Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922)49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89
Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Курган (3522)50-90-47
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Петрозаводск (8142)55-98-37
Псков (8112)59-10-37
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
Самара (846)206-03-16
Саранск (8342)22-96-24
Санкт-Петербург (812)-309-46-40
Саратов (845)249-38-78
Севастополь (8692)22-31-93
Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
Сургут (3462)77-98-35
Сыктывкар (8212)25-95-17
Тамбов (4752)50-40-97
Тверь (4822)63-31-35
Тольятти (8482)63-91-07
Томск (3822)98-41-53
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Тюмень (3452)66-21-18
Ульяновск (8422)24-23-59
Улан-Удэ (3012)59-97-51
Уфа (347)229-48-12
Хабаровск (4212)92-98-04
Чебоксары (8352)28-53-07
Челябинск (351)202-03-61
Череповец (8202)49-02-64
Чита (3022)38-34-83
Якутск (4112)23-90-97
Ярославль (4852)69-52-93

Россия +7(495)268-04-70
Казахстан +7(7172)727-132
Киргизия +996(312)96-26-47

Эл. почта: sao@nt-rt.ru || Сайт: https://laser.nt-rt.ru

AVALANCHE PHOTODIODES

You can also give us a call!

USA	+1 603 821 7040
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AVALANCHE PHOTODIODES

Sophisticated Si and InGaAs APDs

Avalanche photodiodes are manufactured from different semiconductor materials. Depending on the spectral sensitivity, silicon or InGaAs is used.

Silicon avalanche photodiodes detect radiation in the range from 255 nm to 1100 nm. Different versions are optimized for each of their own wavelength ranges; thus, there are series available for the UV range, the visible range, and the NIR.

For detection in the infrared spectral range, InGaAs is used. The products have three features: an extremely high damage threshold, a very low capacitance, and a low dark current.

Custom APD Products

Our team in Arizona offers not only standard avalanche photodiodes but also receivers and photon counting detectors, to name just two examples. Custom projects are always welcome – ask us for details!

You can also give us a call!

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Nomenclature

Our product nomenclature allows you to see at a glance what's what – details are given below.

APD-Type		
SAE	=	SAE Series
SAR	=	SAR Series
SAP	=	SAP Series
SARP	=	SARP Series
SARF	=	SARF Series
SAT	=	SAT Series
IAG	=	IAG Series
SUR	=	SUR Series
SAH	=	SAH Series

Active Area		
080	=	80 µm
200	=	200 µm
230	=	230 µm
350	=	350 µm
500	=	500 µm
800	=	800 µm
1500	=	1500 µm
3000	=	3000 µm

Package	
E1	TO-8
F2	TO-46 2-pin with filter
F3	TO-46 3-pin with filter
FP	fiber-coupled
G1	TO-5
Hx	Receiver
LCC44	SMD
M1	SMD
M2	SMD
M6	SMD
M8	SMD
S2	TO-46 2-pin (Si)
S3	TO-46 3-pin (Si)
S5	TO-46 2-pin (InGaAs)
S6	TO-46 3-pin (InGaAs)
S7	TO-46 low profile
T6	TO-37 with 1-stage TEC
T8	TO-37 with 2-stage TEC
Y(Y1)	Ceramic
S14	14-PIN-DIL

BASICS

You can also give us a call!

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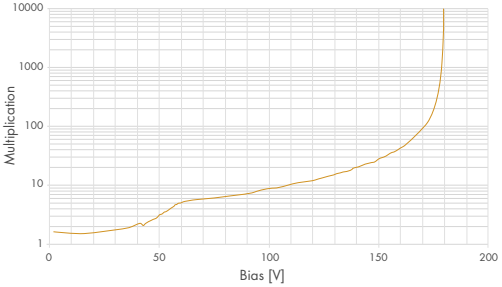


Typical gain vs. operating voltage for a Si APD when D = 500 µm

What Is An APD?

APDs differ from "normal" PIN photodiodes in that incoming photons internally trigger a charge avalanche. The prerequisite for this is the application of reverse bias voltage to the APD to broaden the absorption layer "A".

