



# Sintec Optronics Pte Ltd

50 Bukit Batok Street 23 #07-15 Singapore 659578

Tel: +65 67781866 Fax: +65 65152908

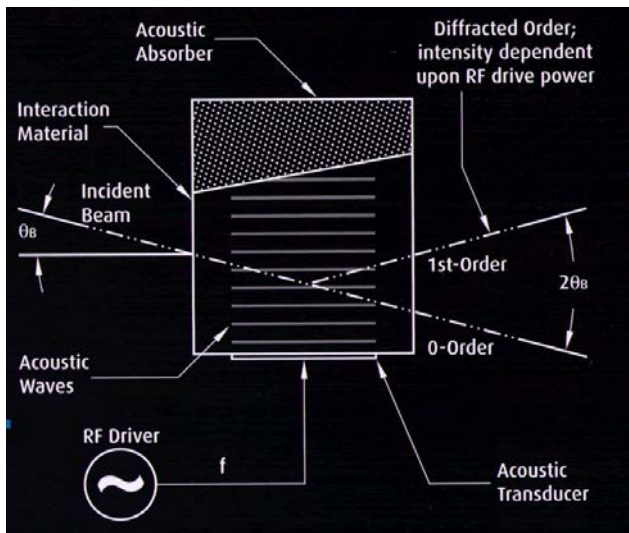
## Acousto-Optic Modulators

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.

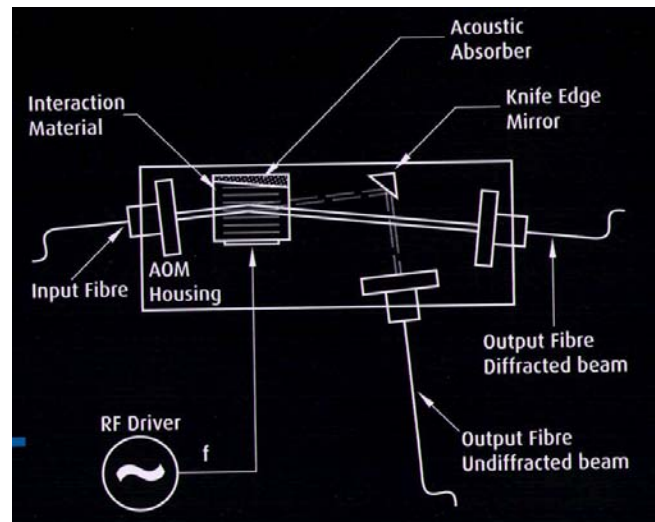
In an AOM a laser beam is caused to interact with a high frequency ultrasonic sound wave inside an optically polished block of crystal or glass (the interaction medium). By carefully orientating the laser with respect to the sound waves the beam can be made to reflect off the acoustic wavefronts (Bragg 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 than 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 analogue 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	SiO <sub>2</sub> , used for various wavelength, 38MHz, aperture 2mm, deflection 6.75mrad, RF 1W	11038-1ML
12038-3-TE	SiO <sub>2</sub> , 1064nm wavelength, 38MHz, aperture 3mm, deflection, 6.75mrad, RF 1W	11038-1ML
12041-3-BR-TE	SiO <sub>2</sub> , used for various wavelength, 41MHz, aperture 2mm, deflection 7.3mrad, RF 1W	11041-1ML
12041-3-TE	SiO <sub>2</sub> , 1064nm wavelength, 41MHz, aperture 3mm, deflection 7.3mrad, RF 1.2W	11041-1ML

