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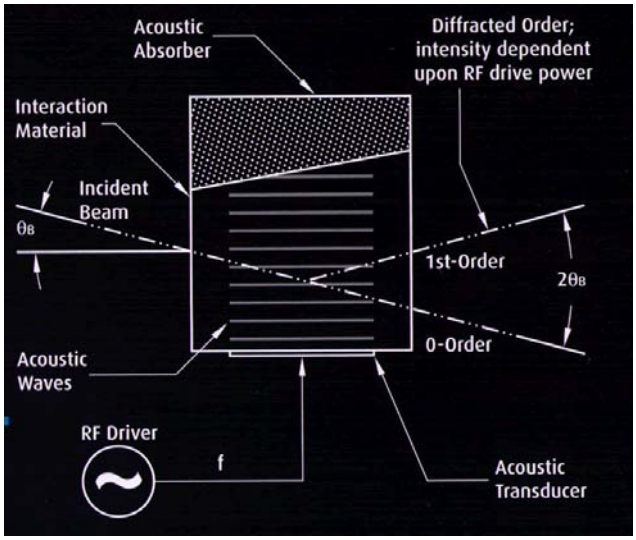
Acousto-Optic Modulators

By virtue of having no moving parts our acousto-optic modulators (AOMs) are able to amplitude modulate a laser beam at very high speed. For example modulation bandwidths in excess of 50MHz are readily achievable.

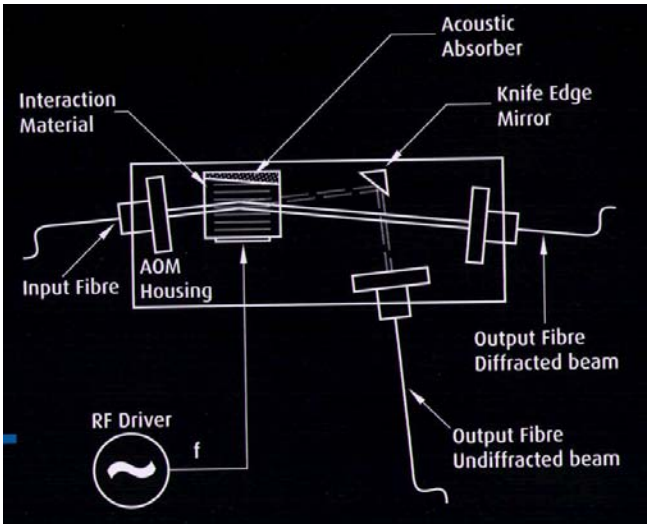
In an AOM a laser beam is caused to interact with a high frequency ultrasonic sound wave inside an optically polished block of crystal or glass (the interaction medium). By carefully orientating the laser with respect to the sound waves the beam can be made to reflect off the acoustic wavefronts (Bragg diffraction). Therefore, when the sound field is present the beam is deflected and when it is absent the beam passes through undeviated. By switching the sound field on and off very rapidly the deflected beam appears and disappears in response (digital modulation). By varying the amplitude of the acoustic waves the intensity of the deflected beam can similarly be modulated (analogue modulation).

It is usual to choose the deflected beam as the one that is used in the optical system because it can be switched on and off with high extinction ratio (typically >40dB) and intensity can be varied from zero to more that 85% of the incident beam. The rate at which the beam can be modulated is governed by the time it takes the acoustic wavefronts to traverse the laser beam, which depends on the beam diameter and the acoustic velocity in the interaction medium.

The sound waves are generated by a transducer, usually a thin wafer of lithium niobate, that is bonded onto the interaction medium using a highly efficient cold-weld metallic bonding process. When a high frequency electrical signal is applied to the transducer it vibrates, generating the acoustic wave. The signal is derived from an RF driver, which generates a high frequency carrier that is itself modulated by an analogue or digital input signal.



AO Modulator Cell Schematic



Fiber-coupled AO Modulator Cell Schematic

Principal applications for AO modulators are pre-press (putting image and text data onto films or plates as part of the printing process), laser imaging and displays, switching in telecom fibres, instrumentation and research.

1. Free-space Acousto-optical Modulators

We offer a wide range of standard AO Modulators, for digital or analogue intensity modulation of laser beams. Their main specifications are as follows:

- Wavelength Range: 240nm to 2100nm
- Drive Frequencies: 20MHz to 350MHz
- Optical Rise-Times: Down to 5ns
- Modulation Bandwidths: Up to 100MHz
- Interaction Materials: Tellurium Dioxide, Lead Molybdate, Fused Silica, Crystal Quartz, halcogenide Glass, Flint Glass.

An RF Driver provides the electronic signal operating the AO Modulator. With a digital driver, an external TTL signal enables rapid on and off switching of the optical beam. Alternatively an anologue driver enables a variable intensity output, typically from 0% to 85% of the input beam.

The maximum modulation bandwidth, or optical rise-time, is a function of the acoustic transit time across the optical beam. Therefore, for the highest speeds it is often necessary to focus the optical beam down to a small spot inside the modulator.

Our standard AOMs are listed below.

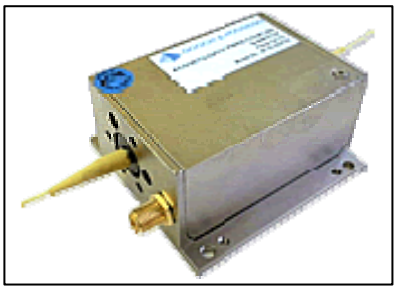
Model	Description	Driver
M080-2G-LV1	High efficiency AO Modulator for lasers where fast modulation is not critical, RF 0.5W	A36080 N21080-1DM, N21080-1AM
M080-2B/F-GH2	480-800nm, 150ns risetime, 80MHz, 2mm aperture, RF<2W	A36080, N21080-2AM, N21080-2DM
M080-2H/J-xxx	1300-1650nm, 40ns risetime, 80MHz, 0.4mm aperture, RF<3W	A35080, N31080-3DM, N31080-3AM
M111-10C-TR7	AO Modulator for wavelength 514 to 532nm, high damage threshold , RF 5W	A35111 N31111-5DM, N31111-5AM
M111-2J-AV1	1520 to 1630nm covering C & L bands, 111MHz, 60ns rise-time. (old version is 120MHz), RF 3.5W	A35111 N31111-3.5DM, N31111-3.5AM
M111-10UV-OR1	351 to 364nm, 111MHz, 110ns rise-time, Crystal Quartz for high power handling, RF 3W	A35111 N31111-3DM, N31111-3AM
M200-4A-GH11	380 to 430nm, 200MHz, 10ns rise-time. Suitable for use with Ti:Sapphire lasers, RF 2.5W	A35200 N21200-2AM, N21200-2DM
M200-4B/E-LD4	High intensity RGB modulation, 200MHz, 10ns risetime, ideally suited to laser display and reprographic systems, RF 6W	N31200-6DM, N31200-6AM
M250-2x-xx	488nm, 532nm or 633nm, 250MHz, 10ns rise-time	A36250 N21250-2AM, N21250-2DM
M350-2x	488nm, 532nm or 633nm, 350MHz, 5ns rise-time	A35350
12038-3-BR-TE	SiO2, used for various wavelength, 38MHz, aperture 2mm, deflection 6.75mrad, RF 1W	11038-1ML
12038-3-TE	SiO2, 1064nm wavelength, 38MHz, aperture 3mm, deflection, 6.75mrad, RF 1W	11038-1ML
12041-3-BR-TE	SiO2, used for various wavelength, 41MHz, aperture 2mm, deflection 7.3mrad, RF 1W	11041-1ML
12041-3-TE	SiO2, 1064nm wavelength, 41MHz, aperture 3mm, deflection 7.3mrad, RF 1.2W	11041-1ML

12050-3-BR-TE	SiO2, used for various wavelength, 50MHz, aperture 2mm, deflection 8.9mrad, RF 1W	11050-1ML
12050-3-TE	SiO2, 1064nm wavelength, 50MHz, aperture 3mm, deflection 8.9mrad, RF 1.2W	11050-1ML
12080-3-BR-TE	SiO2, used for various wavelength, 80MHz, aperture 2mm, deflection 14.2mrad, RF 1W	11080-1ML
12080-3-TE	SiO2, 1064nm wavelength, 80MHz, aperture 3mm, deflection 14.2mrad, RF 1.2W	11080-1ML
13389-BR	SiO2, used for various wavelength, 389MHz, aperture 60um, deflection 41mrad, RF 0.5W	64389-SYN-9.5-X
15180-1.06-LTD-GAP	GaP, 1.06um wavelength, 180MHz, aperture 0.3mm, deflection 28.7mrad, RF 1.7W	
15210	TeO2, 440-850nm wavelength, 210MHz, aperture 0.2mm, deflection 31mrad, RF1W	21210-1xx
15210-FOA/71002	TeO2, 440-850nm wavelength, 210MHz, aperture 0.2mm, deflection 31mrad, RF1W	21210-1xx
15210-FOA	TeO2, 440-850nm wavelength, 210MHz, aperture 0.2mm, deflection 31mrad, RF1W	21210-1xx
15260	TeO2, 440-850nm wavelength, 260MHz, aperture 0.2mm, deflection 39mrad, RF0.7W	21260-.7xx
15260-FOA/71002	TeO2, 440-850nm wavelength, 260MHz, aperture 0.2mm, deflection 39mrad, RF1W	21260-1xx
15260-FOA	TeO2, 440-850nm wavelength, 260MHz, aperture 0.2mm, deflection 39mrad, RF1W	21260-1xx
17389-1.06-LTD-GaP	GaP, 1.06um wavelength, 389MHz, aperture 0.15mm, deflection 62mrad, RF 1W	11389-5AM, 64389.5-SYN-9.5-X
17389-.93	TeO2, 700-1064nm wavelength, 389MHz, aperture 70um, deflection 73mrad, RF 0.7W	11389-5AM, 64389.5-SYN-9.5-X
17389-.93-FOA	TeO2, 700-1064nm wavelength, 389MHz, aperture 70um, deflection 73mrad, RF 0.7W	11389-5AM, 64389.5-SYN-9.5-X
35085-0.5-350	Fused silicon, 300-400nm wavelength, 85MHz, aperture 0.5mm, deflection 5mrad, RF 6W	31085-6xx
35085	Fused silicon, 400-540nm wavelength, 85MHz, aperture 0.5mm, deflection 5mrad, RF 6W	31085-6xx
35085-3-350	Fused silicon, 300-400nm wavelength, 85MHz, aperture 3mm, deflection 5mrad, RF 3W	31085-3xx
35085-3	Fused silicon, 400-540nm wavelength, 85MHz, aperture 3mm, deflection 5mrad, RF 6W	31085-6xx
35110-2-244	KrF grade fused silica, 244nm wavelength, 110MHz, aperture 2mm, deflection 4.5mrad, RF 2W	21110-2xx
35210-BR/71004	Fused silica, 300-700nm wavelength, 210MHz, aperture 0.13mm, deflection 17mrad, RF 6W	31210-6xx
35210-BR	Fused silica, 300-700nm wavelength, 210MHz, aperture 0.13mm, deflection 17mrad, RF 6W	31210-6xx
35250-.2-.53-XQ	Crystal quartz, 532nm wavelength, 250MHz, aperture 0.2mm, deflection 23mrad, RF 6W	31250-6xx
37027-3	Ge, 10.6um wavelength, 27.12MHz, aperture 3mm, deflection 52nm, RF 30W	R39027-30DSA05
37027-5	Ge, 10.6um wavelength, 27.12MHz, aperture 5mm, deflection 52nm, RF 30W	R39027-35DSA05

2. Fiber-coupled Acousto-optical Modulators

Our standard fibre-coupled AOMs are listed below. If you would like to see a detailed technical data sheet just go on the relevant model number. If you do not see a device that meets your requirements please contact one of our engineers. We manufacture application-specific AOMs and would be pleased to design one that meets your needs.

The devices listed are aimed at fibre-optic telecommunications applications but we can also offer fibre-coupled versions of our standard AOMs, if required. If you are considering a non-standard device, or are just not sure which of the listed devices would suit you best, you may find it useful to email us with your questions.



We offer a wide range of standard fibre-coupled AOMs with the following characteristics: -

- Wavelengths: 1310nm or 1550nm
- Drive Frequencies: 40MHz, 80MHz or 110MHz
- Optical Rise-Times: as low as 10ns
- Materials: Tellurium Dioxide & Chalcogenide Glass
- Options: Single mode, polarisation maintaining and multimode, with or without connectors. Available in two, three or four fibre package configurations.

Model	Description	Driver
M040-8J-FxS	1550nm, fibre-coupled, 40MHz, 110ns rise-time, RF 0.2W	N21040-0.4xx A36040
M111-2J-FxS	1550nm, fibre-coupled, 111MHz, 25/65ns rise-time, RF 3W	N31111-3xx A35111
M200-2J-F2S	1550nm fibre-coupled, 10ns rise-time, 200MHz frequency shift, max input laser 1W (average)	N21200-2xx
M111-2G-F2S	1000-1100nm for 1µm fibre lasers, 111MHz, high extinction ratio, <3dB insertion loss, 25ns rise-time, RF 2W	A35111, A36111 N21111-xx
M080-2G-F2S	1000-1100nm for 1µm fibre lasers, 80MHz, high extinction ratio, <2dB insertion loss, 65ns rise-time, RF 2W	A35080, A36080 N21080-2xx
M175-2G-F2S	1000-1100nm for 1µm fibre lasers, 175MHz, high extinction ratio, 10ns rise-time, RF 2W	A35175, A36175 N21175-2xx
15200-.2-1.55-LTD-GaP-FO	Gap, 1.55um wavelength, linear polorisation, rise/fall time 10ns, 8/125 PM fiber, 200MHz, RF 2W	N21200-2xx
15200-.2-1.06-LTD-GaP-FO-GH	Gap, 1.06um wavelength, linear polorisation, rise/fall time 10ns, 6/125 PM fiber, 200MHz, RF 2W	N21200-2xx
23080-1-1.3-LTD-FO	TeO2, 1300nm, 80MHz, random, risetime 50ns, single mode fiber 9/125 (PM 8/125 optional), RF <1.5W	N21080-2xx
23080-1-1.06-LTD-FO	TeO2, 1060nm, 80MHz, random, risetime 50ns, single mode fiber 6/125 (PM 6/125 optional), <0.5W @ 1060nm, Used external to laser cavity, RF <1.25W	N21080-1xx
23080-1-1.06-LTD-FO-HP	TeO2, 1060nm, 80MHz, random, risetime 50ns, single mode fiber 6/125 (PM 6/125 optional), <2W @ 1060nm, Used external to laser cavity, RF <1.25W	N21080-1xx
23080-1-1.06-LTD-FO-2HP	TeO2, 1060nm, 80MHz, random, risetime 50ns, single mode fiber 6/125 (PM 6/125 optional), <2W @ 1060nm, may be used internal to laser cavity), RF <1.25W	N21080-1xx
23080-1-1.55-LTD-FO	TeO2, 1520-1570nm, 80MHz, random, risetime 50ns, single mode fiber 9/125, RF <2W	N21080-2xx
26035-2-1.3-LTD-FO	AMTIR, 1300nm, 35MHz, random, risetime 100ns, single mode fiber 9/125 (PM 8/125 optional), RF <0.5W	N21035-0.4xx
26035-2-1.55-LTD-FO	AMTIR, 1520-1570nm (1570-1620nm optional), 35MHz, random, risetime 100ns, single mode fiber 9/125 (PM 8/125 optional), RF <0.5W	N21035-0.4xx
26055-1-1.55-LTD-FO	AMTIR, 1520-1570nm (1570-1620nm optional), 55MHz, random, risetime 100ns, single mode fiber 9/125, 3 ports, RF <1W	N21055-0.4xx
26055-1-1.55-LTD-3FO	AMTIR, 1550nm, 55MHz, random, risetime 100ns, single mode fiber 9/125, 3 ports, RF <1W	N21055-0.4xx
26055-1-1.55-LTD-4FO	AMTIR, 1550nm, 55MHz, random, risetime 100ns, single mode fiber 9/125, 4 ports, RF <0.5W	N21055-0.4xx
54035-1.55-.5AS-FO	AMTIR, 1520-1570nm (1570-1620nm optional), 35MHz, random, risetime 100ns, single mode fiber 9/125, 1, 2, 3 or 4	Driver integrated

	channels	
54055-1.55-.5DS-3FO	AMTIR, 1550nm, 55MHz, random, risetime 100ns, single mode fiber 9/125, 3 ports	Driver integrated
54080-1.55-2DS	TeO2, 1520-1570nm (1570-1620nm optional), 80MHz, random, risetime 50ns, single mode fiber 9/125, 1, 2, 3 or 4 channels	Driver integrated

Remark:

- xx in the driver model (such as N21200-2xx) may be DM, AM, DS or AS
- Standard connector is FC/PC. We also commonly supply the following options: FC/APC, SC/PC & SC/APC. (Remark: 1. FC = Named as “Frank Charlie”, screw-in type metal plug connector; 2. SC = Named as “Sam Charlie”, square type plastic connector. 3. PC = Polished Connector, usually with Return Loss (RL) > 40dB (min) [eg. FC/PC, SC/PC]; 4. APC = 8 deg Angled-Polished Connector, usually with RL > 50dB (min) [eg. FC/APC, SC/APC])

3. AOM Drivers

	N31xxx-yyAM N31xxx-yyDM	N21xxx-yAM N21xxx-yDM	A35xxx	A36xxx
RF power, W	2-20W	0.4, 1 or 2W	1-5W, adj.	2W
RF frequency, MHz	24-260	27-300	80, 100, 110, 150, 200, 250, 300, 350	
Max. modulation frequency, MHz			<1/3 carrier frequency and <50MHz	
Input modulation	Analogue or digital		Analogue and digital	

Description of N series drivers:
xxx = a fixed frequency of between 27 and 300 MHz crystal controlled.
y = 0.4, 1, or 2 Watts output (N21 series), 2-20W adjustable output (N31 series)
D = Digital Modulation or **A** = Analogue Modulation
M = OEM Module

Description of A3 series drivers:
♦ low profile housing
♦ various standard frequencies, other frequencies from 80 to 350 MHz available
♦ analogue and digital modulation
♦ EMC-safe design, power stage and control circuits separately grounded, entirely shielded
♦ supply voltage 24 V DC

Type	RF Power [W]	Standard Frequencies [MHz]								RF on/off ratio guaranteed at any RF output level	Follow-up Model for:
		80	100	110	150	200	250	300	350		
		080	*100*	*110*	*150*	*200*	*250*	*300*	*350*		
A36___	2	✓	✓	✓	✓	✓	✓	✓	✓	TBD	A0__, A1__, A30_, A31_, A32_
A35___	5	✓	✓	✓	✓	✓	✓	✓	✓	≥ 65 dB	A20_, A33_, A34_

1. Free-space Acousto-Optic modulators (AOMs)

1.1 AO Modulator M080-2G-LV1

• High efficiency (95% typical)
• Low drive power (0.3W typical)
• Compact
• Easy to align

Description
The M080-2G-LV1 is a compact AO Modulator specifically designed for extra-cavity modulation of Nd:YAG/Nd:YVO4 lasers where fast modulation is not critical.

Rise times down to 10µs are readily achievable, together with excellent efficiency, typically > 95% for a well-collimated laser beam.

The relatively wide field of view means that good efficiency is achieved for more divergent beams.

Specification
Interaction Material: TeO2
Wavelength: 1064nm
Anti-Reflection Coating: < 0.3% per surface
Polarisation Alignment: ±5°
Frequency: 80MHz
Input Impedance: 50Ω
Acoustic Mode: Slow Shear
Active Aperture: 2.0 x 5.0mm
Clear Aperture: 4.0 x 5.0mm (min)
Recommended Beam Diameter: 1mm
Input Polarisation: Linear - vertical to base
Diffracted Beam Polarisation: Linear - rotated by 90° wrt input
Diffraction Efficiency: > 90%
RF Connector: SMA Female
RF Power: 0.5W
RF Driver Model No.: A36080, N21080-1DM or N21080-1AM

1.2 AO Modulator M111-10C-TR7

• 514 to 532 nm
• High damage threshold
• 111MHz drive frequency

Description
An acousto-optic modulator ideal for use with frequency doubled DPSS lasers.

Manufactured in Crystal Quartz for improved thermal management and efficiency. This modulator combines high quality optical finishing with in house anti-reflection coatings to provide high extinction ratio and optimised throughput.

Alternative wavelengths, apertures or package designs are available.

Specification
Interaction Material: Crystal Quartz
Wavelength: 514 to 532nm
Anti-Reflection Coating: < 0.3% per surface
Transmission: > 99.5%
Polarisation: Linear, vertical to base
Extinction Ratio (1st order on / off) > 55dB
Damage Threshold: > 50KW/cm2 (Average)
> 500MW/cm2 (Peak)

Frequency: 111MHz
VSWR: < 1.2:1 (50Ω input impedance)
Active Aperture: 2.0mm
Diffraction Efficiency: > 85%
Rise-Time / Fall-Time: 110ns / mm
Separation Angle: 9.6mrad at 515nm
RF Power: < 5.0W
RF Driver Model No.: A35111, N31111-5DM, N31111-5AM

1.3 AO Modulator M080-2B/F-GH2

• 480 to 800nm
• 80MHz drive frequency
• Up to 2mm beam diameter

Description

A general purpose acousto-optic modulator for use in the visible or near infra-red spectral regions. It's broadband anti-reflection coatings and large active aperture make it the ideal choice for cost-effective amplitude modulation of a wide range of low-power gas and diode lasers.

Available for the visible (B/E) and near infra-red (F), with active apertures of 2mm, laser beams with diameters ranging from 0.5 to 2mm may be modulated at moderate speed with high efficiency. For faster modulation, please refer to our extensive range of other AO modulators.

Specification

Interaction Material: Tellurium Dioxide
Wavelength: 480 to 800nm
Anti-Reflection Coating: < 0.5% per surface
Transmission: > 95%
Polarisation: Any
Frequency: 80MHz
VSWR: < 1.2:1 (50Ω input impedance)
Active Aperture: 2mm
Rise-Time / Fall-Time: 155ns/mm
Diffracted Beam Ellipticity: < 5% typical
Diffraction Efficiency: > 85% typical
RF Power: < 2W

Driver Selection:

A36080,
Digital Modulation: N21080-2DM
Analogue Modulation: N21080-2AM

1.4 AO Modulator M250-2x-xx

• 488, 532 and 633nm
• 250MHz drive frequency
• 10ns rise-time

Description

An acousto-optic modulator combining high efficiency and fast switching speed, suitable for use with visible wavelength lasers. This AOM features excellent extinction ratio, superb diffraction efficiency even at maximum modulation rates and minimal optical beam quality distortion.

Options include a choice of mounting and pivot holes, RF connectors and aperture dimensions. Alternative models in lead molybdate or for other wavelengths are available.

Specification

Interaction Material: Tellurium Dioxide
Acoustic Mode: Isotropic, compressional
Wavelength M250-2B-P2: 488nm, < 20mW

M250-2C-ES1: 532nm, < 20mW
M250-2E-O2: 633nm
Anti-Reflection Coating: < 0.2% per surface
Transmission: > 97%
Polarisation: Linear, vertical to base
Frequency: 250MHz
VSWR: < 1.2:1 (50Ω input impedance)
Active Aperture: 0.4mm
Separation Angle: 28 to 37mrad, wavelength dependant
RF Power: < 1.5W

Performance with a 65µm diameter, linearly polarised beam:
Rise-Time / Fall-Time: 10ns
Modulation Bandwidth: 50MHz
Diffracted Beam Ellipticity: < 10%
Diffraction Efficiency: > 85%

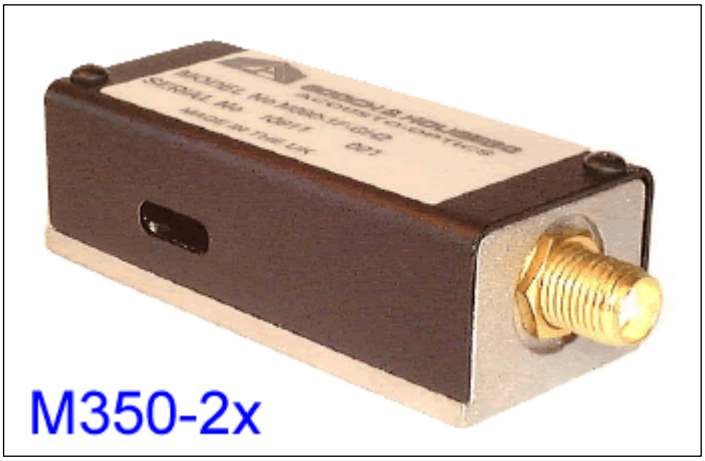
Driver Selection
A36250, N21250-2AM, N21250-2DM

1.5 AO Modulator M350-2x

• 488nm, 532nm and 633nm
• 350MHz drive frequency
• 5ns rise-time

Description
A high bandwidth acousto-optic modulator, for use in the visible RGB spectral region. Using specially selected top-grade tellurium dioxide and with our renowned quality manufacturing processes, this modulator provides fast switching capability at low RF drive powers.