In conventional photodiodes, incoming photons create electron-hole pairs, also called charge carriers, which supply a measurable photocurrent. The power of the incoming photons has been transformed into electrical energy. Here, APDs have taken a significant step forward. The bias potential is much higher than in normal photodiodes. In the APD, the charge carriers set free by the light are accelerated in the electrical field in such a manner that they produce further electron-hole pairs through impact ionization. If the reverse bias voltage is less than the breakdown voltage, the avalanche will die down again due to friction losses. To this point a single photon has generated hundreds or even thousands of electrons. Above the breakdown voltage, the acceleration of the charge carriers is high enough to keep the avalanche alive. A single photon can be sufficient to generate a constant current which can be measured by external electronic equipment.

The current generated is calculated as follows:

$$I = R_0 \cdot M \cdot P_S$$

whereby R_0 (A/W) is the spectral responsivity of the APD, M is the internal gain and P_S (Watt) the incident optical power.

The gain of the APD thereby depends on the reverse bias voltage applied (see opposite diagram).

Choosing The Correct APD

APDs are generally recommended for very high bandwidth applications or where internal gain is needed to overcome secondary amplifier noise. The following items must be considered when making a selection:

Spectral Operating Range

APDs are available in the range from 260 nm to 1700 nm. Silicon APDs are, depending on their structure, suitable between 260 nm and 1100 nm, germanium between 800 nm and 1600 nm, and InGaAs from 900 nm to 1700 nm.

Silicon offers the most extensive APD product range. Depending on the manufacturing process, various parameters which offer advantages for the individual applications can be achieved. Compared to germanium APDs, InGaAs APDs have significantly lower noise characteristics, a higher bandwidth relative to the active area and advantages due to the extended spectral response to 1700 nm. A disadvantage is that InGaAs APDs are more expensive than Ge APDs. Germanium is therefore primarily recommended for cost-sensitive applications or in systems exposed to electromagnetic interference and in which the secondary amplifier noise is significantly higher.

Detector Area

It is obvious that small-area APDs are more economical than larger detectors since more chips can be manufactured per wafer. Therefore, the minimum active surface size required to realize the optical structure should first be determined. Sometimes it may be advantageous to use a somewhat larger APD, since special optics for focusing on a small spot may be more expensive than the additional charge for a larger APD.

Bandwidth and Noise

To compare the efficiency of an APD with a PIN diode, it is not sufficient to merely compare the noise of the detectors. The signal-to-noise ratio of the entire system is crucial. For PIN diodes, the respective preamplifier must also always be considered. Its noise characteristics are, among other things, frequency dependent. An APD is superior to a PIN diode whenever the APD can substantially boost the signal level without significantly increasing the overall system noise. Thus APDs are preferred wherever low light intensities at middle or high frequencies have to be detected. The optimum internal gain is selected when the detector noise is approximately equal to the input noise of the secondary amplifier (or load resistance), so that the APD does not affect the system noise. Noise increases with the bandwidth of the system for PIN diodes as well as APDs. Therefore it is important to reduce the bandwidth as far as is practicable.

Silicon APDs

Silicon avalanche photodiodes detect radiation from 260 nm to 1100 nm. Different versions are optimized for each of their own wavelength ranges.

Generic Specifications for all Si APDs • Absolute Maximum Ratings

	Min	Max
Storage temperature [°C]	-55	100
Operating temperature [°C]	-40	85
Reverse current (cw) [µA]		200
Reverse current (1 sec) [mA]		1
Forward current (cw) [mA]		5
Forward current (1 sec) [mA]		50
Max. power dissipation [mW]		60
Soldering (for 5 sec) [°C]		260

SAE Series

The SAE series is based on a planar epitaxial structure and is offered as either red-enhanced or NIR-enhanced to best match the requirements of the application. These APDs feature a choice of active area size (230 µm or 500 µm diameter) and feature high gain and a wide dynamic range.

Si Epi APDs • SAE Series

Part Number	Diameter [µm]	Wavelength Range [nm]	Peak Sensitivity [nm]	Responsivity @ λ Peak [A/W]	Packages*	V_{br} [V]	Vbr TC [V/°C]	Id [nA]	Noise [pA/sqrt.Hz]	Capacitance [pF]	Rise Time [ps]
SAE230Nx	230	550 – 1050	850	50	S2, S3, M8, F3, L3	150 – 300	0.6	0.5	0.2	1	500
SAE500Nx	500	550 – 1050	850	50	S2, S3, M8, L3, F3	150 – 300	0.6	1.0	0.2	2	500
SAE230Vx	230	400 – 1000	650	38	S2, S3, L3, M8	150 – 300	0.2	5	0.6	4	450
SAE500Vx	500	400 – 1000	650	38	S2, S3, L3, M8	150 – 300	0.2	5	0.6	4	450

! Information Specifications @ M=100, peak sensitivity

*Other packages are available on request.

SAR Series

The SAR series is based on a reach-through structure for high sensitivity across the range 400 – 1100 nm and features very fast response as well as extremely low noise and dark current levels. Active area sizes from 500 µm to 3 mm are offered. A specially selected low noise version (SARP series) is also available.

Si Reach-Through APDs • SAR Series

Part Number	Diameter [µm]	Wavelength Range [nm]	Peak Sensitivity [nm]	Responsivity @ λ Peak [A/W]	Package	V_{br} [V]	V_{br} TC [V/°C]	I_d [nA]	Noise [pA/ sqrt. Hz]	Capacitance [pF]	Rise Time [ps]
SAR500x	500	400 – 1100	890	60	S2, S3, F3	150 – 400	1	1.5	< 1	1.5	450
SARP500x	500	400 – 1100	890	60	S2, S3	150 – 400	1	0.5	< 0.2	1.5	450
SAR1500x	1500	400 – 1100	890	55	G1, T6	typ. 270	1	1	typ. 2.5	4	500
SAR3000x	3000	400 – 1100	890	55	E1, G1, T6	typ. 270	1	3	typ. 5	7	500

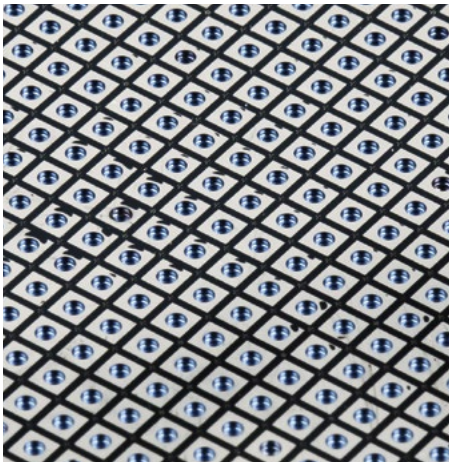
* With integrated bandpass filter.

SUR Series

The SUR series is based on a silicon reach-through structure with high sensitivity in the DUV/UV wavelength range. Many applications particulary in the medical and biomedical fields require highly sensitive detectors at short wavelengths for fluorescence measurements, analytical equipment or scintillation.

Electrical Characteristics • SUR Series

	Min	Typ.	Max
Wavelength range [nm]	260		1000
Active area diameter [nm]		0.5	
Breakdown voltage @ I_d=10 µA [V]	100	200	300
Responsivity @ M=100 [A/W]			
260 nm		21	
300 nm		22	
350 nm		25	
400 nm		28	
650 nm		44	
NEP @ M=100 [W/sqrt (Hz)]			
280 nm		22	
300 nm		20	
350 nm		18	
400 nm		16	
Temperature coefficient @ M=100 [V/K]		0.9	
Dark Current, I_d @ M=100 [pA]		200	
Noise current @ M=100 [pA/sqrt (Hz)]		2	
Capacitance @ M=100 [pF]		1.4	
Rise Time @ M=100 & 400 nm & RL=50 Ohms [nsec]		2	
Cut-off frequency @ M=100 [MHz]		150	



Characteristics

The benefit of the SUR series is an extremely high sensitivity and low noise performance operating in the blue to UV wavelength range. They are superior to any similar detector commercially available in the wavelength range from 260 nm to 1000 nm.

The diameter of the active area is 0.5 mm. The SUR series is delivered in a hermetically sealed TO-46 package optimized for the UV wavelength range.

SARF Series Si APDs with 905 nm Filter

The SARF500F2 features a reach-through structure with excellent quantum efficiency and fast response. The modified TO-46 package contains a 500 µm APD chip with peak sensitivity optimized for 905 nm as well as a bandpass filter centered at that wavelength.

For 905 nm Rangefinding

The detector is the device of choice for 905 nm rangefinding applications where low gains are used due to high background light, or where temperature compensation is not possible.

The advantages are obvious: cost saving, as no external filter or filter mount is required, compact design and optimized performance at 905 nm.

