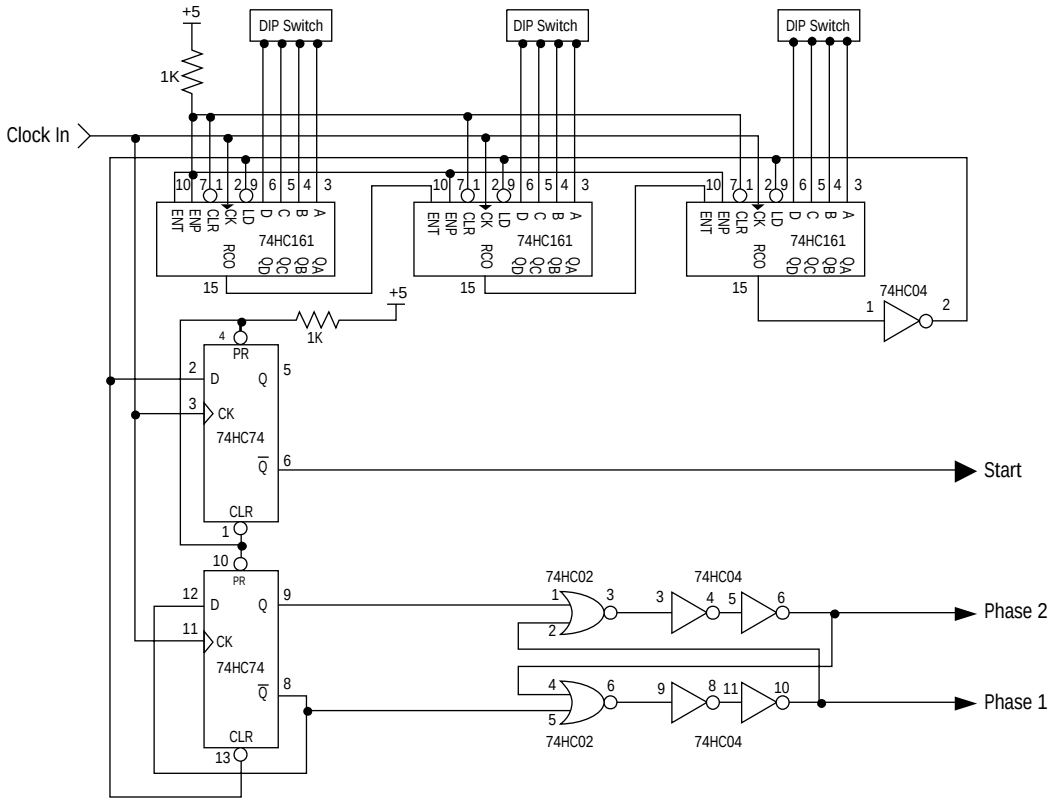


Figure 7. Two-Phase Drive Circuit



Dark Signal and Noise

There are two components of the dark signal from the L-series sensors. These are due to: (1) spatial variations in the switching transients coupled into the video line through the clocks and internal multiplex switches, and (2) the integrated dark current. A portion of the switching transient effect will be spatially random and a portion will have the periodicity of the clocks. The latter portion can be minimized by matching the clock amplitudes and rise and fall times and by good circuit layout to minimize capacitance between clocks and video lines. The peak-to-peak fixed pattern due to all switching transient effects should be less than 1% of the saturated signal. The dark signal due to dark current is the dark current multiplied by the integration time. This can be arbitrarily reduced by lowering the temperature or by reducing the integration time.

There are three identifiable sources of readout noise: (1) reset noise, (2) shot noise, and (3) amplifier noise. Reset noise is associated with resetting the diode capacitance to a fixed voltage. Its root mean square value is given by (kTC)1/2/q where k is Bolzmann's constant, T is the absolute temperature, q is the electronic charge and C is the total capacitance of the photodiode, the associated video line and the capacitance of the external circuitry. At room temperature, kTC noise is approximately 1500 electrons rms. It can be reduced somewhat by cooling. The rms value of the dark shot noise is the square root of the number of electrons in the dark signal charge. For example, with a room temperature dark current of 0.25 pA and 10 ms integration time, the rms dark current shot noise is approximately 125 electrons. Because of the exponential temperature dependence of dark current, shot noise can be reduced dramatically with a moderate amount of cooling. Amplifier noise depends on the amplifier circuit used. In general, the low video output capacitance of the L-series sensors makes it easy to achieve low amplifier noise, and values below 2000 electrons are possible.

Temperature Diodes

The L-series sensor arrays have two on-chip diodes for sensing array temperature. The standard method of use is to force a fixed forward current (normally 100 µA) through the diodes and measure the forward diode voltage drop. The diode test circuitry is shown in Figure 5. The forward diode voltage drop at 25°C is 592.8 mV. The equation for computing junction temperature from the measured diode forward voltage (Vf) is the familiar straight-line equation:

$$T_j = K * V_f + T_0$$

where T_j is the junction temperature, K = -0.407 (°C/mV) is the slope or derivative of the diode junction temperature versus forward voltage (°C/mV), V_f is the diode forward voltage and T_0 = 266.26 °C is the ordinate-intercept or offset temperature.