Available in three models, one each for red, green and blue, high efficiency coupled with excellent transmitted beam quality make it particularly suited to electronic pre-press applications.



Specification
Interaction Material: Tellurium Dioxide
Acoustic Mode: Isotropic, compressional
Wavelength M350-2B: 488nm, < 20mW
M350-2C: 532nm, < 20mW
M350-2E: 633nm
Anti-Reflection Coating: < 0.2% per surface
Transmission: > 97%
Polarisation: Linear, vertical to base
Frequency: 350MHz
VSWR: < 1.2:1 (50Ω input impedance)
Active Aperture: 0.15mm
Separation Angle: 40 to 52mrad, wavelength dependant
RF Power: < 2W
Performance with a 30µm diameter, linearly polarised beam:
Rise-Time / Fall-Time: 5ns
Modulation Bandwidth: 100MHz
Diffracted Beam Ellipticity: < 15%
Diffraction Efficiency: > 80%

Driver Selection
Analogue / Digital Modulation: A35350

1.6 AO Modulator M111-2J-AV1

• 1520 to 1630nm

• 111MHz drive frequency
• 60ns rise-time

Description
A free-space acousto-optic modulator appropriate for use either intra-cavity or extacavity, for example to Q-Switch or modulate erbium doped fibre lasers.

Broadband anti-reflection coatings, combined with top grade tellurium dioxide, guarantee excellent throughput and beam quality. Special design and high quality manufacturing processes result in superior efficiency with excellent extinction ratio.

Specification
Interaction Material: Tellurium Dioxide
Acoustic Mode: Isotropic, compressional
Wavelength: 1520nm to 1630nm
Transmission: > 97%
Damage Threshold: >10MW/cm2 Pulsed, >50KW/cm2 CW
Polarisation: Any
Frequency: 111MHz
VSWR: < 1·2:1 (50Ω Input Impedance)
Active Aperture: 0.65mm
Separation Angle: 39 to 43mrad, wavelength dependant
RF Power: 3·5W
Operating Temperature: +10 to +60ºC
Storage Temperature: - 15 to +65ºC

Performance with a 400µm diameter, linearly polarised beam:
Rise-Time / Fall-Time: 61ns
Modulation Bandwidth: 8.2MHz
Extinction Ratio: > 40dB
Diffracted Beam Ellipticity: < 20%
Diffraction Efficiency: > 85%

Driver Selection
A35111, N31111-3.5DM or N31111-3.5AM

1.7 AO Modulator M111-10UV-OR1

• 351, 355 & 364nm
• High damage threshold
• 111MHz drive frequency

Description
An acousto-optic modulator ideal for use with 355nm frequency tripled Nd:YAG and Nd:YVO4 or 351nm / 364nm Argon lasers.

Manufactured in Crystal Quartz for improved thermal management & efficiency. This modulator combines high quality optical finishing with in house anti-reflection coatings to provide high extinction ratio and optimised throughput.

Alternative wavelengths, apertures or package designs are available. Please don't hesitate to contact us with your specific requirements.

Specification
Interaction Material: Crystal Quartz
Wavelength: 351 to 364nm

Anti-Reflection Coating: < 0.3% per surface at 355nm
< 0.5% per surface at 351 to 364nm
Transmission: > 99% at 355nm
> 98.6% at 351 to 364nm
Polarisation: Linear, vertical to base
Extinction Ratio (1st order on / off) > 55dB
Damage Threshold: > 50KW/cm2 (Average)
> 500MW/cm2 (Peak)
Frequency: 111MHz
VSWR: < 1.2:1 (50Ω input impedance)
Active Aperture: 3.0mm
Diffraction Efficiency: > 85%
Rise-Time / Fall-Time: 110ns / mm
Separation Angle: 6.5mrad at 355nm
RF Power: < 3.0W

Driver Selection
A35111, N31111-3DM or N31111-3AM

1.8 AO Modulator M200-4A-GH11
• 380 to 430nm AO modulation
• 200MHz drive frequency
• 10ns rise-time

Description
An acousto-optic modulator suitable for use with frequency doubled Ti:Sapphire lasers.

Manufactured in fused silica and with our superior high damage threshold anti-reflection coatings this modulator provides extremely fast digital or analogue switching, coupled with an ultra-high extinction ratio and optimised throughput.

Specification
Interaction Material: Fused Silica
Acoustic Mode: Isotropic, compressional
Wavelength: 380 to 430nm
Polarisation: Linear, vertical to base
Anti-Reflection Coating: < 0.5% per surface
Transmission: > 98.5%
Extinction Ratio (1st order on/off): > 55dB
Frequency: 200MHz
Active Aperture: 0.20mm
Input Impedance: 50Ω
Maximum RF Power Requirement: 2.5W
Operating Temperature: +10 to +60°C
Storage Temperature: -15 to +70°C

Performance characteristics at 405nm:
Beam Diameter: 90µm
Rise-Time (10-90%): 10ns
Modulation Bandwidth (3dB): 50MHz
Diffracted Beam Ellipticity: < 15%
Separation Angle: 13.5mrad
Diffraction Efficiency: > 80%
RF Power: 2W

Driver Selection
A35200, N21200-2AM or N21200-2DM

1.9 AO Modulator M200-4B/E-LD4
• High intensity RGB modulation

• 200MHz drive frequency
• 10ns rise-time

Description
An acousto-optic modulator for use with high intensity RGB lasers, ideally suited for laser display and reprographic applications.

Manufactured in fused silica and with our superior high damage threshold anti-reflection coatings this modulator provides extremely fast digital or analogue switching in the RGB range, coupled with an ultra-high extinction ratio and optimised throughput.

Specification
Interaction Material: Fused Silica
Acoustic Mode: Isotropic, compressional
Wavelength: RGB
Polarisation: Linear, vertical to base
Laser Power Maximum: > 100W
Anti-Reflection Coating: < 0.5% per surface
Transmission: > 97%
Extinction Ratio (1st order on/off): > 55dB
Frequency: 200MHz
Active Aperture: 0.20mm
Input Impedance: 50Ω
Maximum RF Power: 6W
Operating Temperature: +10 to +60°C
Storage Temperature: -15 to +70°C

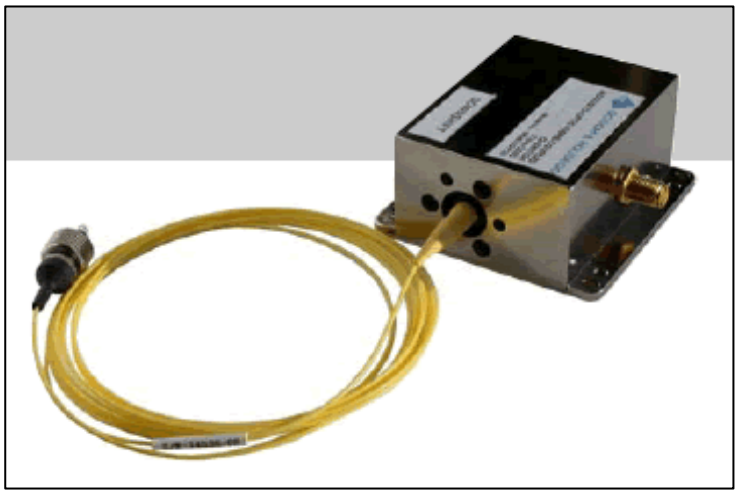
Wavelength:	**446nm**	**532nm**	**628nm**
Beam Diameter:	90µm	90µm	120µm
Rise-Time (10-90%):	10ns	10ns	13.5ns
Modulation Bandwidth (3dB):	50MHz	50MHz	37MHz
Diffracted Beam Ellipticity:	16%	21%	17%
Separation Angle:	15mrad	18mrad	21mrad
Diffraction Efficiency:	> 80%	> 80%	> 80%
RF Power:	3W	4W	5.5W

Driver Selection
N31200-6DM, N31200-6AM

1.10 M080-2B/F-GH2

Device	AO Modulator
Interaction Material	Tellurium Dioxide
RF Frequency	80MHz
Wavelength	480 - 800nm
AR Coating Reflectivity	≤ 0.5% /surface
Transmission	≥ 95%
Input Polarisation	Any
Active Aperture	2.0mm
Diffraction Efficiency	≥ 85%
Risetime	155ns / mm
RF Input Impedance	50Ω
RF Drive Power	< 2W (wavelength dependent)
RF Connector	SMA Female
Driver	N21080-2AM or N21080-2DM or A36080

2. Fiber-coupled Acousto-Optic modulators (AOMs)



2.1. AO Modulator

M040-8J-FxS

- 1550nm fibre coupled
- 40MHz frequency shift, 110ns rise-time
- Polarisation insensitive with no PMD

Description

A fibre-coupled acousto-optic modulator and frequency shifter for use in telecommunications. Optimised for low insertion loss at 1550nm, the use of chalcogenide glass provides essentially no polarisation sensitive loss or polarization mode dispersion. Very high extinction ratio and rise-time make this device suitable for all-optical switching and re-routing applications.

In addition to the two fibre version, a three fibre model allows both zero and first order output beams to be utilised.

Specifications

Interaction Material	Chalcogenide Glass
Wavelength	1550nm
Polarisation Dependant Loss	None
Polarisation Mode Dispersion	None
Insertion Loss	M040-8J-F2S < 2.4dB (first order)
	M040-8J-F3S < 3.0dB (zero and first order)
Extinction Ratio (1st order on/off)	> 50dB
Rise-Time / Fall-Time	110ns
Frequency	40MHz
VSWR	< 1.2:1 (50Ω input impedance)
RF Power	0.2W typical
Frequency Shift	-40MHz, down shift
Fibre Type	Single mode, 2m
Fibre Connectors	FC / PC, Seiko-Geiken

Options

Wavelength	1310nm, 1520 to 1580nm
Frequency Shift	+40MHz, up shift
Fibre Type	Polarisation maintaining, multimode
Fibre Connectors	Pig-tails for splicing, FC / APC

Driver Selection

N21040-0.4DM, N21040-0.4AM, or A36040

2.2. AO Modulator
M111-2J-FxS

- 1550nm fibre-coupled
- As fast as 25ns rise-time
- 111MHz frequency shift

Description
A fibre-coupled acousto-optic modulator suitable for use in telecommunications applications. Designed to provide the highest bandwidth all-optical switching available, it also exhibits excellent extinction ratio and low polarisation sensitivity.

In addition to the two fibre version, a three fibre model allows both zero and first order output beams to be utilised. Other options include a choice of operating wavelengths and fibre connectors.

Specification

Interaction Material	Tellurium Dioxide
Acoustic Mode	Isotropic, compressional
Wavelength	1550nm
Polarisation Dependant Loss	< 0.5dB
Polarisation Mode Dispersion	< 4ps (2 fibre), < 8ps (3 fibre)
Insertion Loss	< 3.0dB
Extinction Ratio (1st order on/off)	> 50dB
Rise-Time / Fall-Time	25ns (2 fibre), 65ns (3 fibre)
Frequency	111MHz
VSWR	< 1.2:1 (50Ω input impedance)
RF Power	3.0W
Frequency Shift	-111MHz, down shift
Fibre Type	Single mode, 2m
Fibre Connectors	FC / PC, Seiko-Geiken

Options

Wavelength	1310nm, 1520 to 1580nm
Frequency Shift	+111MHz, up shift
Fibre Type	Polarisation maintaining, multimode
Fibre Connectors	Pig-tails for splicing, FC / APC

Driver Selection
N31111-3DM, N31111-3AM or A35111

2.3. AO Modulator
M200-2J-F2S

- 1550nm fibre-coupled
- 10ns rise-time
- 200MHz frequency shift

Description
A telecom compatible fibre-coupled acousto-optic modulator ideal for fibre test applications especially in conjunction with erbium doped fibre amplifiers (EDFA's).

The fastest, most compact fibre-coupled AO modulator in its range, complete with pig-tails for splicing or FC / APC connectors. Providing a cost effective solution where rapid optical switching is

required. Dual digital / analogue RF drivers are also available.