12050-3-BR-TE	SiO <sub>2</sub> , used for various wavelength, 50MHz, aperture 2mm, deflection 8.9mrad, RF 1W	11050-1ML
12050-3-TE	SiO <sub>2</sub> , 1064nm wavelength, 50MHz, aperture 3mm, deflection 8.9mrad, RF 1.2W	11050-1ML
12080-3-BR-TE	SiO <sub>2</sub> , used for various wavelength, 80MHz, aperture 2mm, deflection 14.2mrad, RF 1W	11080-1ML
12080-3-TE	SiO <sub>2</sub> , 1064nm wavelength, 80MHz, aperture 3mm, deflection 14.2mrad, RF 1.2W	11080-1ML
13389-BR	SiO <sub>2</sub> , 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	TeO <sub>2</sub> , 440-850nm wavelength, 210MHz, aperture 0.2mm, deflection 31mrad, RF1W	21210-1xx
15210-FOA/71002	TeO <sub>2</sub> , 440-850nm wavelength, 210MHz, aperture 0.2mm, deflection 31mrad, RF1W	21210-1xx
15210-FOA	TeO <sub>2</sub> , 440-850nm wavelength, 210MHz, aperture 0.2mm, deflection 31mrad, RF1W	21210-1xx
15260	TeO <sub>2</sub> , 440-850nm wavelength, 260MHz, aperture 0.2mm, deflection 39mrad, RF0.7W	21260-.7xx
15260-FOA/71002	TeO <sub>2</sub> , 440-850nm wavelength, 260MHz, aperture 0.2mm, deflection 39mrad, RF1W	21260-1xx
15260-FOA	TeO <sub>2</sub> , 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	TeO <sub>2</sub> , 700-1064nm wavelength, 389MHz, aperture 70um, deflection 73mrad, RF 0.7W	11389-5AM, 64389.5-SYN-9.5-X
17389-.93-FOA	TeO <sub>2</sub> , 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, 1.55µm wavelength, linear polarisation, rise/fall time 10ns, 8/125 PM fiber, 200MHz, RF 2W	N21200-2xx
15200-.2-1.06-LTD-GaP-FO-GH	Gap, 1.06µm wavelength, linear polarisation, rise/fall time 10ns, 6/125 PM fiber, 200MHz, RF 2W	N21200-2xx
23080-1-1.3-LTD-FO	TeO <sub>2</sub> , 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	TeO <sub>2</sub> , 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	TeO <sub>2</sub> , 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	TeO <sub>2</sub> , 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	TeO <sub>2</sub> , 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		
<b>A36</b> __	2	✓	✓	✓	✓	✓	✓	✓	✓	TBD	A0__, A1__, A30__, A31__, A32__
<b>A35</b> __	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 10 $\mu$ s 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: TeO<sub>2</sub>

Wavelength: 1064nm

Anti-Reflection Coating: < 0.3% per surface

Polarisation Alignment:  $\pm 5^\circ$

Frequency: 80MHz

Input Impedance: 50 $\Omega$

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/cm<sup>2</sup> (Average)  
> 500MW/cm<sup>2</sup> (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

Diffacted 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

Diffacted 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/cm<sup>2</sup> Pulsed, >50KW/cm<sup>2</sup> 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 +60°C  
 Storage Temperature: - 15 to +65°C

*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

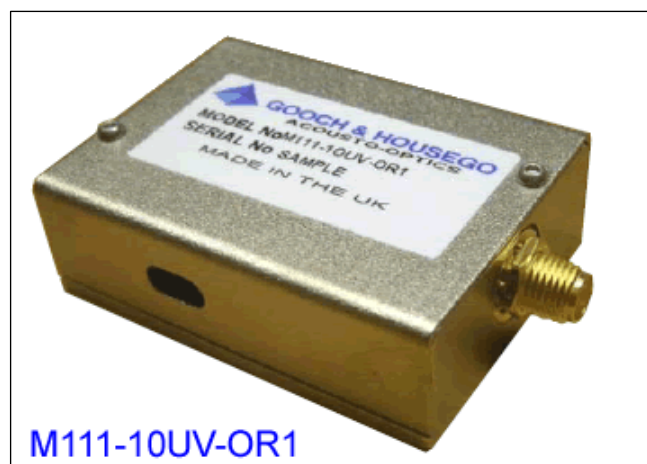
### 1.7 AO Modulator M111-10UV-OR1

- 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

<http://www.SintecOptronics.com> <http://www.SintecOptronics.com.sg>

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/cm<sup>2</sup> (Average)  
 > 500MW/cm<sup>2</sup> (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
Diffacted 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)

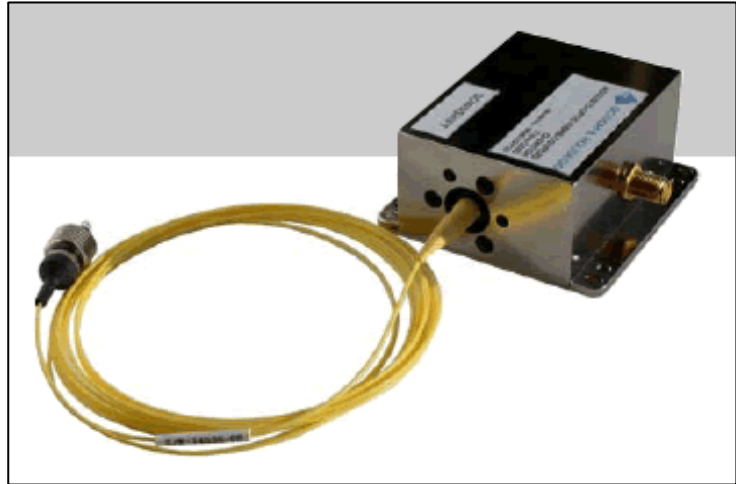
### 2.1. AO Modulator

#### 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

<http://www.SintecOptronics.com> <http://www.SintecOptronics.com.sg>

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 (50 $\Omega$ 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

- 1  $\mu$  m fibre-coupled
- 80MHz drive frequency
- < 2dB insertion loss



### Description

A fibre-coupled acousto-optic Q-Switch designed to be used with 1 $\mu$ m 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 (50 $\Omega$ 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  $\mu$  m 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 1 $\mu$ m 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 (50 $\Omega$ 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  $\mu$  m 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 1 $\mu$ m 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 (50 $\Omega$ 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

Output Frequency (**xxx**)

Spurious Levels

Harmonic Distortion

Digital Input

Extinction Ratio

RF Rise

PRF

Fall Time

PRF

RF Output Power (**y**)

Output Impedance

Supply Voltage

Supply Current

#### MAXIMUM RATINGS

Supply Voltage

Power Output

Case Temperature

#### CONNECTORS & MECHANICAL

RF Output Connector

Modulation Input Connector

Power Supply Connections

Physical Size

#### Specification

27 to 300 MHz + 0.01% Quartz Stabilized

-50 dBc Maximum

-15 dBc Maximum

TTL Levels (TTL HIGH = Full RF Power; TTL LOW = Minimum RF Power)

50 dB Minimum

20 ns Maximum

10 to 90 %

20 ns Maximum

90 to 10 %

0.4, 1 or 2 Watts Nominal, Adjustable. Factory Set for Optimum Performance When Paired with a NEOS AO Device.

50 Ohms Nominal

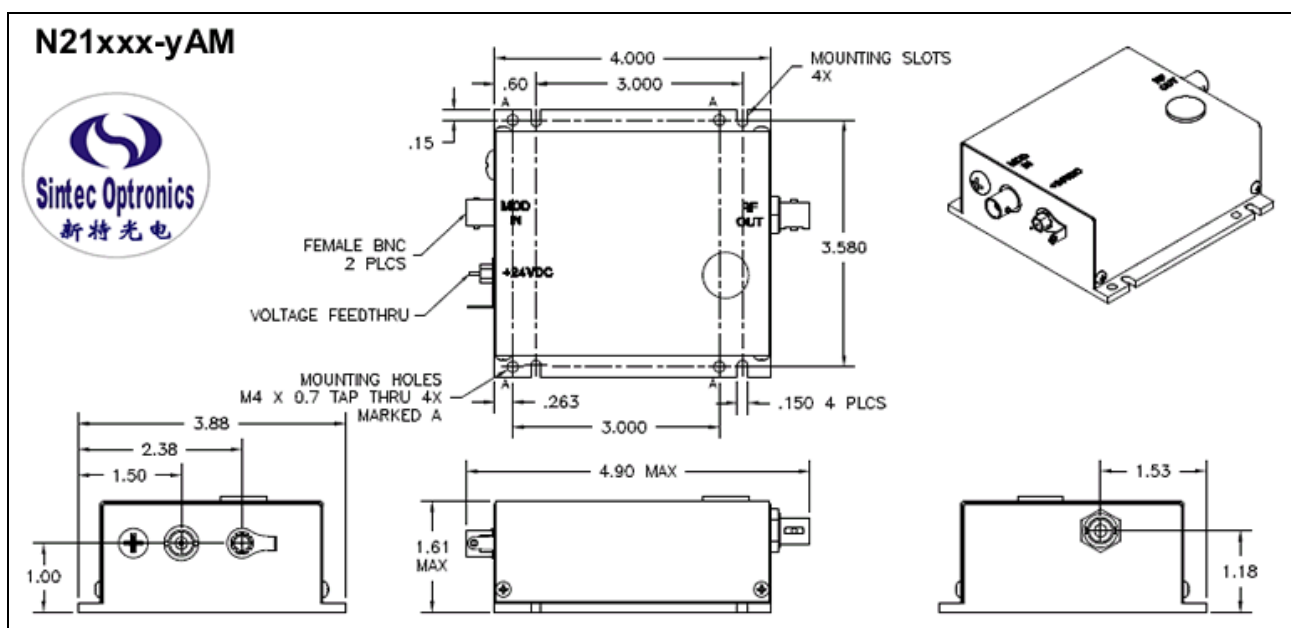
+ 24 VDC + 0.5 Volt

1 Amp Maximum

+ 28 Volts

No DC Feedback Allowed

+ 55°C. The Driver Must Be Attached to an Adequate Heatsink.



**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** = Analog Modulation

**M** = OEM Module

**PARAMETER**

Output Frequency (**xxx**)

Spurious Levels

Harmonic Distortion

Analog Input

Extinction Ratio

RF Rise

PRF

Fall Time

PRF

RF Output Power (**y**)

Output Impedance

Supply Voltage

Supply Current

**MAXIMUM RATINGS**

Supply Voltage

Power Output

Case Temperature

**CONNECTORS & MECHANICAL**

RF Output Connector

Modulation Input Connector

Power Supply Connections

Physical Size

**SPECIFICATION**

27 to 300 MHz + 0.01% Quartz Stabilized

-50 dBc Maximum

-15 dBc Maximum

+ 1 Volt into 50 Ohms (+ 1 Volt = Full RF Power; 0 Volt = Minimum RF Power)

50 dB Minimum

20 ns Maximum

10 to 90 %

20 ns Maximum

90 to 10 %

0.4, 1 or 2 Watts Nominal, Adjustable

50 Ohms Nominal

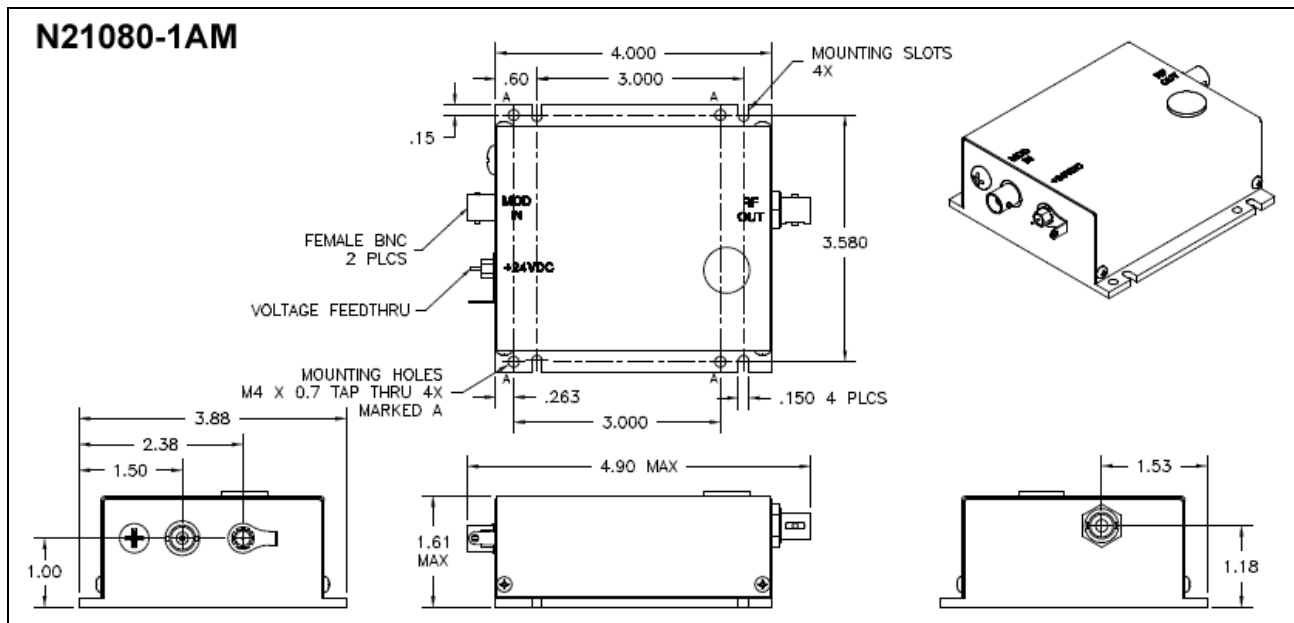
+ 24 VDC + 0.5 Volt

1 Amp Maximum

+ 28 Volts

No DC Feedback Allowed

+ 55°C. The Driver Must Be Attached to an Adequate Heatsink.



**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**

Output Frequency (**xxx**)

Spurious Levels

Harmonic Distortion

Analog Input

Digital Input

Extinction Ratio

RF Rise/ Fall Time

RF Output Power (**yy**)

Output Impedance

Supply Voltage

Supply Current

Air Flow Across heat sink

**MAXIMUM RATINGS**

Supply Voltage

Power Output

Case Temperature

**CONNECTORS & MECHANICAL**

RF Output Connector

Modulation Input Connector

Power Supply Connections

Physical Size

**SPECIFICATION**

24 MHz to 260 MHz  $\pm 0.01\%$  Quartz Stabilized

-40 dBc Maximum

-15 dBc Maximum

0-1 Volt into 50 Ohms (+ 1 Volt = Full RF Power; 0 Volt = Minimum RF Power)

TTL Levels (TTL HIGH = FULL RF Power; TTL LOW = Minimum RF Power)

40 dB Minimum

30ns maximum, 20 ns typical, 10ns > 210MHz ( $P_{RF}$ : 10 to 90%)

2 to 20 Watts Nominal. Maximum output power set by internal pot.

