analog optical isolators

Features

- High input-to-output voltage isolation
- True resistance element output
- Single- or dual-element outputs available
- Low cost
- Suitable for AC or DC use
- Wide range of input-to-output characteristics
- Low drive current
- Low "on" resistance, high "off " resistance
- Complete solid-state construction

Typical Applications

- DC Isolators
- Feedback Elements in Automatic Gain Control Circuits
- Audio Limiting and Compression
- Noiseless Switching
- Logic Interfacing
- Remote Gain Control for Amplifiers
- Photochoppers
- Noiseless Potentiometers

Principle of Operation

Analog Optical Isolators are used in many different types of circuits and applications.

Available Related Products

VTL5C Series
LT3011 Series
LT9900 Series

Datasheets available upon request

Description

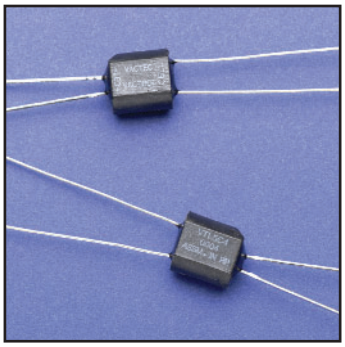
PerkinElmer Optoelectronics has been a leading manufacturer of analog optical isolators (AOI) for over twenty years and makes a broad range of standard parts under its trademark VACTROL®.

There are many kinds of optical isolators, but the most common is the LED/phototransistor type. Other familiar types use output elements such as light-sensitive SCRs, Triacs, FETs and ICs. The major application for these silicon-based devices is to provide electrical isolation of digital lines connected between different pieces of equipment. The principle of operation is very simple. When an input current is applied to the LED, the output phototransistor turns on. The only connection between the LED and phototransistor is through light—not electricity—thus the term optical isolator. These optical isolators are primarily digital in nature with fast response times for interfacing with logic gates. Rise and fall times of a few microseconds, faster for some isolators, are typical.

The AOI also uses an optical link between input and output. The input element is an LED and the output element is always a photoconductive cell or, simply a photocell. Together, the coupled pair act as an electrically variable potentiometer. Since the output element of the AOI is a resistor, the voltage applied to this output resistor may be DC and/or AC and the magnitude may be as low as zero or as high as the maximum voltage rating. Because the input will control the magnitude of a complex waveform in a proportional manner, this type of isolator is an analog-control element. AOIs may be used in the ON-OFF mode but the fastest response time is only in the millisecond range. A level-sensitive Schmitt trigger is required between the AOI and logic gates when used in digital circuits.

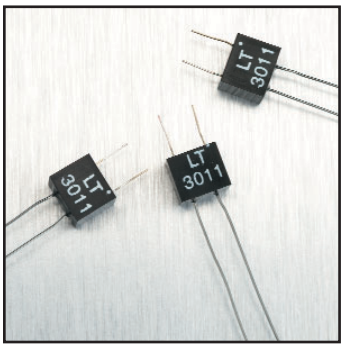
Absolute Maximum Ratings @ 25°

Maximum Temperatures	
Storage and Operating:	–40°C to 75°C
Cell Power:	175 mW
Derate Above 30°C:	3.9 mW/°C
LED Current:	40 mA
Derate Above 30°C:	0.9 mA/°C
LED Reverse Breakdown Voltage:	3.0 V
LED Forward Voltage Drop @ 20 mA:	2.0 V (1.65 V Typ.) VTL5C8 = 2.8 V (2.2 V typ.) VTL5C9 = 2.8 V (2.2 V typ.) VTL5C10 = 2.8 V (2.2 V typ.)
Minimum Isolation Voltage @ 70% Rel. Humidity:	2500 VRMS
Output Cell Capacitance:	5.0 pF
Input/Output Coupling Capacitance:	0.5 pF



Analog Optical Isolators—VTL5C Series

PerkinElmer Optoelectronics' line of AOIs consists of a light-tight package which houses a light source and one or more photoconductive cells. Through control of the input current or voltage applied to the AOI, the output resistance can be varied. The output resistance can be made to switch between an "on" and "off" state or made to track the input signal in an analog manner. Because a small change in input signal can cause a large change in output resistance, AOIs have been found to provide a very economical and technically superior solution for many applications.