Figure 8. L-series Readout Amplifier

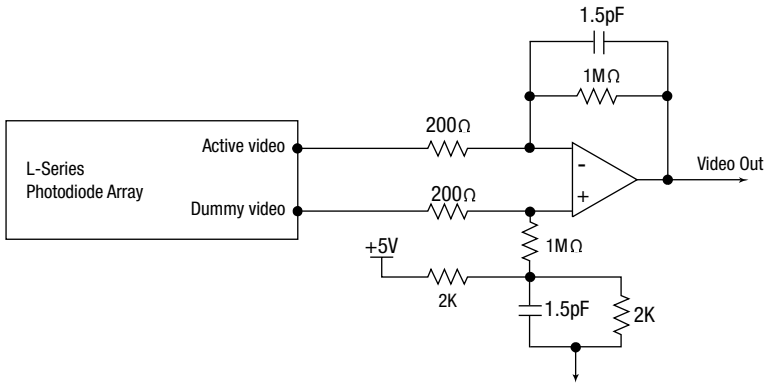
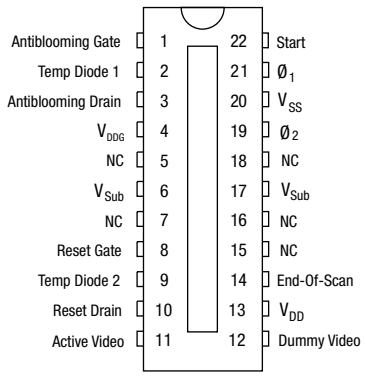


Figure 9. Pinout Configurations



DIL, Top View

Notes:

1. Video Out Amplitude = Signal Charge / Feedback Capacitance

$$\text{Video Amp} = \frac{Q}{Cf} = \frac{10pC}{1.5pF} = \overset{\uparrow}{\underset{\downarrow}{6.7V}}$$

t=CfRf=(1.5pF)(1Mohm)=1.5 µs

2.5V offset

*t = time constant

2. Circuit shown is for a RL12xx device.

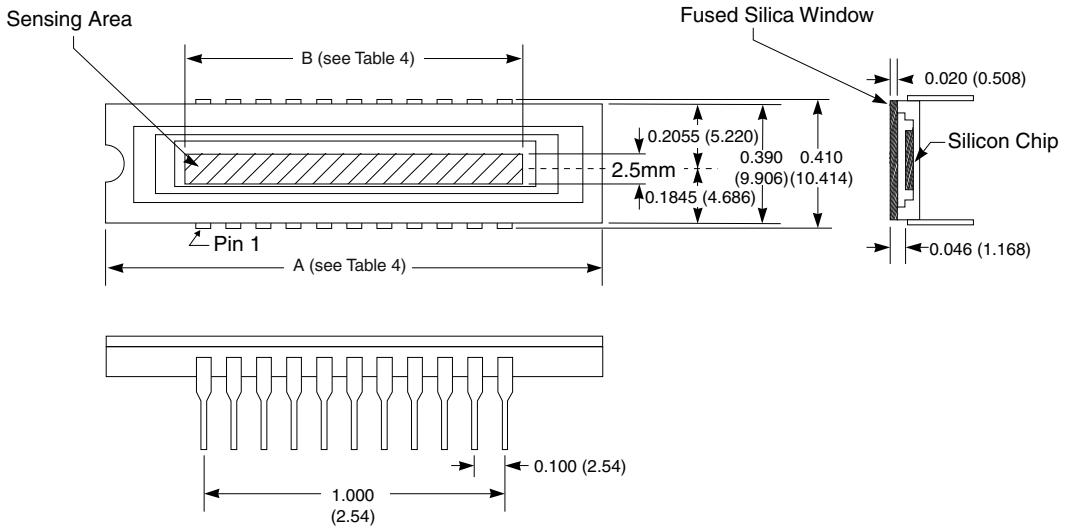
Table 4. Package Dimensions and Tolerances

Part Number	A	B
RL1201	1.080 (27.43)	0.126 (3.20)
RL1202	1.080 (27.43)	0.252 (6.40)
RL1205	1.080 (27.43)	0.504 (12.80)
RL1210	1.600 (40.64)	1.008 (25.60)
RL1501	1.080 (27.43)	0.252 (6.40)
RL1502	1.080 (27.43)	0.504 (12.80)
RL1505	1.600 (40.64)	1.008 (25.60)

Note:
All dimensions in inches (mm)

Figure 10. Package Dimensions

(All dimensions are typical and in inches (mm))



Ordering Information

While the information provided in this data sheet is intended to describe the form, fit and function for this product, PerkinElmer reserves the right to make changes without notice.

Table 5. Stock Part Numbers

Pixels	Pixel Pitch	
	25µm	50µm
128	RL1201LGQ-711	RL1501LFQ-711
256	RL1202LGQ-711	RL1502LFQ-711
512	RL1205LGQ-711	RL1505LFQ-711
1024	RL1210LGQ-711	-

For more information e-mail us at opto@perkinelmer.com or visit our web site at **www.perkinelmer.com/opto**. All values are nominal; specifications subject to change without notice.

Table 6. Sales Offices

	North America
United States	PerkinElmer Optoelectronics 2175 Mission College Blvd. Santa Clara, CA 95054 Toll Free: 800-775-OPTO (6786) Phone: +1-408-565-0830 Fax: +1-408-565-0703
	Europe
Germany	PerkinElmer Optoelectronics GmbH Wenzel-Jaksch-Str. 31 D-65199 Wiesbaden, Germany Phone: +49-611-492-570 Fax: +49-611-492-165
	Asia
Japan	PerkinElmer Optoelectronics NEopt. 18F, Parale Mitsui Building 8 Higashida-Cho, Kawasaki-Ku Kawasaki-Shi, Kanagawa-Ken 210-0005 Japan Phone: +81-44-200-9170 Fax: +81-44-200-9160 www.neopt.co.jp
Singapore	47 Ayer Rajah Crescent #06-12 Singapore 139947 Phone: +65-770-4925 Fax: +65-777-1008

© 2001 PerkinElmer Inc. All rights reserved. PerkinElmer, the PerkinElmer logo and the stylized "P" are trademarks of PerkinElmer, Inc. Reticon is a registered trademark of PerkinElmer, Inc.

DSP-106.01C – 10/2001W

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP