Stand 02.07.2018

Photops ™

Photodiode-Amplifier Hybrids

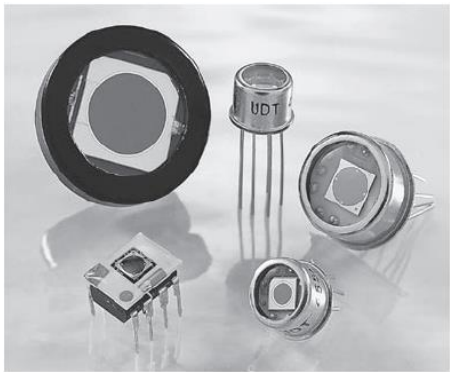
Features

- Detector / Amplifier combined
- Adjustable Gain / Bandwidth
- Low Noise
- Wide Bandwidth
- DIP Package
- Large Active Area

Applications

- General Purpose Light Detection
- Laser Power Monitoring
- Medical Analysis
- Laser Communications
- Bar Code Readers
- Industrial Control Sensors
- Pollution Monitoring
- Guidance Systems
- Colorimeter

The Photops™ Series, combines a photodiode with an operational amplifier in the same package. Photops™ general-purpose detectors have a spectral range from either 350 nm to 1100 nm or 200 nm to 1100nm. They have an integrated package ensuring low noise output under a variety of operating conditions. These op-amps are specifically selected by OSI Optoelectronics engineers for compatibility to our photodiodes.



Among many of these specific parameters are low noise, low drift and capability of supporting a variety of gains and bandwidths determined by the external feedback components. Operation from DC level to several MHz is possible in an either unbiased configuration for low speed, low drift applications or biased for faster response time. LN-Series Photops™ are to be used with OV-bias.

Any modification of the above devices is possible. The modifications can be simply adding a bandpass optical filter, integration of additional chip (hybrid) components

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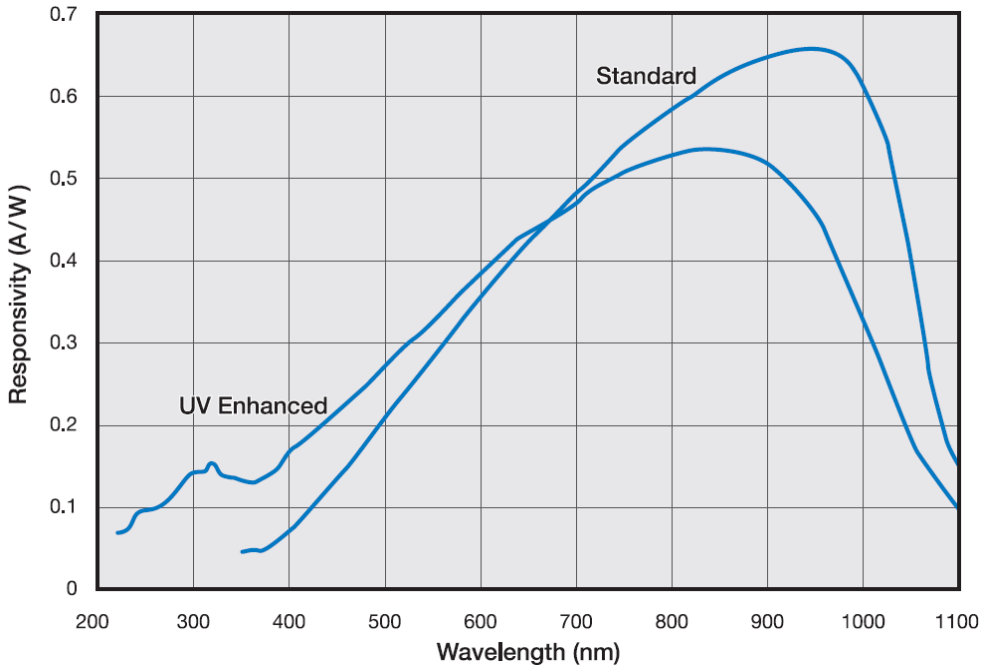
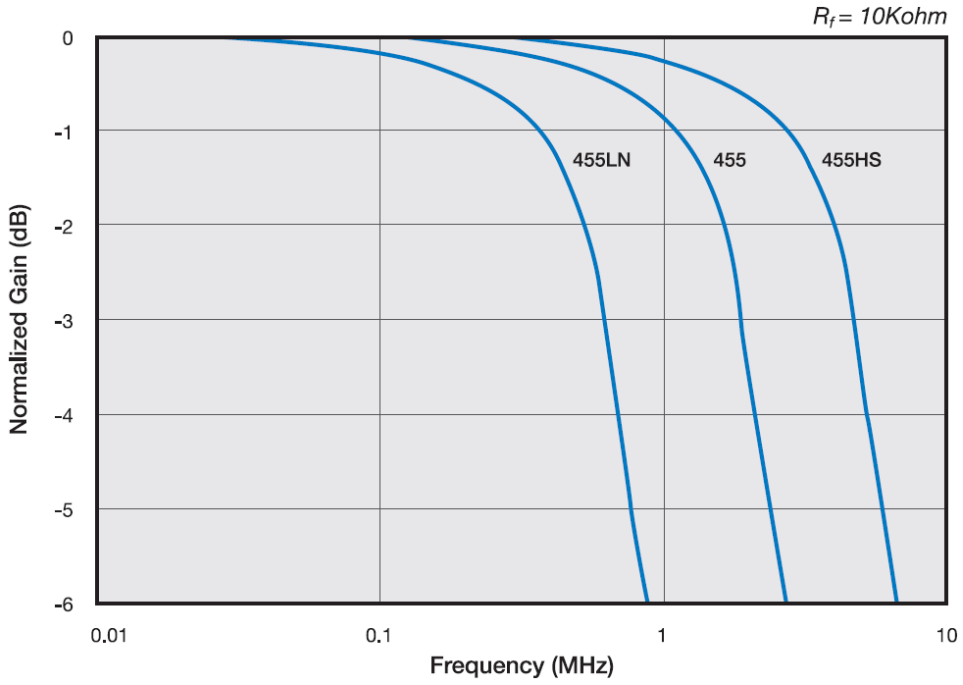
inside the same package, utilizing a different op-amp, photodetector replacement, modified package design and / or mount on PCB or ceramic. For your specific requirements, contact one of our Applications Engineers.

Typical Spectral Response



Typical Gain vs. Frequency



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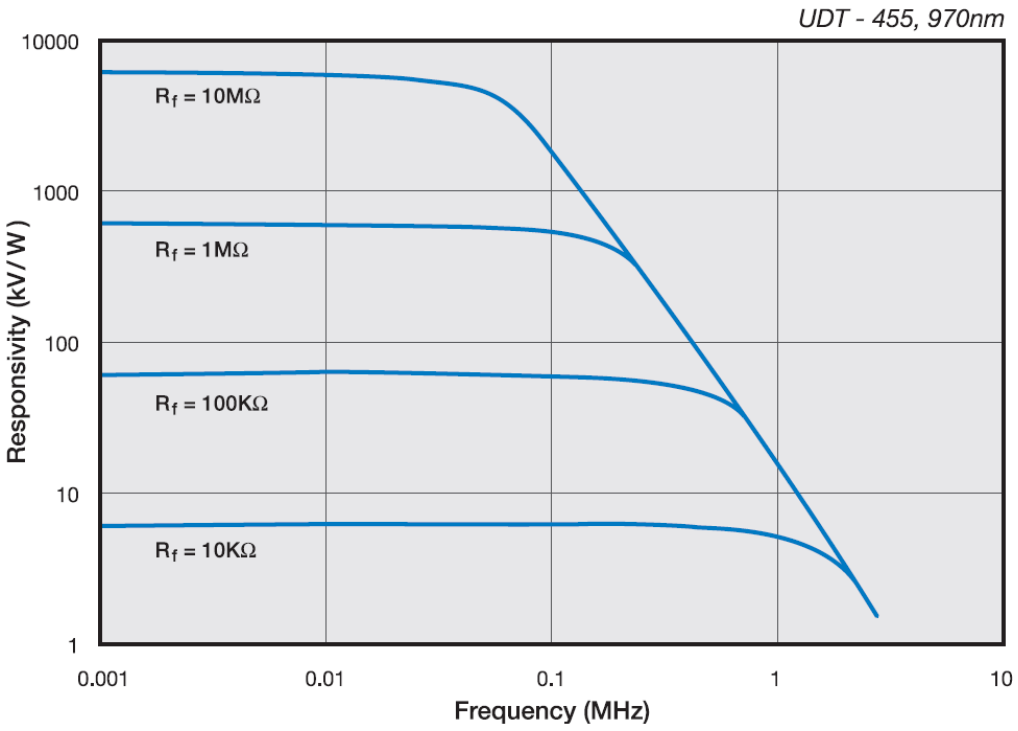
Opto-Electronic Components

Typical Responsivity vs. Frequency



Typical Electro-Optical Specifications (at T_A = 23°C)

Model Number	Active Area		Responsivity (A/W)				Capacitance (pF)		Dark Current (nA)	
	Area (mm^2)	Dimensions (mm)	254nm		970nm		0V	-10V	-10V	
			Min	Typ	Min	Typ	Typ	Typ	Typ	Max
350-1100nm Spectral Range										
UDT-451	5.1	2.54 ϕ	---		0.60	0.65	85	15	0.25	3
UDT-455										
UDT-455LN **										
UDT-455HS										
UDT-020D	16	4.57 ϕ					330	60	0.5	10
UDT-555D	100	11.3 ϕ					1500	300	2	25
200-1100nm Spectral Range										
UDT-455UV	5.1	2.54 ϕ	0.10	0.14	---		300	---		
UDT-455UV/LN **										
UDT-020UV	16	4.57 ϕ					1000			
UDT-055UV	50	7.98 ϕ					2500			
UDT-555UV	100	11.3 ϕ					4500			
UDT-555UV/LN **										

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Model Number	Shunt Resistance (MΩ)	NEP (W/√Hz)		Reverse Voltage (V)	Temp. Range (°C) *		Package Style
	-10mV	0V, 254nm	-10V, 970nm				
	Typ	Typ	Typ	Max	Operating	Storage	
350-1100nm Spectral Range							
UDT-451	---		1.4 e-14	30**	0 ~ +70	-30 ~ +100	29/ DIP
UDT-455							30/ TO-5
UDT-455LN **							
UDT-455HS							
UDT-020D			1.9 e-14				31/ TO-8
UDT-555D			3.9 e-14				32/ Special
200-1100nm Spectral Range							
UDT-455UV	100	9.2 e-14	---	5**	0 ~ +70	-30 ~ +100	30/ TO-5
UDT-455UV/LN **							
UDT-020UV	50	1.3 e-13					31/ TO-5
UDT-055UV	20	2.1 e-13					32/ Special
UDT-555UV	10	2.9 e-13					
UDT-555UV/LN **							

Operational Amplifier Specifications

Model Number	Supply Voltage (V)			Quiescent Supply Current (mA)		Input Offset Voltage (mV)		Temp. Coefficient Input Offset Voltage (µV/°C)	
				± 15V					
	Min	Typ	Max	Typ	Max	Typ	Max	Typ	Max
UDT-451	---	±15	±18	1.4	2.5	3.0	6.0	10	---
UDT-455				2.8	5.0	0.5	3	4	30
UDT-455UV									
UDT-020D									
UDT-020UV									
UDT-455HS				4.8	8.0	0.5	3	4	30
UDT-455LN**	±5			0.9	1.8	0.26	1	---	20
UDT-455UV/LN**									
UDT-055UV	---		±22	2.7	4.0	0.4	1	3	10
UDT-555D									
UDT-555UV									

YOUR PARTNER

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Model Number	Input Bias Current (pA)		Gain Bandwidth Product (MHz)		Slew Rate (V/µs)		Open Loop Gain, DC (V/mV)	
	Typ	Max	Min	Typ	Min	Typ	Min	Typ
UDT-451	30	200	---	4.0	---	13	50	150
UDT-455	±80	±400	3.0	5.4	5	9		200
UDT-455UV								
UDT-020D								
UDT-020UV								
UDT-455HS		±500	11	26	25	40		
UDT-455LN**	0.15	0.3	0.5	1	0.5	3		2500
UDT -455UV/LN**								
UDT-055UV	±40	±200	3.5	5.7	7.5	11	75	220
UDT-555D								
UDT-555UV								

Model Number	Input Noise Voltage (nV/√Hz)		Input Noise Current (fA/√Hz)
	100Hz	1 kHz	1 kHz
	Typ		Typ
UDT-451	---	18	10
UDT-455	20	15	
UDT-455UV			
UDT-020D			
UDT-020UV			
UDT-455HS			
UDT-455LN**	78	27	0.22
UDT -455UV/LN**			
UDT-055UV	20	15	10
UDT-555D			
UDT-555UV			

* Non-condensing temperature and storage range, non-condensing environment.
** LN-series devices are to be used with a 0V bias.
For mechanical drawings please refer to “Mechanical Drawings"

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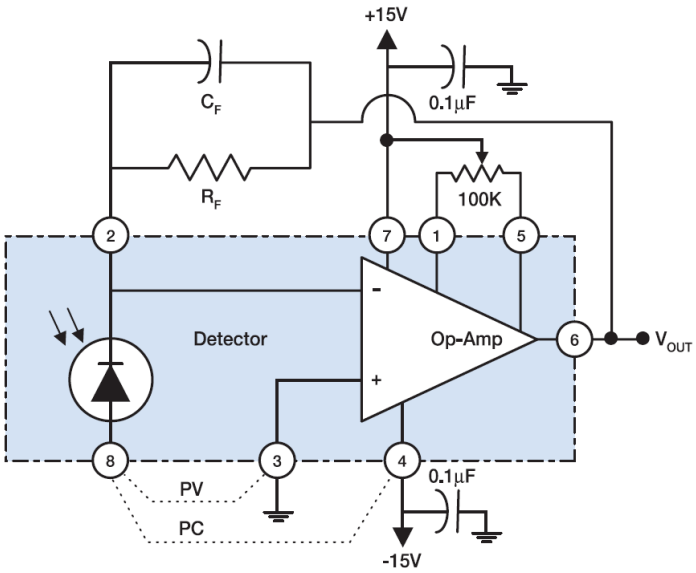
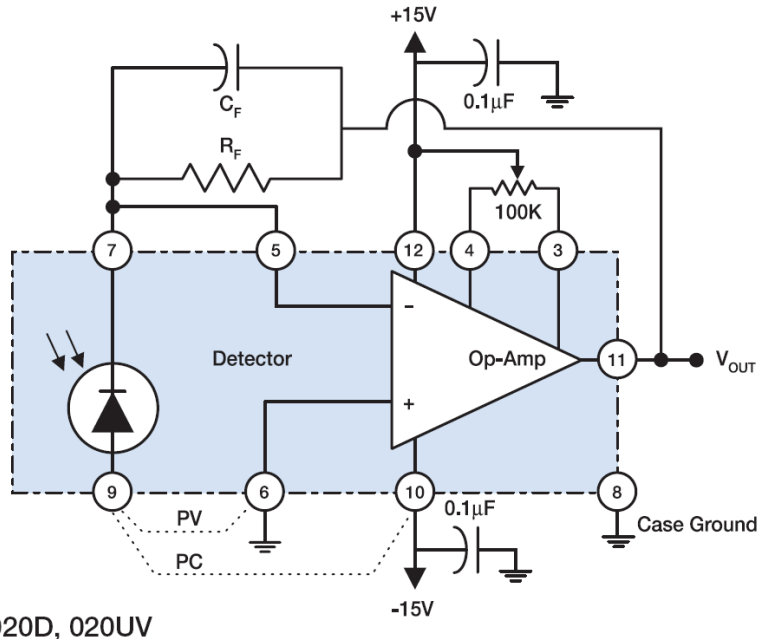
Opto-Electronic Components

Schematic Diagrams



UDT-455, 455HS
UDT-555D, 555UV, 055UV



UDT-020D, 020UV

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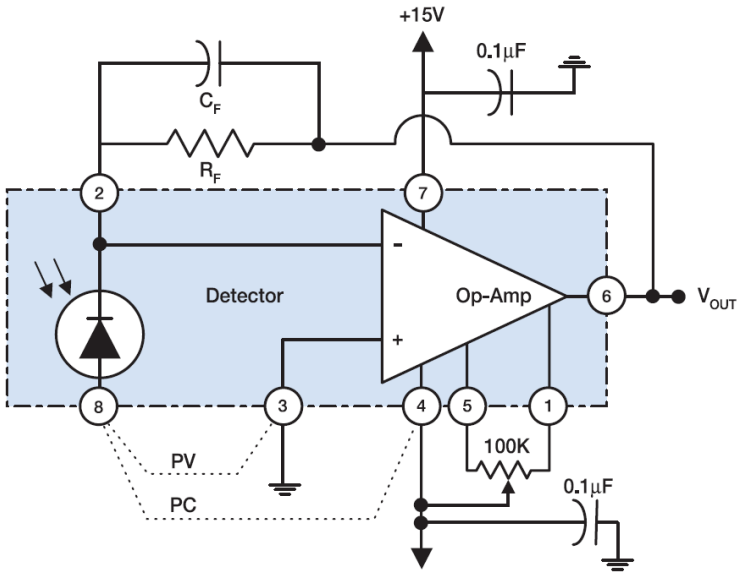

UDT-451, 455LN, 455UV/LN
UDT-555UV/LN

The output voltage is proportional to the light intensity of the light and is given by:

$$V_{OUT} = I_P \times R_F$$
$$= (P \times R_\lambda) \times R_F$$

Frequency Response (Photodiode/Amplifier Combination)

The frequency response of the photodiode / amplifier combination is determined by the characteristics of the photodetector, pre-amplifier as well as the feedback resistor (R_F) and feedback capacitor (C_F). For a known gain, (R_F), the 3dB frequency response of the detector/pre-amp combination is given by:

$$f_{3dB} = \frac{1}{2\pi C_F R_F}$$

However, the desired frequency response is limited by the Gain Bandwidth Product (GBP) of the op-amp. In order to have a stable output, the values of the R_F and C_F must be chosen such that the 3dB frequency response of the detector / pre-amp combination, be less than the maximum frequency of the op-amp, i.e. $f_{3dB} \leq f_{max}$.

$$f_{max} = \sqrt{\frac{GBP}{2\pi R_F (C_F + C_J + C_A)}}$$

where C_A is the amplifier input capacitance.

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In conclusion, an example for frequency response calculations is given below. For a gain of 10^8, an operating frequency of 100 Hz, and an op-amp with GBP of 5 MHz:

$$C_F = \frac{1}{2\pi f_{3dB} R_F} = 15.9pF$$

Thus, for C_F = 15.9 pF, C_J = 15 pF and C_A = 7 pF, f_{max} is about 14.5 kHz. Hence, the circuit is stable since $f_{3dB} \leq f_{max}$.

For more detailed application specific discussions and further reading, refer to the APPLICATION NOTES INDEX in the catalog.

Note: The shaded boxes represent the Photop™ components and their connections. The components outside the boxes are typical recommended connections and components.

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