LT Series

LT Series Key

R1mA	Output Resistance at If=1 mA
R20mA	Output Resistance at If=20 mA
R_{01}	Dark Resistance after 1 sec (If=0)
R_{05}	Dark Resistance after 5 sec (If=0)
T_{op}	Operating Temperature Range
T_{st}	Storage Temperature Range
V_i	Input/Output Insulation Voltage
TC	Module Thermal Coefficient
T_{on}	Rise Time to 63% of final R_{20}
T_{off}	Decay Time to 37% of initial R_{20}
C_s	Output Capacity
V_{max}	Operating Voltage at If=0
P_{max}	Output Power Dissipation at 25°C

VTL5C Series

Technical Specification

Part Number	Material Type	On Resistance Input Current	On Resistance Dark Adapted typ.	Off Resistance @ 10 sec. min.	Slope	Dynamic Range	Cell Voltage	Response Time Turn-on to 63% Final R_{ON} typ.	Response Time Turn-off (Decay) to 100Ω max.
VTL5C1	1	1 mA 10 mA 40 mA	20 kΩ 600 Ω 200 Ω	50 MΩ	15	100 db	100 V	2.5 ms	35 ms
VTL5C2	0	1 mA 10 mA 40 mA	5.5 kΩ 800 Ω 200 Ω	1 MΩ	24	69 db	200 V	3.5 ms	500 ms
VTL5C2/2	0	5 mA 40 mA	2.5 kΩ 700 Ω	1 MΩ	20	65 db	50 V	7 ms	150 ms
VTL5C3	3	1 mA 10 mA 40 mA	30 kΩ 5 kΩ 1.5 Ω	10 MΩ	20	75 db	250 V	2.5 ms	35 ms
VTL5C3/2	3	1 mA 40 mA	55 kΩ 2 kΩ	10 MΩ	19	71 db	100 V	3 ms	50 ms
VTL5C4	4	1 mA 10 mA 40 mA	1.2 kΩ 125 Ω 75 Ω	400 kΩ	18.7	72 db	50 V	6 ms	1.5 sec
VTL5C4/2	4	1 mA 10 mA	1.5 kΩ 150 Ω	400 kΩ	8.3	68 db	30 V	6 ms	1.5 sec
VTL5C6	0	1 mA 10 mA 40 mA	75 kΩ 10 kΩ 2 kΩ	100 MΩ	16.7	88 db	250 V	3.5 ms	50 ms (1 MΩ)
VTL5C7	7	0.4 mA 2 mA	5 kΩ 1.1 kΩ	1 MΩ	5.7	75 db	50 V	6 ms	1 sec. (100 kΩ)
VTL5C8	0	1 mA 4 mA 16 mA	4.8 kΩ 1.8 kΩ 1 kΩ	10 MΩ	8	80 db	500 V	4 ms	60 ms
VTL5C9	1	2 mA	630 Ω	50 MΩ	7.3	112 db	100 V	4 ms	50 ms
VTL5C10	4	1 mA	400 Ω	400 kΩ	3.8	75 db	50 V	1 ms	1.5 sec

Specification Notes

LED Current: Since the input has a substantially constant voltage drop, a current-limiting resistance is required.

ON Resistance: Dark adapted resistance measured after 24 or more hours of no input.

OFF Resistance: Measured 10 sec. after removal of the input. The ultimate resistance is many times greater than the value at 10 sec.

Response Time: Ascent measured to 63% of final conductance from the application of 40 mA input. The conductance rise time to a specified value is increased at reduced input drive while the conductance decay time to a specified value is decreased.

Typical matching and tracking from 0.4 to 40 mA is 25%.

Measured 5 sec. after removal of the input. The ultimate resistance is many times greater than the value at 5 sec.

VTL5C9 response times are based on a 2 mA input. VTL5C10 response times are based on a 10 mA input for ascent time and a 1 mA input for decay time.

LT Series

Technical Specification

Part Number	Typical Electro-Optical Characteristics R1mA kΩ	R20mA typ. kΩ	R_{01} min. mΩ	R_{05} min. mΩ	t_{op} range °C	t_{st} range °C	Limit Values V_i min. V	TC 10 lux %/°K	t_{on} msec	t_{off} typ. msec	C_s max. pF	V_{max} V	P_{max} mW
LT3011-2	—	1	3	9	-20-+60	-20-+80	2500	2	10	10	2	50	50
LT3011	—	0.32	0.1	0.3	-20-+70	-20-+70	2500	0.4	50	40	2	100	75
LT9909	0.7-1.2	0.35	0.06	0.18	-20-+70	-20-+70	1000	0.4	40	40	1	50	50
LT9910	1.2-2.5	0.7	0.06	0.18	-20-+70	-20-+70	1000	0.4	40	40	1	50	50
LT9911	2-5	1.5	0.1	0.3	-20-+70	-20-+70	1000	0.4	50	40	1	100	50
LT9912	4.5-9	2	0.2	0.6	-20-+70	-20-+70	1000	0.4	40	30	1	100	50
LT9913	8-16	3.5	0.5	1.5	-20-+70	-20-+70	1000	0.4	35	30	1	100	50
LT9914	14-25	6	0.7	2.1	-20-+70	-20-+70	1000	0.4	35	30	1	100	50

All readings taken at standard light A (2854 K color temperature) after 2 hours of preillumination at 500 lux.

Input/Output Coupling Capacity: 1 pF max.

Reverse Voltage: 4 V max.

Diode Forward Current: 25 mA max. DC