Specification

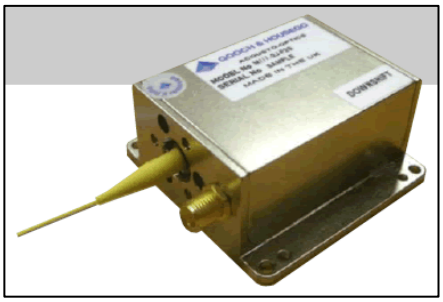
Interaction Material	Tellurium Dioxide
Acoustic Mode	Isotropic, compressional
Wavelength	1550nm
Polarisation Dependant Loss	< 0.5dB
Polarisation Mode Dispersion	< 4ps
Insertion Loss	< 8dB
Extinction Ratio (1st order on/off)	> 45dB
Rise-Time / Fall-Time	10ns
Frequency	200MHz
VSWR	< 1.2:1 (50Ω input impedance)
RF Power	2.0W
Frequency Shift	-200MHz, down shift
Fibre Type	Single mode, 2m
Fibre Connectors	FC / PC, Seiko-Geiken

Options

Wavelength	1520 to 1580nm
Frequency Shift	+ 200MHz, up shift
Fibre Type	Polarisation maintaining, multimode
Fibre Connectors	Pig-tails for splicing, FC / APC

Driver Selection
N21200-2AM or N21200-2DM

2. 4. Fibre-Q 80 AO Q-Switch
M080-2G-F2S



- 1μm fibre-coupled
- 80MHz drive frequency
- < 2dB insertion loss

Description
A fibre-coupled acousto-optic Q-Switch designed to be used with 1μm fibre lasers. This compact design features low insertion loss with high extinction ratio and may be optimised for any wavelength around the popular 1060nm mark. With conduction cooling and a matching RF driver, this Q-Switch is ready to be spliced into a fibre laser system. Special options such as custom fibres may be integrated through discussion with our team of scientists.

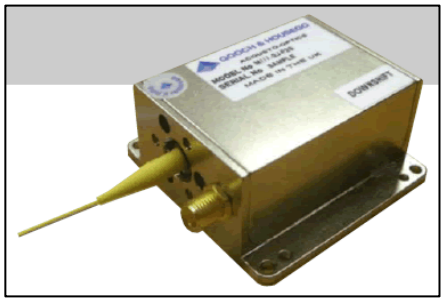
Specification

Interaction Material	Tellurium Dioxide
Acoustic Mode	Isotropic, compressional
Wavelength	1000nm to 1100nm
Insertion Loss	< 2dB (at a specified wavelength)
Polarisation Dependant Loss	< 0.5dB
Extinction Ratio (1st order on/off)	> 50dB
Back Reflection	< -50dB
Rise-Time / Fall-Time	65ns
Frequency	80MHz
VSWR	< 1.2:1 (50Ω input impedance)
RF Power	< 2W
Frequency Shift	- 80MHz, down shift
Fibre Type	Single mode, 2m, Flexcore 1060
Fibre Connectors	Pigtails for splicing

Options

Frequency Shift	+ 80MHz, up shift
Fibre Type	Polarisation maintaining or free issue fibre
Fibre Connectors	FC / PC, Seiko-Geiken

Driver Selection
A35080, A36080, N21080-2AM or N21080-2DM



2.5. Fibre-Q 111 AO Q-Switch
M111-2G-F2S

- 1 μm fibre-coupled
- 111MHz drive frequency
- 25ns rise-time

Description
A fibre-coupled acousto-optic device for use as a Q-Switch or intensity controller with 1μm fibre lasers.

Utilising Gooch & Housego's renowned crystal processing and coating expertise, coupled with superior design technologies, this device exhibits less than 3dB insertion loss while offering superb extinction ratio and rapid switching speeds, making it the perfect solution for Q-Switching fibre-lasers.

Even faster switching is available with model M175-2G-F2S and lower insertion loss with model M080-2G-F2S.

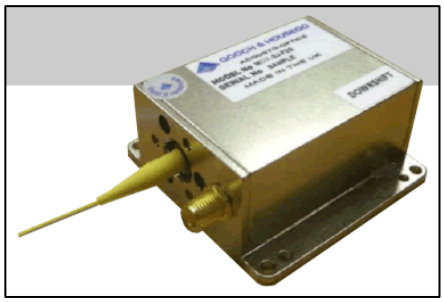
Specification

Interaction Material	Tellurium Dioxide
Acoustic Mode	Isotropic, compressional
Wavelength	1000nm to 1100nm
Insertion Loss	< 3dB (at a specified wavelength)
Polarisation Dependant Loss	< 0.5dB
Extinction Ratio (1st order on/off)	> 50dB
Back Reflection	< -40dB
Rise-Time / Fall-Time	25ns
Frequency	111MHz
VSWR	< 1.2:1 (50Ω input impedance)
RF Power	< 2W
Frequency Shift	- 111MHz, down shift
Fibre Type	Single mode, 2m, Flexcore 1060
Fibre Connectors	Pigtails for splicing

Options

Frequency Shift	+ 111MHz, up shift
Fibre Type	Polarisation maintaining or free issue fibre
Fibre Connectors	FC / PC, Seiko-Geiken

Driver Selection
A35111, A36111, N21111-2AM or N21111-2DM



2.6. Fibre-Q 175 AO Q-Switch
M175-2G-F2S

- 1 μm fibre-coupled

- 175MHz drive frequency
- 10ns rise-time

Description
A fibre-coupled acousto-optic device for use as a Q-Switch or high bandwidth modulator with 1µm fibre lasers.

In a compact, conduction cooled package, with fibres ready for splicing, this modulator exhibits an incredibly fast 10ns rise-time, making it ideal for short pulse generation. It may be used intra-cavity as a Q-Switch, or extra-cavity as a high bandwidth (50MHz) analogue/digital modulator.

Refer to model M080-2G-F2S for a lower insertion loss option.

Specification

Interaction Material	Tellurium Dioxide
Acoustic Mode	Isotropic, compressional
Wavelength	1000nm to 1100nm
Insertion Loss	< 6dB (at a specified wavelength)
Polarisation Dependant Loss	< 0.5dB
Extinction Ratio (1st order on/off)	> 45dB
Back Reflection	< -40dB
Rise-Time / Fall-Time	10ns
Frequency	175MHz
VSWR	< 1.2:1 (50Ω input impedance)
RF Power	< 2W
Frequency Shift	- 175MHz, down shift
Maximum optical power	2W
Fibre Type	Single mode, 2m, Flexcore 1060
Fibre Connectors	Pigtails for splicing

Options

Frequency Shift	+ 175MHz, up shift
Fibre Type	Polarisation maintaining or free issue fibre
Fibre Connectors	FC / PC, Seiko-Geiken

Driver Selection
A35175, A36175, N21175-2AM, N21175-2DM

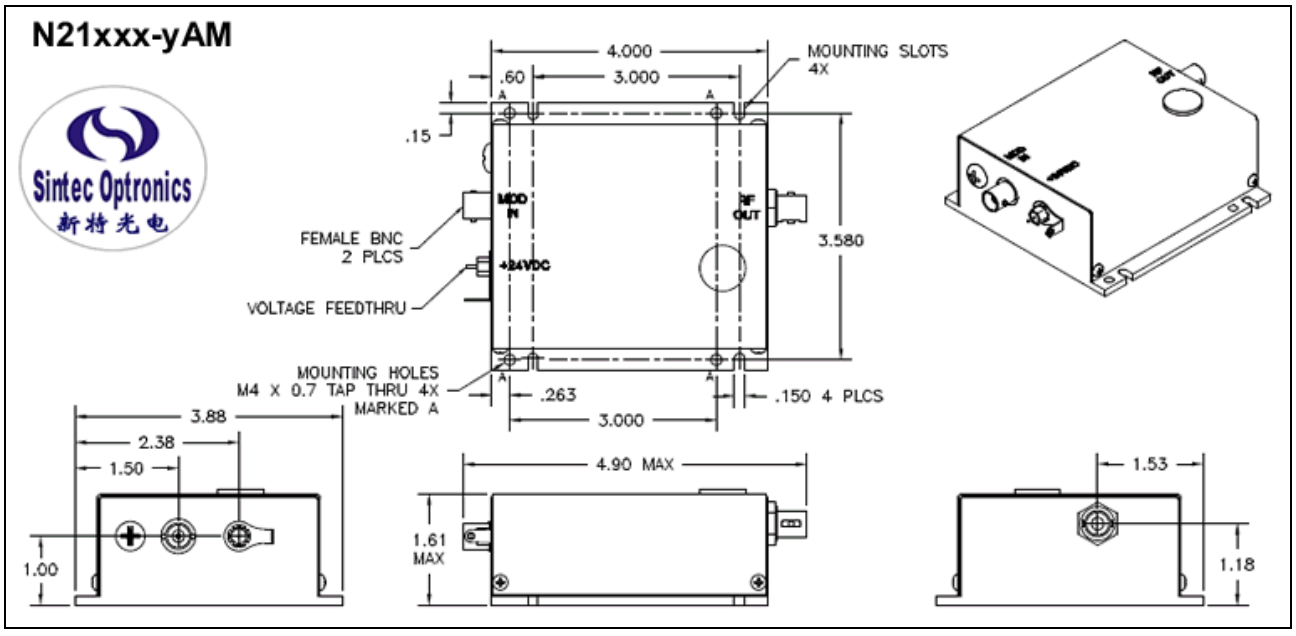
3. AOM Drivers

AOM Driver: N21xxx-yDM (27 to 300MHz, 0.4 to 2W)

The N21xxx-yDM OEM Module Is A RF Driver With Digital Modulation Input And Maximum 2 Watt Output Into A 50 Ohm Load. The model number is described as follows:

xxx = a fixed frequency of between 27 and 300 MHz crystal controlled.
y = 0.4, 1, or 2 Watts output
D = Digital Modulation
M = OEM Module

Parameter	**Specification**
Output Frequency (**xxx**)	27 to 300 MHz + 0.01% Quartz Stabilized
Spurious Levels	-50 dBc Maximum
Harmonic Distortion	-15 dBc Maximum
Digital Input	TTL Levels (TTL HIGH = Full RF Power; TTL LOW = Minimum RF Power)
Extinction Ratio	50 dB Minimum
RF Rise	20 ns Maximum
PRF	10 to 90 %
Fall Time	20 ns Maximum
PRF	90 to 10 %
RF Output Power (**y**)	0.4, 1 or 2 Watts Nominal, Adjustable. Factory Set for Optimum Performance When Paired with a NEOS AO Device.
Output Impedance	50 Ohms Nominal
Supply Voltage	+ 24 VDC + 0.5 Volt
Supply Current	1 Amp Maximum
MAXIMUM RATINGS	
Supply Voltage	+ 28 Volts
Power Output	No DC Feedback Allowed
Case Temperature	+ 55^{0}C. The Driver Must Be Attached to an Adequate Heatsink.
CONNECTORS & MECHANICAL	
RF Output Connector	BNC Female
Modulation Input Connector	BNC Female
Power Supply Connections	Vcc: Solder Post; Return: Ground Lug
Physical Size	4.8" L x 1.61" H x 3.87" W

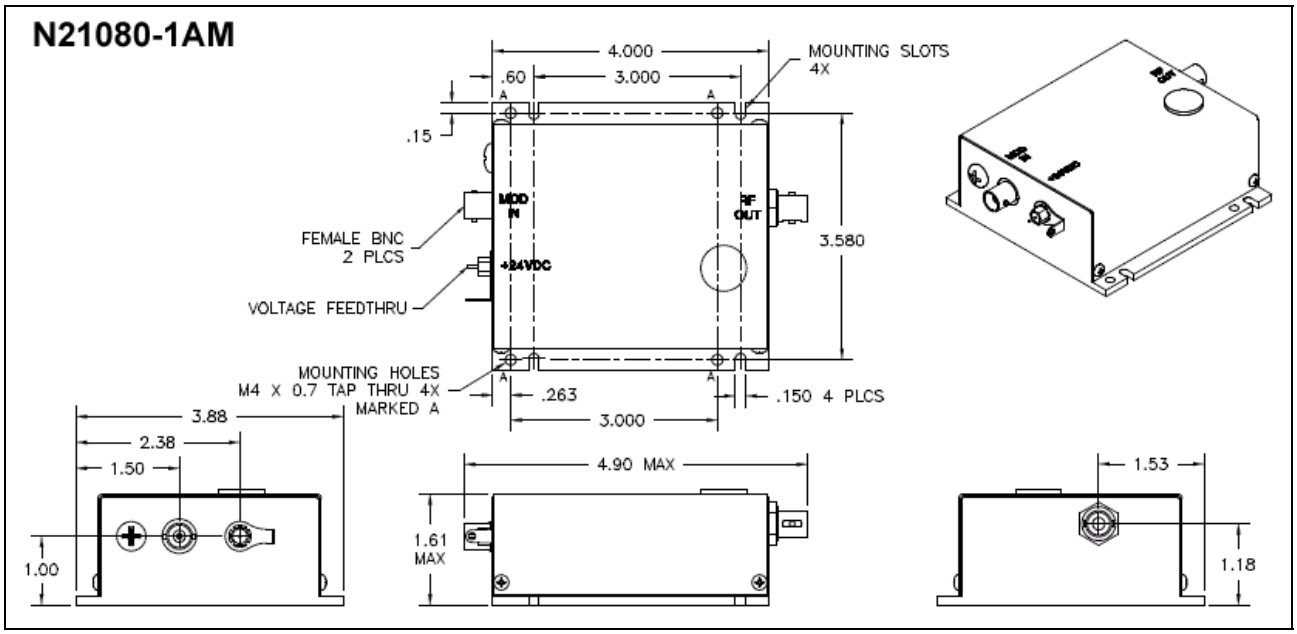


AOM Driver: N21xxx-yAM (27 to 300MHz, 0.4 to 2W)

The N21xxx-yAM OEM Module Is A RF Driver With Analog Modulation Input And Maximum 2 Watt Output Into A 50 Ohm Load. The model number is described as follows:

xxx = a fixed frequency of between 27 and 300 MHz crystal controlled.
y = 0.4, 1, or 2 Watts output
A = Anolog Modulation
M = OEM Module

PARAMETER	**SPECIFICATION**
Output Frequency (**xxx**)	27 to 300 MHz + 0.01% Quartz Stabilized
Spurious Levels	-50 dBc Maximum
Harmonic Distortion	-15 dBc Maximum
Analog Input	+ 1 Volt into 50 Ohms (+ 1 Volt = Full RF Power; 0 Volt = Minimum RF Power)
Extinction Ratio	50 dB Minimum
RF Rise	20 ns Maximum
PRF	10 to 90 %
Fall Time	20 ns Maximum
PRF	90 to 10 %
RF Output Power (**y**)	0.4, 1 or 2 Watts Nominal, Adjustable
Output Impedance	50 Ohms Nominal
Supply Voltage	+ 24 VDC + 0.5 Volt
Supply Current	1 Amp Maximum
MAXIMUM RATINGS	
Supply Voltage	+ 28 Volts
Power Output	No DC Feedback Allowed
Case Temperature	+ 55^{0}C. The Driver Must Be Attached to an Adequate Heatsink.
CONNECTORS & MECHANICAL	
RF Output Connector	BNC Female
Modulation Input Connector	BNC Female
Power Supply Connections	Vcc: Solder Post; Return: Ground Lug
Physical Size	4.8" L x 1.61" H x 3.87" W

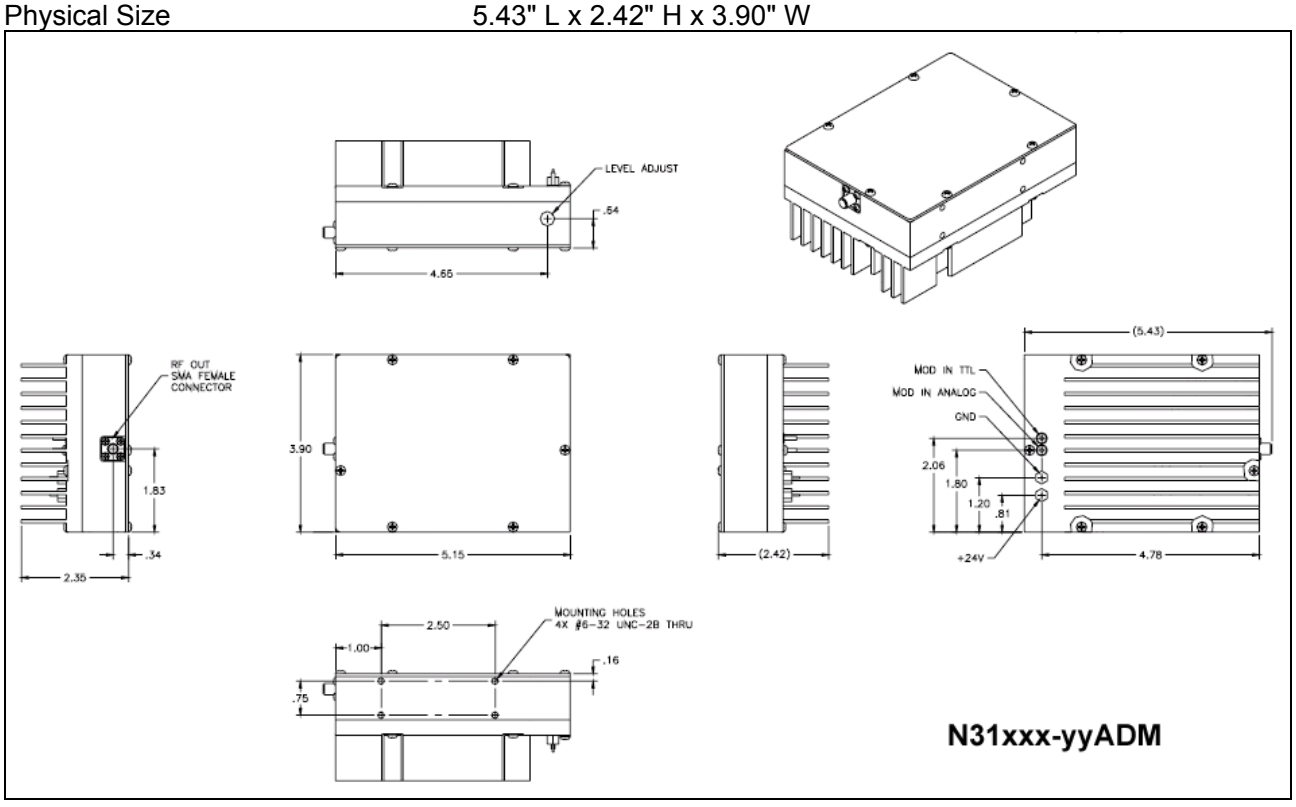


AOM Driver: N31xxx-yyADM (24 to 260MHz, 2 to 20W)

The 31xxx-yyADM Driver is a RF Driver module with Analog and Digital Modulation Input and up to 20 Watts Output into a 50 Ohm Load. The model number is described as follows:

xxx = a fixed frequency of between 24 and 260 MHz crystal controlled.
yy = 2 to 20W nominal. Set by internal pot
A = Analog Modulation
D = Digital Modulation
M = OEM Module

PARAMETER	**SPECIFICATION**
Output Frequency (**xxx**)	24 MHz to 260 MHz ±0.01% Quartz Stabilized
Spurious Levels	-40 dBc Maximum
Harmonic Distortion	-15 dBc Maximum
Analog Input	0-1 Volt into 50 Ohms (+ 1 Volt = Full RF Power; 0 Volt = Minimum RF Power)
Digital Input	TTL Levels (TTL HIGH = FULL RF Power; YYL LOW = Minimum RF Power)
Extinction Ratio	40 dB Minimum
RF Rise/ Fall Time	30ns maximum, 20 ns typical, 10ns > 210MHz (P_{RF}: 10 to 90%)
RF Output Power (**yy**)	2 to 20 Watts Nominal. Maximum output power set by internal pot.
Output Impedance	50 Ohms Nominal
Supply Voltage	+ 24 VDC + 0.5 Volt
Supply Current	3 Amp Maximum
Air Flow Across heat sink	18 CFM at 25 ^{o}C
MAXIMUM RATINGS	
Supply Voltage	+ 28 Volts
Power Output	No DC Feedback Allowed
Case Temperature	+ 55^{0}C.
CONNECTORS & MECHANICAL	
RF Output Connector	BNC Female
Modulation Input Connector	Feed Through Pin
Power Supply Connections	Vcc: Vcc Feed Through Pin; Return: Feed Through Pin
Physical Size	5.43" L x 2.42" H x 3.90" W



AOM Driver: A35xxx (80 to 350MHz, 5W)

The A35xxx RF driver series provides up to 5 Watt output power. Various types cover a frequency range from 80 to 350 MHz. The frequency is customizable.

The maximum RF output power is adjustable by an internal potentiometer. The analogue modulation voltage controls the output power from 0 to 100% of the adjusted maximum power.

Additional to the analogue modulation voltage a digital modulation control signal can switch on and off the RF power. An operation scheme below illustrates the interaction of the two modulation signals in detail。

Both the analogue and digital modulation are characterized by extraordinary on/off ratios of at least 65dB.

The driver can be operated with modulation frequencies (analogue and digital) up to 1/4 of the carrier frequency.

Optimum EMC shielding and mechanical protection is achieved by an aluminium casing and a conductive surface passivation.

The base plate serves for mounting as well as for heat dissipation. Also a compatible base plate style, which eases maintenance of facilities equipped with legacy drivers A33x or A34x, is available.

Key Features:

- Frequency range 80 to 350 MHz
- RF output power 5 Watt
- Optimized for grey-scale applications
- RF on/off ratio > 65 dB
- Constant output power design: maximum fluctuation ± 5% between cold and warm state
- Modulation frequency up to 50 MHz
- Conductive cooling through base plate
- Compact housing, fully shielded (EMC)

Applications:

- Fast modulation components for extra cavity applications, e. g. laser projection systems
- Frequency shifting

Technical Data

Supply voltage	+24 VDC
Supply current	typ. 1.5 A @ 5 W RF output power
Output impedance	nom. 50Ω
Maximum RF output power (adjustable) *	> 5 W (+37 dBm)
Analogue modulation	
Impedance	50 or 600Ω
Voltage range @ 50Ω	0 … +1 V or 0 … +5 V **
Voltage range @ 600Ω	0 … +5 V or 0 … +10 V **
RF ON / OFF ratio	> 65 dB
Digital modulation	
Impedance	4k7 or 50 _ (pull-up or pull-down) **
Level	High = ≥ 3V … 5V Low = 0 … < 2V

Logic styles	Input signal:	High	Low	not connected
positive logic, pull-up	RF power:	on	off	on
positive logic, pull-down		on	off	off
negative logic, pull-up		off	on	off
negative logic, pull-down		off	on	on

RF ON / OFF ratio	> 100 dB
* into 50Ω load	** other combinations on request

Technical Data, Frequency-Dependent

RF output frequency [MHz]	80	100	110	150	200	250	300	350
Frequency accuracy [ppm]					< ±30			
Harmonics distortion * [dBc]					< -26			
Analogue modulation RF rise time / fall time (10 … 90%) *					< 8 ns			
Digital modulation RF rise time / fall time (10 … 90%) *					< 8 ns			

* into 50Ω load

Connectors, Dimensions, Weight, Cooling

RF output connector	SMA female
Control input connector	D-Sub 7W2
Pins 1 and 2, inside linked	GND (case)
Pins 3 and 5, inside linked	+Us (24 VDC)
Pin 4	not connected
Pin A1 (coaxial)	Analogue modulation
Pin A2 (coaxial)	Digital modulation
Dimensions	
Casing	120 mm x 50 mm x 35 mm **
Mounting plate, standard case	120 mm x 70 mm x 3 mm **
	** length x width x height
Weight	
Standard case	340 grams
Compatible case	370 grams
Cooling	Conduction, the base plate must be attached to a suitable heat sink.

Environmental Conditions

Warm up time	10 minutes for optimum stability
Base plate temperature	+10°C … +40°C For optimum output power stability constant base plate temperature should be provided.
Storage temperature	-20°C … +70°C, non condensing

Absolute Maximum Ratings

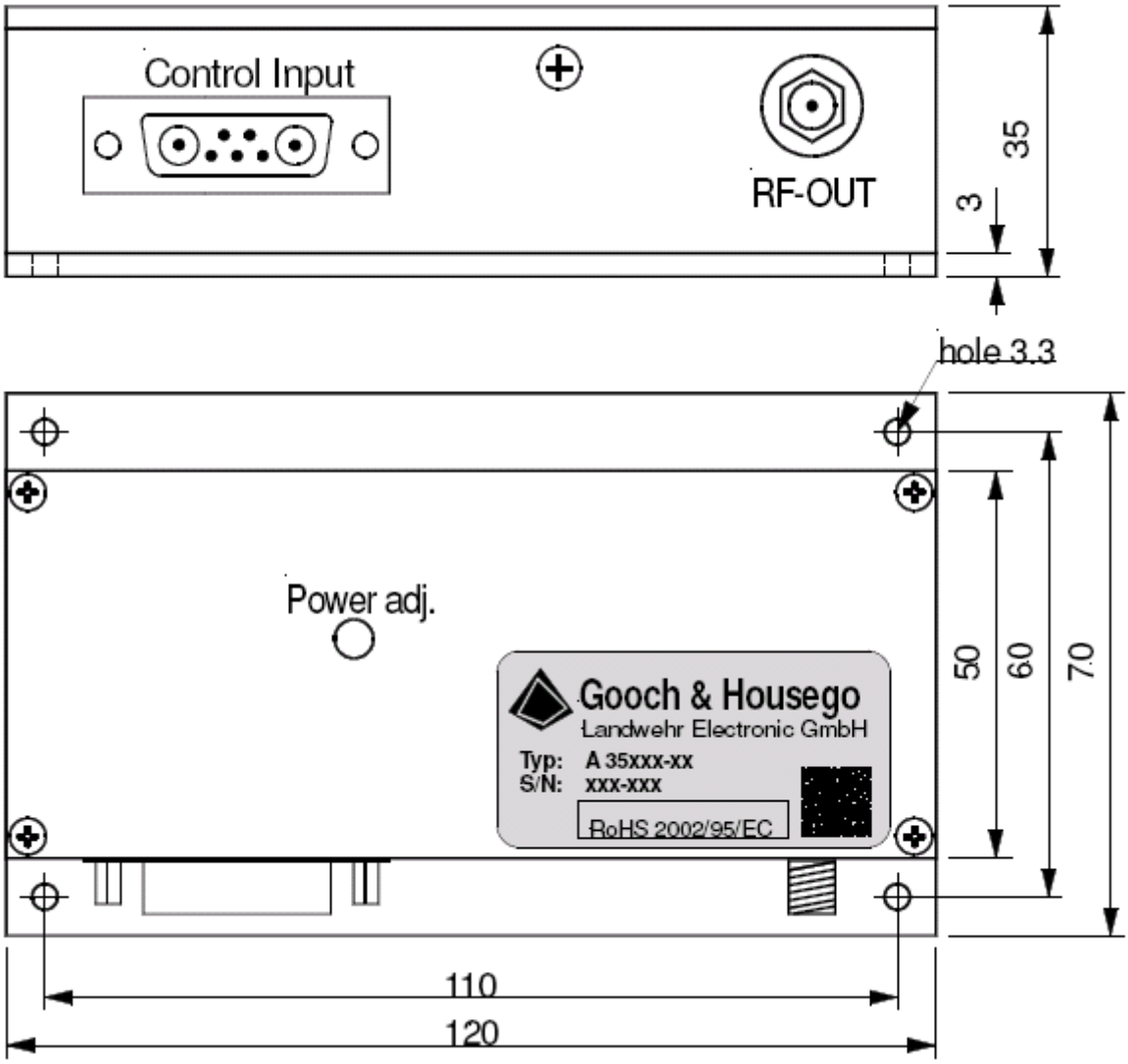
Supply voltage max.	+26 VDC
Analogue modulation	
Voltage range @ 0 … +1 V	-0.5 V … +1.1 V
Voltage range @ 0 … +5 V	-0.5 V … +5.5 V
Voltage range @ 0 … +10 V	-0.5 V … +11.0 V
Digital modulation	
Level	-0.5 V … +5.5 V
Maximum operating temperature	+50°C base plate temperature

Quality Standards

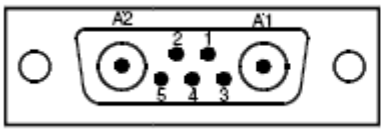
EU 2002/95/EC (RoHS)	compliant
EMC standards	VDE 0871-B
	FCC Rules Part 15-B
Thermal test	2h @ 70°C passive
Burn-in test	30 minutes @ maximum RF power output

Outline Drawings

Dimensions in mm
Standard casing

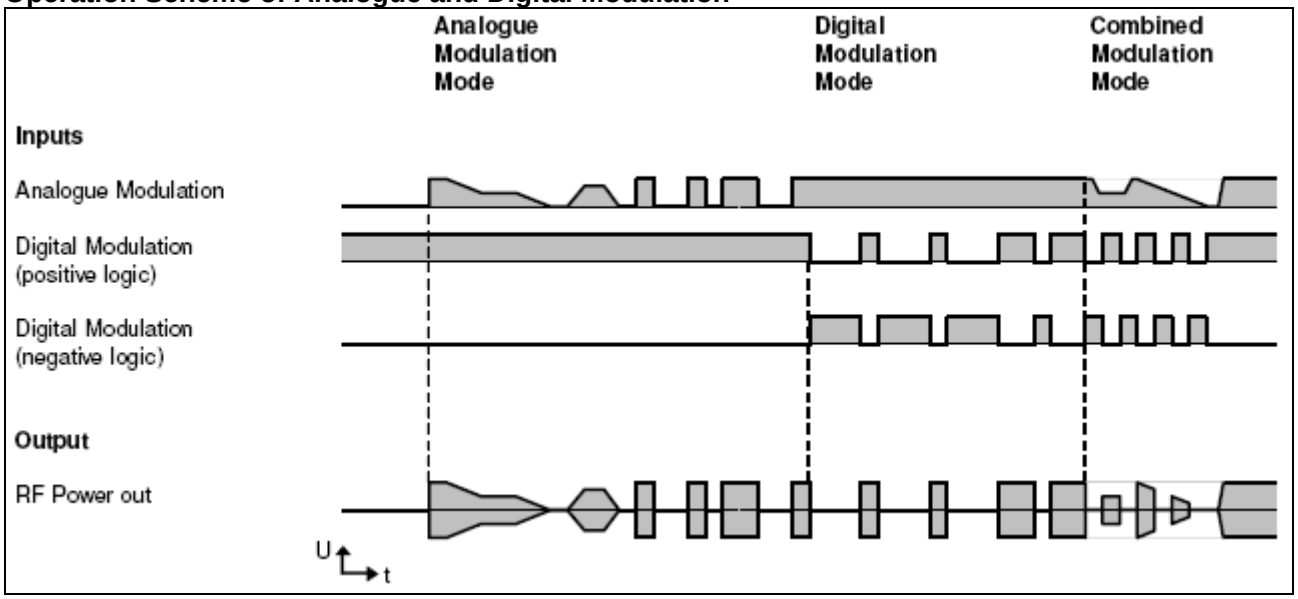


Control Input



1, 2	GND (case) inside linked	A1	Analogue modulation
3, 5	+Us (24VDC) inside linked	A2	Digital modulation
4	not connected		

Operation Scheme of Analogue and Digital Modulation



Variants List / Ordering Codes

A35 ☐ - ☐ - ☐ - ☐

Frequency [MHz]		Base Plate)[1]		Analogue Modulation Input)[2])[4]			Digital Modulation Input)[4]		
				Voltage Range	Impedance		Logic	Impedance)[3]
080	s	standard 120x70 mm	1/50	0...1V	50Ω	p4k7u	positive	4,7kΩ pull-up
100						p4k7d	positive	4,7kΩ pull-down
110			5/50	0...5V	50Ω	p50u	positive	50Ω pull-up
150						p50d	positive	50Ω pull-down
200	c	compatible 165x70	5/600	0…5V	600Ω	n4k7u	negative	4,7kΩ pull-up
250						n4k7d	negative	4,7kΩ pull-down
300			10/600	0…10V	600Ω	n50u	negative	50Ω pull-up
350						n50d	negative	50Ω pull-down

1 The base plate dimensions (size, holes) of the compatible style are equal with legacy drivers A33x and A34x.
2 The voltage range corresponds to 0 to 100% of the potentiometer pre-adjusted maximum RF output power.
3 A pull-up resistor provides HIGH level, a pull-down resistor LOW level in case of not connected input.
4 Further configurations on request.

AOM Driver A36-Series

The A36xxx RF driver series provides up to 2 Watt output power. Various types cover a frequency range from 80 to 350 MHz. The frequency is customizable.

The maximum RF output power is adjustable by an internal potentiometer. The analogue modulation voltage controls the output power from 0 to 100% of the adjusted maximum power.

Additional to the analogue modulation voltage a digital modulation control signal can switch on and off the RF power. An operation scheme below (page 6) illustrates the interaction of the two modulation signals in detail。

Both the analogue and digital modulation are characterized by extraordinary on/off ratios of at least 70 dB.

The driver can be operated with modulation frequencies (analogue and digital) up to 1/4 of the carrier frequency.

Optimum EMC shielding and mechanical protection is achieved by an aluminium casing and a conductive surface passivation. The base plate serves for mounting as well as for heat dissipation.

Key Features:
- Frequency range 80 to 350 MHz, customizable
- RF output power 2 Watt
- RF on/off ratio > 70 dB
- Constant output power design
- Models with a modulation frequency up to 50 MHz available
- Conductive cooling through base plate
- Compact casing, fully shielded (EMC)

Applications:
- Fast modulation components for extra cavity applications, e. g. laser projection systems
- Frequency shifting Compact casing, fully shielded (EMC)

Technical Data

Supply voltage	+24 VDC
Supply current	typ. 1.1 A @ 2 W RF output power
Output impedance	nom. 50Ω
Maximum RF output power (adjustable) *	> 2 W (+33 dBm)
Analogue modulation	
Impedance	50 or 600Ω
Voltage range @ 50Ω	0 … +1 V or 0 … +5 V **
Voltage range @ 600Ω	0 … +5 V or 0 … +10 V **
RF ON / OFF ratio	> 70 dB
Digital modulation	
Impedance	4k7 or 50 _ (pull-up or pull-down) **
Level	High = ≥ 3V … 5V Low = 0 … < 2V

Logic styles	Input signal:	High	Low	not connected
positive logic, pull-up	RF power:	on	off	on
positive logic, pull-down		on	off	off
negative logic, pull-up		off	on	off
negative logic, pull-down		off	on	on

RF ON / OFF ratio	> 100 dB
* into 50Ω load	** other combinations on request

Technical Data, Frequency-Dependent

RF output frequency [MHz]	80	100	110	150	200	250	300	350
Frequency accuracy [ppm]			< ±30		< ±30			
Harmonics distortion * [dBc]			< -26		< -26			
Analogue modulation RF rise time			< 8 ns		< 8 ns			

/ fall time (10 … 90%) *		
Digital modulation RF rise time / fall time (10 … 90%) *	< 8 ns	< 8 ns

* into 50Ω load

Connectors, Dimensions, Weight, Cooling

RF output connector	SMA female
Control input connector	D-Sub 7W2
Pins 1 and 2, inside linked	GND (case)
Pins 3 and 5, inside linked	+Us (24 VDC)
Pin 4	not connected
Pin A1 (coaxial)	Analogue modulation
Pin A2 (coaxial)	Digital modulation
Dimensions	
Casing	120 mm x 50 mm x 35 mm **
Mounting plate, standard case	120 mm x 70 mm x 3 mm **
	** length x width x height
Weight	
Standard case	300 grams
Cooling	Conduction, the base plate must be attached to a suitable heat sink.

Environmental Conditions

Warm up time	10 minutes for optimum stability
Base plate temperature	+10°C … +40°C For optimum output power stability constant base plate temperature should be provided.
Storage temperature	-20°C … +70°C, non condensing

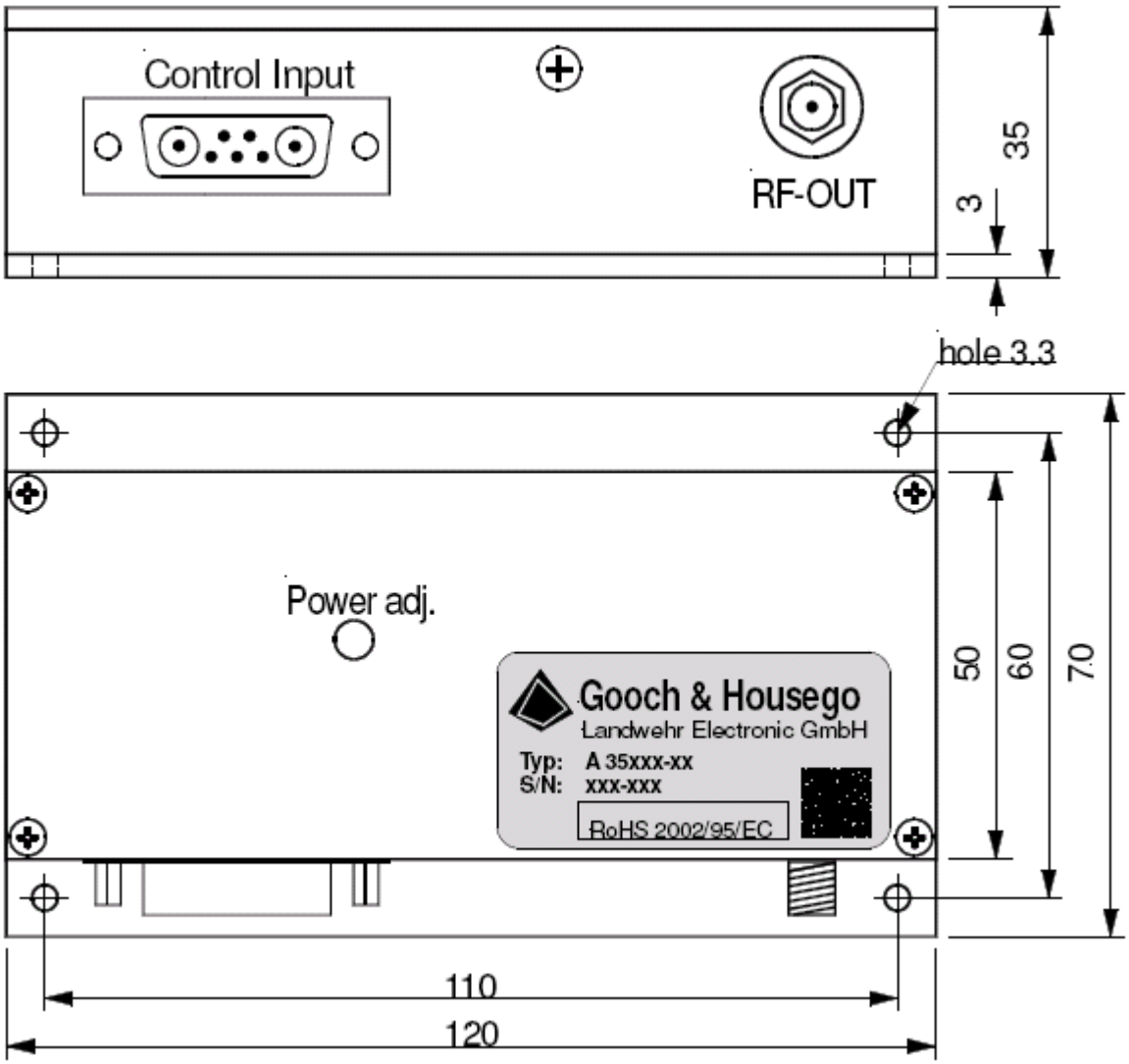
Absolute Maximum Ratings

Supply voltage max.	+26 VDC
Analogue modulation	
Voltage range @ 0 … +1 V	-0.5 V … +1.1 V
Voltage range @ 0 … +5 V	-0.5 V … +5.5 V
Voltage range @ 0 … +10 V	-0.5 V … +11.0 V
Digital modulation	
Level	-0.5 V … +5.5 V
Maximum operating temperature	+50°C base plate temperature

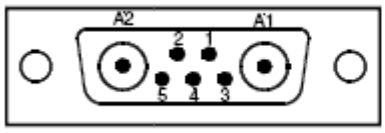
Quality Standards

EU 2002/95/EC (RoHS)	compliant
EMC standards	VDE 0871-B
	FCC Rules Part 15-B
Thermal test	2h @ 70°C passive
Burn-in test	30 minutes @ maximum RF power output

Outline Drawings
Dimensions in mm
Standard casing

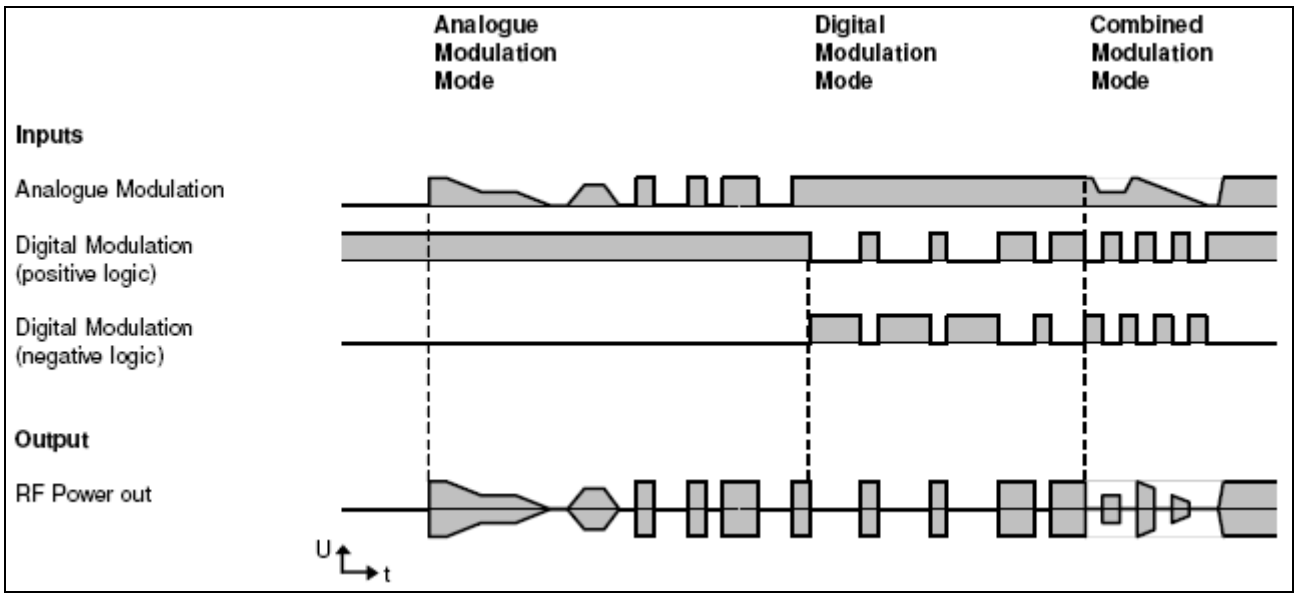


Control Input



1, 2	GND (case) inside linked	A1	Analogue modulation
3, 5	+Us (24VDC) inside linked	A2	Digital modulation
4	not connected		

Operation Scheme of Analogue and Digital Modulation



Variants List / Ordering Codes

A36 ☐ - ☐ - ☐

Frequency [MHz]		Analogue Modulation Input)[1])[3]			Digital Modulation Input)[3]	
		Voltage Range	Impedance		Logic	Impedance)[2]
080	1/50	0...1V	50Ω	p4k7u	positive	4,7kΩ pull-up
100				p4k7d	positive	4,7kΩ pull-down
110	5/50	0...5V	50Ω	p50u	positive	50Ω pull-up
150				p50d	positive	50Ω pull-down
200	5/600	0…5V	600Ω	n4k7u	negative	4,7kΩ pull-up
250				n4k7d	negative	4,7kΩ pull-down
300	10/600	0…10V	600Ω	n50u	negative	50Ω pull-up
350				n50d	negative	50Ω pull-down

Remarks
1 The voltage range corresponds to 0 to 100% of the potentiometer pre-adjusted maximum RF output power.
2 A pull-up resistor provides HIGH level, a pull-down resistor LOW level in case of not connected input.
3 Further configurations on request.

More AOMs

Model	**12038-3-TE**	**12038-3-BR-TE**
Interactive Material	SiO2	SiO2
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	1.06 µm	Used for Various λ (Specifications shown for 1.06 µm
Window Configuration	AR "V" Coated	Brewster
Static Transmission	>99 %	>99 %
Operating Frequency	38 MHz + 150 KHz	38 MHz + 182 KHz
Mode spacing	300 KHz Typical	364 KHz Typical
Mode Bandwidth -3dB	10 KHz approximate	10 KHz approximate
Average Loss Modulation	15 % minimum with Linear Polarized Light, Perpendicular to Acoustic Propagation	10 % minimum with Linear Polarization Light, Perpendicular to Acoustic Propagation
Acoustic Aperture Size (in air)	3 mm	2 mm
Deflection Angle	6.75 mrad	6.75 mrad @ 1.06 µm
RF Power Level	<1.2 watt	<1 watt
Impedance	50 ohms @ Resonant Frequency	50 ohms @ Resonant Frequency
VSWR	<1.5:1 @ Resonant Frequency	<1.5:1 @ Resonant Frequency
Package:	53A2198	53A3890
Recommended Driver:	11038-1ML	11038-1ML

Model	**12041-3-BR-TE**	**12041-3-TE**
Interactive Material	SiO2	SiO2
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	Used for Various λ Specification shown for 1.06 µm	1.06 µm
Window Configuration	Brewster	AR "V" Coated
Static Transmission	>99 %	>99%
Operating Frequency	41 MHz + 182 KHz	41 MHz + 150 KHz
Mode spacing	364 KHz Typical	300 KHz Typical
Mode Bandwidth -3dB		10 KHz approximate
Average Loss Modulation	10 % minimum with Linear Polarized Light, Perpendicular to Acoustic Propagation	15 % minimum with Linear Polarized Light, Perpendicular to Acoustic Propagation
Acoustic Aperture Size (in air)	2 mm	3 mm
Deflection Angle	7.3 mrad @ 1.06 µm	7.3 mrad
RF Power Level	<1 watt	<1.2 watt
Impedance	50 ohms @ Resonant Frequency	50 ohms @ Resonant Frequency
VSWR	<1.5:1 @ Resonant Frequency	<1.5:1 @ Resonant Frequency
Package:	53A3890	53A2198
Recommended Driver:	11041-1ML	11041-1ML

Model	**12050-3-BR-TE**	**12050-3-TE**
Interactive Material	SiO2	SiO2
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	Used for Various λ Specifications shown for 1.06 µm	1.06 µm
Window Configuration	Brewster	AR "V" Coated
Static Transmission	>99 %	>99%
Operating Frequency	50 MHz + 182 KHz	50 MHz + 150 KHz
Mode spacing	364 KHz Typical	300 KHz Typical
Mode Bandwidth -3dB	10 KHz approximate	10 KHz approximate
Average Loss Modulation	6.5 % minimum with Linear Polarized Light, Perpendicular to Acoustic Propagation	10 % minimum with Linear Polarized Light, Perpendicular to Acoustic Propagation
Acoustic Aperture Size (in air)	2 mm	3 mm
Deflection Angle	8.9 mrad @ 1.06 µm	8.9 mrad
RF Power Level	<1 watt	<1.2 watt
Impedance	50 ohms @ Resonant Frequency	50 ohms @ Resonant Frequency
VSWR	<1.5:1 @ Resonant Frequency	<1.5:1 @ Resonant Frequency
Package:	53A3890	53A2198
Recommended Driver:	11050-1ML	11050-1ML

Model	**12080-3-BR-TE**	**12080-3-TE**
Interactive Material	SiO2	SiO2
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	Used for Various λ Specifications shown for 1.06 µm	1.06 µm
Window Configuration	Brewster	AR "V" Coated
Static Transmission	>99 %	>99 %
Operating Frequency	80 MHz + 182 KHz	80 MHz + 150 KHz
Mode spacing	364 KHz Typical	300 KHz Typical
Mode Bandwidth -3dB	10 KHz approximate	10 KHz approximate
Average Loss Modulation	6.5 % minimum with Linear Polarized Light, Perpendicular to Acoustic Propagation	10 % minimum with Linear Polarized Light, Perpendicular to Acoustic Propagation
Acoustic Aperture Size (in air)	2 mm	3 mm
Deflection Angle	14.2 mrad @ 1.06 µm	14.2 mrad
RF Power Level	<1 watt	<1.2 watt
Impedance	50 ohms @ Resonant Frequency	50 ohms @ Resonant Frequency
VSWR	<1.5:1 @ Resonant Frequency	<1.5:1 @ Resonant Frequency
Package:	53A3890	53A2198
Recommended Driver:	11080-1ML	11080-1ML

Model	**13389-BR**	**15180-1.06-LTD-GAP**
Interactive Material	SiO2	GaP
Acoustic Mode	longitudinal	Longitudinal
Operating Wavelength	Used for Various λ Specifications shown for 633 nm	1.06 µm
Window Configuration	Brewster, λ/10 over acoustic aperture	AR “V” coated
Static Transmission	>99 %	>90%
Operating Frequency	389 MHz	180 MHz
Diffraction Efficiency	>5.5 % @ 500 mW	>70%
Light Polarization	Linear, Perpendicular to Acoustic Propagation	Linear, horizontal
Acoustic Aperture Size	60 µm in air	300 µm
Rise Time	<6 ns	10 nsec*
Optical Waist Size to achieve Rise Time	44 µm	100 microns
Deflection Angle	41 mrad @ 633 nm	28.7 mrads
RF Power Level Average	500 mW	1.7 Watts
RF Power Level Peak	10 Watts peak, 5 % duty cycle with 10 ns pulse	
Impedance	50 Ohms	50 Ohms nominal
VSWR	<1.5:1 @ 389MHz, <6:1 @ 299, 479 MHz	<1.5:1 at 180 MHz
Package:	53A5314	53B0624
Recommended Drivers:	64389-SYN-9.5-X	

Model	**15200-.2-1.55-LTD-GaP-FO**
Interaction Material	GaP
Acoustic Mode	Longitudinal
Operating Wavelength	1.55 µm
Operating Frequency	200 MHz
Thruput Loss	< 3.5 db**
Contrast Ratio	35 db min
Light Polarization	Linear
Rise/fall Time	10 ns*
RF Power Level	< 2 watts
Impedance	50 Ohms nominal
VSWR	<1.5:1 @ 200 MHz
Package	53B3659
Fiber Type	8/125, polarization maintaining fiber, 1 meter long
Fiber connector type	FC/PC, FC/APC or other optional connector
Recommended Drivers:	Analog Driver Module: 21200-2AM Analog Driver System: 21200-2AS Digital Driver Module: 21200-2DM Digital Driver System: 21200-2DS

Model	**15210**	**15210-FOA / 71002**	**15210-FOA**
Interactive Material	TeO2	TeO2	TeO2
Acoustic Mode	Longitudinal	Longitudinal	Longitudinal
Operating Wavelength	440 – 850 nm	440 – 850 nm	440 – 850 nm
Window Configuration	AR Coated	AR Coated	AR Coated
Static Transmission	> 95 %	>95 %	>95 %
Operating Frequency	210 MHz	210 MHz	210 MHz
Diffraction Efficiency	> 70 % @ 633 nm with Linear, Polarization Perpendicular to Acoustic Propagation or with Random Polarization	>70 % @ 633 nm with Linear, Polarization Perpendicular to Acoustic Propagation or with Random Polarization	>70 % @ 633 nm with Linear, Polarization Perpendicular to Acoustic Propagation or with Random Polarization
Acoustic Aperture Size	0.2 mm	0.2 mm	0.2 mm
Rise Time	< 10 nsec	<10 nsec	< 10 nsec
Optical Waist Size to achieve Rise Time	55 µm	55 _m	55 _m
Deflection Angle	31 mrad @ 633 nm	31 mrad @ 633 nm	31 mrad @ 633 nm
RF Power Level	< 1 Watt	< 1 Watt	< 1 Watt
Impedance	50 Ohms nominal	50 Ohms nominal	50 Ohms nominal
VSWR	< 1.5:1 @ 210 MHz	< 1.5:1 @ 210 MHz	<1.5:1 @ 210 MHz
Package:	53B0504	53D00314	53B0957
Recommended Drivers:	Analog Driver System: 21210-1AS Analog Driver Module: 21210-1AM Digital Driver System: 21210-1DS Digital Driver Module: 21210-1DM		

Model	**15260**	**15260-FOA/71002**	**15260-FOA**
Interactive Material	TeO2	TeO2	TeO2
Acoustic Mode	Longitudinal	Longitudinal	Longitudinal
Operating Wavelength	440 – 850 nm	440 – 850 nm	440 – 850 nm
Window Configuration	AR Coated	AR Coated	AR Coated
Static Transmission	>95 %	>95 %	>95 %
Operating Frequency	260 MHz	260 MHz	260 MHz
Diffraction Efficiency	>70 % @ 633nm with Linear, Polarization Perpendicular to Acoustic Propagation or with Random Polarization	>70 % @ 633 nm with Linear, Polarization Perpendicular to Acoustic Propagation or with Random Polarization	>70 % @ 633 nm with Linear, Polarization Perpendicular to Acoustic Propagation or with Random Polarization
Acoustic Aperture Size	0.2 mm	0.2 mm	0.2 mm
Rise Time	<10 ns	<10 nsec	<10 nsec
Optical Waist Size to achieve Rise Time	55 um	0.055 mm	55 um
Deflection Angle	39 mrad @ 633nm	39 mrad @ 633 nm	39 mrad @ 633 nm
RF Power Level	700 mW	< 1 Watt	< 1 Watt
Impedance	50 Ohms nominal	50 Ohms nominal	50 Ohms nominal
VSWR	1.5:1 @ 260MHz	1.5:1 @ 260 MHz	1.5:1 @ 260 MHz
Package:	53B0504	53D0314	
FOA Modulator Package:		53B0957	53B0957
Recommended Drivers:	21260-.7AS 21260-.7AM 21260-.7DS 21260-.7DM	Analog Driver System: 21260-1AS Analog Driver Module: 21260-1AM Digital Driver System: 21260-1DS Digital Driver Module: 21260-1DM	

Model	**17389-1.06-LTD-GaP**	**17389-.93**	**17389-.93-FOA**
Interaction Material	GaP	TeO2	TeO2
Acoustic Mode	Longitudinal	Longitudinal	Longitudinal
Operating Wavelength	1.06 µm	700 –1064 nm	700 –1064 nm
Window Configuration	AR "V" coating	AR Coated	AR Coated
Static Transmission	>90%	>95 %	>95%
Operating Frequency	389 MHz	389 MHz	389 MHz
Diffraction Efficiency	56% minimum with linear polarized light parallel to acoustic propagation	>70 % @ 800 nm with Linear, Polarization Perpendicular to Acoustic Propagation. >60 % @ 800 nm with Random Polarization.	>70% @ 800 nm with Linear, Polarization Perpendicular to Acoustic Propagation >60% @ 800 nm with Random Polarization
Acoustic Aperture Size (in air)	150 µm	70 um	70 um
Rise Time	4 nsec minimum	<7 nsec	<7 nsec
Extinction Ratio *	>20dB for neighboring pulses, >27dB for subsequent pulses @ <80MHz pulse rep rate	>20dB for neighboring pulses, >27dB for subsequent pulses @ <80MHz pulse rep rate	>20dB for neighboring pulses, >27dB for subsequent pulses @ <80MHz pulse rep rate
Optical Waist Size To Achieve Rise Time	40 µm	35 um	35um
Deflection Angle	62 mrad	73 mrad @ 800 nm	73mrad @ 800nm
RF Power Level	2.5 watts peak, <1 watt aver.	< 700 mW Average/ 5 Watts Peak 10 % max duty cycle with 10 nsec pulse.	< 700 mW Average/ 5 Watts Peak 10% max duty cycle with 10nsec pulse.
Impedance	50 Ohms nominal	50 Ohms nominal	50 Ohms nominal
VSWR	<1.5:1 @ 389 MHz	<1.5:1 @ 389 MHz	< 1.5:1 @ 389 MHz
Package	53B00624TO1	53B0504	53B0499
Recommended Drivers:	Non - Synchronous Driver: 11389-5AM Synchronous Driver: 64389.5-SYN-9.5-X		

Model	**35085-0.5-350**	**35085-3-350**
Interactive Material	Fused Silica	Fused Silica
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	300 to 400 nm	300 to 400 nm
Window Configuration	AR Coated	AR Coated
Static Transmission	>99 %	>99 %
Operating Frequency	85 MHz	85 MHz
Diffraction Efficiency	>85 %	85 % @ 350 nm
Light Polarization	Linear, Perpendicular to acoustic propagation	Linear, Perpendicular to Acoustic Propagation
Acoustic Aperture	0.5 mm	3 mm
Rise Time	110 nsec/mm beam diameter	110 ns / mm Beam Diameter
Deflection Angle	5 mrad @ 350 nm	5 mrad @ 350 nm
RF Power Level	< 6 Watts	3 Watts
Impedance	50 Ohms	50 Ohms
VSWR	<1.2:1 @ 85 MHz	<1.2:1 @ 85 MHz
Package:	53B1428	53B1428
Recommended Drivers:	Analog System Driver: 31085-6AS	Analog Driver System: 31085-6AS
	Analog Module Driver: 31085-6AM	Analog Driver Module: 31085-6AM
	Digital System Driver: 31085-6DS	Digital Driver System: 31085-6DS
	Digital Module Driver: 31085-6DM	Digital Driver Module: 31085-6DM

Model	**35085-0.5**	**35085-3**
Interactive Material	Fused Silica	Fused Silica
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	400 to 540 nm	400 to 540 nm
Window Configuration	AR Coated	AR Coated
Static Transmission	>99 %	>98 % @ 488 nm
Operating Frequency	85 MHz	85 MHz
Diffraction Efficiency	>85 % With Linear Polarized Light, Perpendicular to acoustic propagation	>85 % @ 488 nm With Light Polarized Linear, Perpendicular to Acoustic Propagation.
Acoustic Aperture Size	0.5 mm	3 mm
Rise Time	110 nsec/mm beam diameter	110 ns / mm Beam Diameter
Deflection Angle	5 mrad @ 514 nm	6.9 mrad @ 488 nm
RF Power Level	< 6 Watts	< 6 Watts @ 488 nm
Impedance	50 Ohms	50 Ohms
VSWR	<1.2:1 @ 85 MHz	<1.2:1 @ 85 MHz
Package:	53B1428	53B1428
Recommended Drivers:	Analog System Driver: 31085-6AS	Analog Driver System: 31085-6AS
	Analog Module Driver: 31085-6AM	Analog Driver Module: 31085-6AM
	Digital System Driver: 31085-6DS	Digital Driver System: 31085-6DS
	Digital Module Driver: 31085-6DM	Digital Driver Module: 31085-6DM

Model	**35210-BR / 71004**	**35210-BR**
Interactive Material	Fused Silica	Fused Silica
Acoustic Mode	Longitudinal	ongitudinal
Operating Wavelength	300 to 700 nm	300 to 700 nm
Window Configuration	Brewster	Brewster
Static Transmission	>99 % @ 488 nm	98 % @ 488 nm
Operating Frequency	210 MHz	210 MHz
Diffraction Efficiency	>70 % @ 488 nm	>70 % @ 488 nm
Light Polarization	Linear, Perpendicular to acoustic propagation	Linear, Perpendicular to acoustic propagation
Acoustic Aperture Size (in air)	0.13 mm	0.13 mm
Rise Time	<15 ns	<15 ns
Optical Waist Size to achieve Rise Time	0.1 mm	0.1 mm
Deflection Angle	17 mrad @488 nm	17 mrad @ 488 nm
RF Power Level	6 Watts	6 Watts
Impedance	50 Ohms	50 Ohms
VSWR	<1.5:1 @ 210 MHz	<1.5:1 @ 210 MHz
Package Assembly: Mount, Optics and Modulator:	53D0307	
Package:	53B3408	53B3408
Recommended Driver:	Analog System Driver: 31210-6AS Analog Module Driver: 31210-6AM Digital System Driver: 31210-6DS Digital Module Driver: 31210-6DM	

Model	**35110-2-244**	**35250-.2-.53-XQ**
Interactive Material	KrF Grade Fused Silica	Crystal Quartz
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	244 nm	532 nm
Window Configuration	AR Coated	AR Coated
Static Transmission	>97 %	>99 %
Operating Frequency	110 MHz	250 MHz
Diffraction Efficiency	70 % With Linear Polarized Light Perpendicular to Acoustic Propagation	>70 %
Light Polarization		Linear, Perpendicular
Acoustic Aperture Size	2 mm	0.2 mm
Rise Time	110 ns / mm beam diameter	10 ns
Optical Waist Size to achieve		0.09 mm

Rise Time		
Deflection Angle	4.5 mrad	23 mrad
RF Power Level	<2 Watts	6 Watts
Impedance	50 Ohms	50 Ohms
VSWR	<1.2:1 @ 110 MHz	<1.5:1 - 170 to 330 MHz
Package:	53B2921	53B1354
Recommended Driver:	21110-2AS 21110-2AM 21110-2DS 21110-2DM	31250-6AS 31250-6AM 31250-6DS 31250-6DM