Si APD with 905 nm Filter

Part Number	Diameter [µm]	Wave-length Range [µm]	Peak Sensitivity [nm]	Responsivity @ λ Peak [A/W]	Package	V_{op} [Volt]	V_{br} TC [V/°C]	I_d [nA]	Noise [pA/ sqrt. Hz]	Capacitance [pf]	Rise Time [ps]
SARF500	500	880 – 930	905	10	F2, F3, M8F	typ. 160	1	1	0.05	1	3000

! Information Specifications @ M = 18, 905 nm

SAH Series (NIR-Enhanced)
Low-Cost Silicon Avalanche Photodiode

The SAH230MX and SAH500MX are low-cost, general purpose silicon APDs in a miniature SMD package. Responsivity is optimised for 850 nm and 905 nm rangefinders. Optional the SAH series is also available with 905 nm bandpass filter.

SAH Series (NIR-Enhanced)

		Diameter [µm]	Wavelength Range [nm]	Peak Sensitivity [nm]	V_{br} [V]	Responsivity @ 905 nm [A/W]	V_{br} TC [V/°C]	Dark current I_d [nA]	Noise I_d [pA/ sqrt. Hz]	Capacitance [pF]	Rise time @ M=100 [psec]	Package
SAH230X	Min		400									M1 (F) M2 (F)
	Typ	230		800	150	40		0.5	0.06	1.0	250	
	Max		1000		200		0.5	1.0				
SAH500X	Min		400									M1 (F) M2 (F)
	Typ	500		800	150	40		1.0	0.09	2.0	300	
	Max		1000		200		0.5	3.0				

Electrical Characteristics, Ta = 25°C, M = 100

SAP Series
Avalanche Photodiodes for Photon Counting

The SAP series silicon avalanche photodiodes are primarily used in photon counting. This series features highest efficiency and lowest dark count rates.

This specially developed APD is designed for operation in Geiger mode ($V_{op} > V_{br}$), where a single photon may cause an avalanche of up to 10^8 charge carriers. This device is especially suitable for Photon Counting, spectroscopy, fluorescence detection, medical applications and high-end LIDAR.

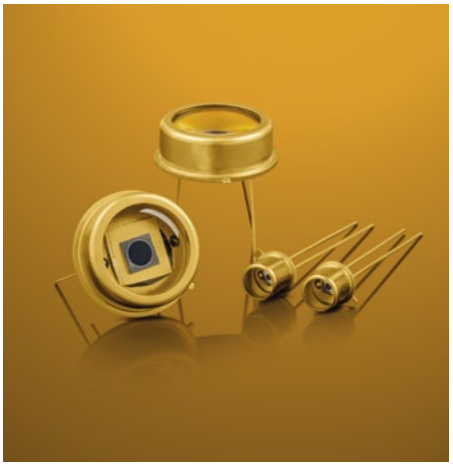
The APD is hermetically sealed in a modified TO-46 package. Cooled versions with either a one-stage or two-stage TEC in TO-37 or TO-8 packages offer significant reduction of noise for even higher performance.

SAP Series

Part Number	Diameter [µm]	Wavelength Range [nm]	Peak Sensitivity [nm]	Responsivity @ 830 nm [A/W]	Package	V_{br} [Volt]	V_{br} TC [V/°C]	I_d* [pA]	Noise* [pA/ sqrt. Hz]	Capacitance* [pf]	Dark count rate** [cps]
SAP500S2	500	400 – 1100	700	110	S2	125	0.35	1000	90	3.3	10,000
SAP500T6	500	400 – 1100	700	110	T6	125	0.35	200	40	3.3	5,000
SAP500T8	500	400 – 1100	700	110	T8	125	0.35	70	20	3.3	2,000

* Specifications @ M = 250, 830 nm

** Geiger mode



SAT Series
Si APDs for 1064 nm

LiDAR applications typically require efficient detectors for 1064 nm.

The SAT series is a Reach-Through-APD with sensitivity optimised for the near IR and a significantly higher QE at 1064 nm than standard silicon APDs. These devices are ideally suited to rangefinding with Nd:YAG lasers.

A choice of active area sizes (800 µm and 3 mm) is offered. TO-5, TO-8 and cooled TO-37 packages are available.

! Only available in the U.S.

The SAT series is only available in the U.S. For all other countries an end-user statement is required!

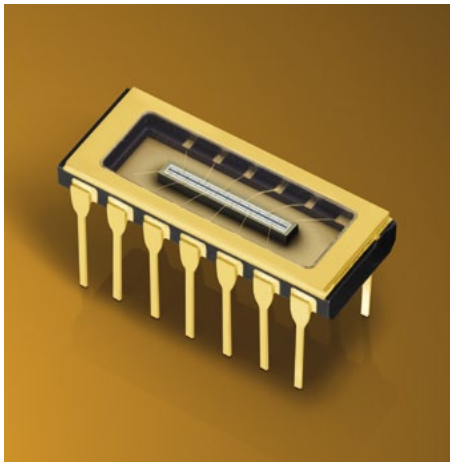
ITAR COMPLIANT
International Traffic in Arms Regulations Compliant

LASER COMPONENTS USA, Inc.

Si APD for 1064 nm • SAT Series

Part Number	Diameter [µm]	Wavelength Range [nm]	Peak Sensitivity [nm]	Responsivity @ λ 1064 nm [A/W]	Package	V_{br} [Volt]	V_{br} TC [V/°C]	I_d [nA]	Noise [pA/ sqrt. Hz]	Capacitance [pF]	Rise Time [ns]
SAT800x	800	700 – 1100	980	25	E1, G1, T6	400	2.5	1	0.5	2	1
SAT3000x	3000	700 – 1100	980	34	E1, G1, T6	400	2.5	5	1	10	3

! Information Specifications @ M = 100, peak sensitivity



Si-APD Arrays

The SAH1LX series is a linear Si-APD array with 8, 12 or 16 elements in a 14-pin-DIL or LCC44 package with protective window. Responsivity is optimised for 850 nm. The LCC44 package version is optional available with integrated TIA.

The array offers uniform gain and small crosstalk between each element. Custom designs are available on request.

Si APD Array

Parameter	Condition	Min	Typ	Max
# of elements		8 / 12 / 16		
Active area [µm] / element		620 x 190		
Gap [µm]		40		
Dark current I_d [nA]	M=100, λ=905 nm, per element		4	10
Capacitance, C [pF]	M=100, per element		3	
Responsivity, R_I	M=100, λ=905 nm	40	50	
Rise time, t_r [psec]	M=100, λ=905 nm, R_L=50 Ohms		1000	
Temperature coefficient [V/K]	I_R=10 µA		0.5	
Crosstalk [dB]	λ=905 nm		50	
Dark current uniformity [%]	M=100		±5	±20
Photo current uniformity [%]	M=100, λ=905 nm		±5	±20
Package		S14 / LCC44		

Electrical Characteristics, Ta = 25°C

InGaAs APDs

InGaAs detectors have been created for the wavelength range 1000 – 1650 nm. These devices offer superior performance to germanium APDs, e.g. much lower noise, higher bandwidth and ensitivity at longer wavelengths.

Generic Specifications for all InGaAs APDs • Absolute Maximum Ratings

	Min	Max
Storage temperature [°C]	-60	125
Operating temperature [°C]	-40	85
Reverse current [mA]		1
Forward current [mA]		10
Soldering (for 5 sec) [°C]		260

IAG Series

The IAG series offers best dark current, noise performance and damage threshold and is offered in three active area sizes, 80 µm, 200 µm and 350 µm, the largest InGaAs-APD currently available on the market.

Both device types are offered in a hermetic TO-46 package. Options include chip-on ceramic as well as a cooled version in a TO-37 package.

InGaAs APDs • IAG Series

Part Number	Diameter [µm]	Wavelength Range [nm]	Peak Sensitivity [nm]	Responsivity @ λ Peak [A/W]	Package	V_{br} [V]	V_{br} TC [V/°C]	I_d [nA]	Noise [pA/ sqrt. Hz]	Capacitance [pF]	Rise Time [ps]
IAG080x	80	1000 – 1630	1550	9	S5, S6, S7, Y, T6, T8	40–80	0.06	typ. 1	< 0.4	0.35	140
IAG200x	200	1000 – 1630	1550	9	S5, S6, S7, Y, T6, T8	50–83	0.075	typ. 8	< 0.9	1.5	235
IAG350x	350	1000 – 1630	1550	9.4	S5, S6, S7, Y, T6, T8	35–70	0.075	typ. 190	typ. 1 4.	4.1	585

Fiber pigtailed Si and InGaAs APDs

Extremely accurate micro-positioners allow the fiber to be adjusted to within a few microns, enabling coupling efficiencies close to 100% to be achieved. The versatile construction approach allows almost any combination of APD and fiber to be built – any of our TO-46 packaged APDs can be pigtailed with monomode or multimode fibers of up to 105 µm core diameter.

Pigtailed APDs offer advantages in many different situations – medical or analytical application often require the detector to be positioned remote from the measurement; photon counting applications benefit from an opaque fiber buffer ensuring that only the photons of interest reach the detector, and data can be easily transmitted over long distances in industrial applications.

APD Type and Size	FP	Fiber	Connector	Length
SAE500N	FP = fiber pigtail	1/15 = 9 µm core, NA 0.15	0 = none	1 to 100 in meters
SAE230N		5/20 = 50 µm core, NA 0.20	SM = SMA	
SAE500V		6/27 = 62.5 µm core, NA 0.27	FC = FC/PC	
SAE230V		10/22 = 105 µm core, NA 0.22	FA = FC/APC	
SAR500				
SARP500				
SAP500				
IAG080				
IAG200				

Note: other fibers and connectors are available on request.

APD Receivers

APD receivers come equipped with an integrated preamplifier – for optimal performance.

The performance of an APD in a specific application is often limited by the electronics, therefore the pre-amplifier needs to be chosen and implemented with great care in order to achieve the best possible signal-to-noise ratio.

Our H series receivers offer the user an APD with matched, integrated pre-amplifier in a compact, hermetic package.

All the receivers listed below are available with silicon* or InGaAs**-APDs and are therefore suitable for the wavelength ranges 400 – 1100 nm and 1000 – 1650 nm respectively.

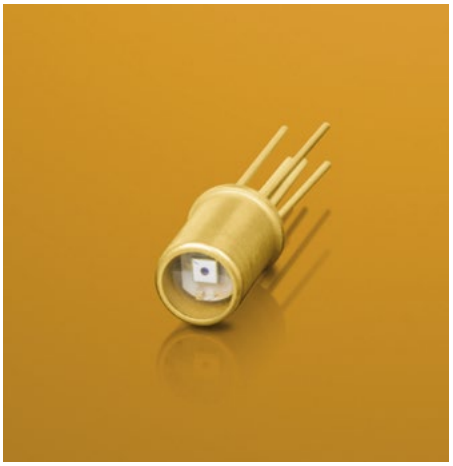
* (SAE, SAR, SAT Series)

** (IAG Series)

H0 Series

The H0 series includes a silicon or InGaAs APD with an optimized low noise hybrid pre-amplifier for the use in laser range finding, LiDAR, medical and analytical applications.

Housed in a modified 5 pin TO-46 package they offer bandwidths up to 80 MHz and a single ended output. Higher bandwidths can be achieved by further lowering the feedback resistor values.



Electrical Characteristics • H0 Series

Part Number	IAG080H0	IAG200H0	SAR500H0	SAR1500H0	SAT800H0
InGaAs-APD[1] | Si-APD[2]	IAG080[1]	IAG200[1]	SAR500[2]	SAR1500[2]	SAT800[3]
Diameter [µm]	80	200	500	1500	800
Wavelength Range [nm]	900 – 1700	900 – 1700	400 – 1000	400 – 1000	700–1100
Peak Sensitivity [nm]	1550	1550	890	890	980
Bandwidth [MHz]	DC - 80	DC - 80	DC - 20	DC - 20	DC - 20
Responsivity [MV/W]					
1550 nm	0.1	0.1			
540 nm			1.35	1.35	1.35
650 nm			2.00	2.00	2.00
905 nm			2.50	2.50	2.50
NEP [pW/rtHz]					
1550 nm	0.3	0.4			
540 nm			0.10	0.10	0.10
650 nm			0.06	0.06	0.06
905 nm			0.05	0.05	0.05
Output Noise Density [nV/rtHz]	30	40	100	100	100
Input Refered Noise Density [pA/rtHz]	3	4	2	2	2
Output Voltage Swing (1MΩ) [V]			3	3	3
Output Voltage Swing (50Ω) [V]			1.5	1.5	1.5
Output Offset Voltage [mV]			25	50	25

1 ! Information Specifications @ M = 10, 25°C, RF = 50 kΩ (typ), (InGaAs)

2 ! Information Specifications @ M = 100, 25°C, RF = 50 kΩ (typ), (Silicon)

3 An export license is required by customers outside the USA.

H1 Series

The H1 series includes a silicon or InGaAs avalanche photodiode with an optimized low noise hybrid preamplifier for the use in laser range finding, LiDAR, medical and analytical applications. Housed in a 12 pin TO-8 package they offer bandwidths up to 25 MHz, an onboard temperature sensor and a single ended output.

The Si-APDs used in these devices are SAR500, SAR1500, SAR3000 and for YAG enhanced application SAT800, providing excellent responsivity between 400 nm and 1100 nm and very fast rise and fall times at all wavelengths. For the wavelength range between 900 nm and 1700 nm our InGaAs-APD IAG series is used.
All APD receivers are available with various gain/bandwidth configurations.

Custom versions with all other APD chips from our product range are available on request.

Electrical Characteristics • H1 Series

H1 Hybrid Series Type	H1A	H1B	H1C	H1D
Bandwidth	DC – 25 MHz	DC – 10 MHz	DC – 3 MHz	DC – 1 MHz
Responsivity [MV/W]				
540 nm	0.27	2.7	27	270
650 nm	0.4	4	40	400
905 nm	0.5	5	50	500
1550 nm (IAG series, M = 10)	0.094	0.94	9.4	94
NEP [fW/#Hz]				
540 nm	150	55	11	11
650 nm	100	37.5	7.5	7.5
905 nm	80	30	6	6
1550 nm (IAG series, M = 10)	425	160	64	32
Output noise density [nV/sqrt. Hz]	40	150	300	3000
Input referred noise density [pA/sqrt. Hz]	4	1.5	0.3	0.3

! Information: All data shown is for SAR series APD, M = 100 unless otherwise noted. Bandwidth specifications refers to SAR500. Noise measured at 100 kHz.

H2/H3/H4/H5 Series

The H2/H3/H4/H5 series includes a Silicon or InGaAs Avalanche Photodiode with an optimized low noise hybrid preamplifier for the use in high speed, low light detection, in laser range finding, LiDAR, medical and analytical applications. Housed in a 5 pin TO-46 or 6 pin TO-5 package they offer bandwidths up to 700 MHz and a differential ended output. The Si-APDs used in these devices are SAR500, SAR1500 and for YAG enhanced application SAT800, providing very good response between 400 nm and 1100 nm and very fast rise and fall times at all wavelengths. For the wavelength range between 900 nm and 1700 nm our InGaAs-APD IAG series is used.
All APD Receivers are available with various gain/bandwidth configurations.

Custom versions with all other APD chips from our product range are available on request.

Electrical Characteristics • H2/H3/H4/H5 Series

Hybrid Series	H2	H3	H4	H5
Supply voltage – Vcc [Volts]	3.3	5.0	3.3 or 5.0	3.3
Supply current [mA]	25	30	30	25
Bandwidth	10 kHz – 100 MHz	10 kHz – 240 MHz	20 kHz – 470 MHz	20 kHz – 700 MHz
Responsivity [MV/W]				
540 nm	1.50	0.54	0.22	0.12
650 nm	2.20	0.80	0.32	0.18
905 nm	2.70	1.00	0.40	0.22
1550 nm (IAG series, M = 10)	0.50	0.19	0.075	0.042
NEP [fW/#Hz]				
540 nm	70	75	230	420
650 nm	45	50	160	290
905 nm	40	40	125	230
1550 nm (IAG series, M = 10)	250	300	700	1200
Output noise density [nV/sqrt. Hz]	100	50	50	50
Input referred noise density [pA/sqrt. Hz]	2	3	7	12

! Information: All data

Package Drawings

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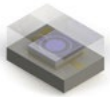

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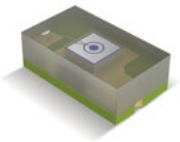

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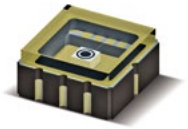

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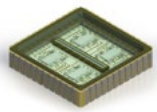

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Россия +7(495)268-04-70
Казахстан +7(7172)727-132
Киргизия +996(312)96-26-47

Эл. почта: sao@nt-rt.ru || Сайт: https://laser.nt-rt.ru