50 Ohms Nominal

+ 24 VDC + 0.5 Volt

3 Amp Maximum

18 CFM at 25 °C

+ 28 Volts

No DC Feedback Allowed

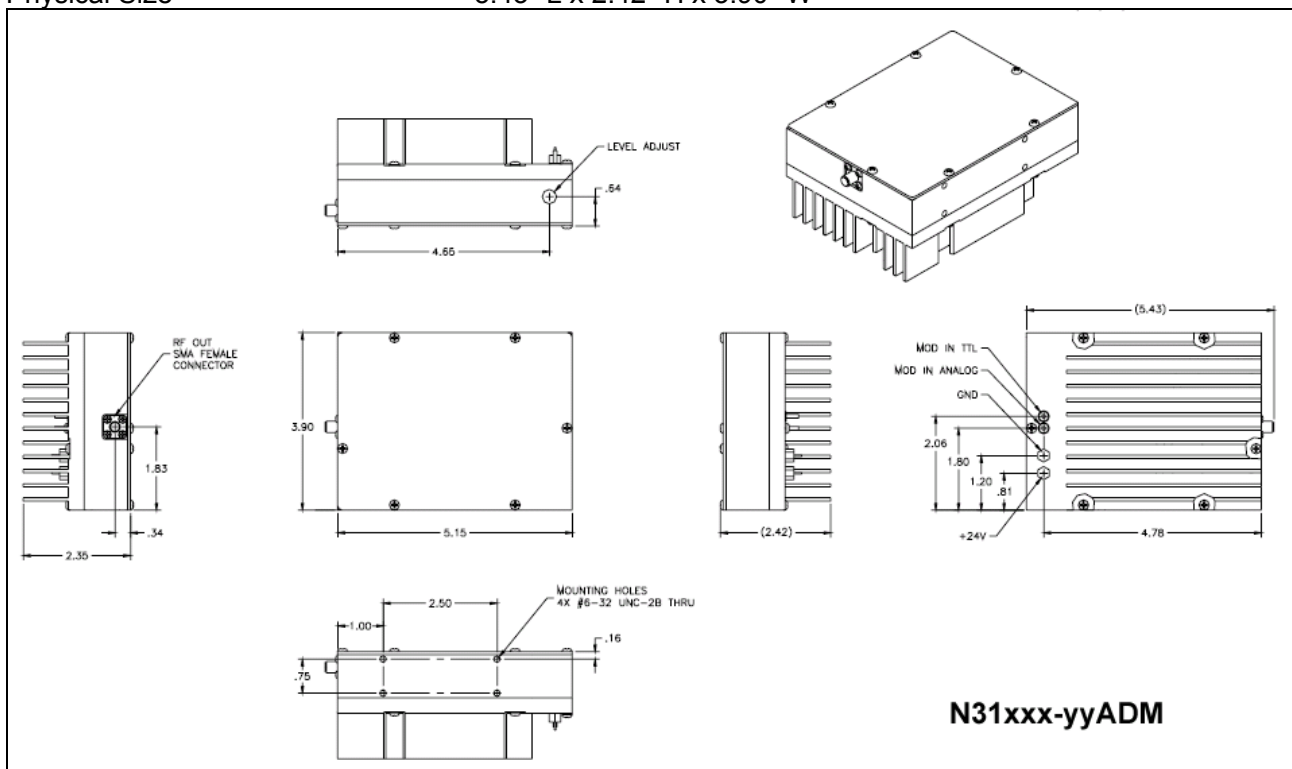
+ 55°C.

BNC Female

Feed Through Pin

Vcc: Vcc Feed Through Pin; Return: Feed Through Pin

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  $\pm 5\%$  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. 50 $\Omega$			
Maximum RF output power (adjustable) *	> 5 W (+37 dBm)			
<b>Analogue modulation</b>				
Impedance	50 or 600 $\Omega$			
Voltage range @ 50 $\Omega$	0 ... +1 V or 0 ... +5 V **			
Voltage range @ 600 $\Omega$	0 ... +5 V or 0 ... +10 V **			
RF ON / OFF ratio	> 65 dB			
<b>Digital modulation</b>				
Impedance	4k7 or 50 $\Omega$ (pull-up or pull-down) **			
Level	High = $\geq 3V$ ... 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 50 $\Omega$ 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**

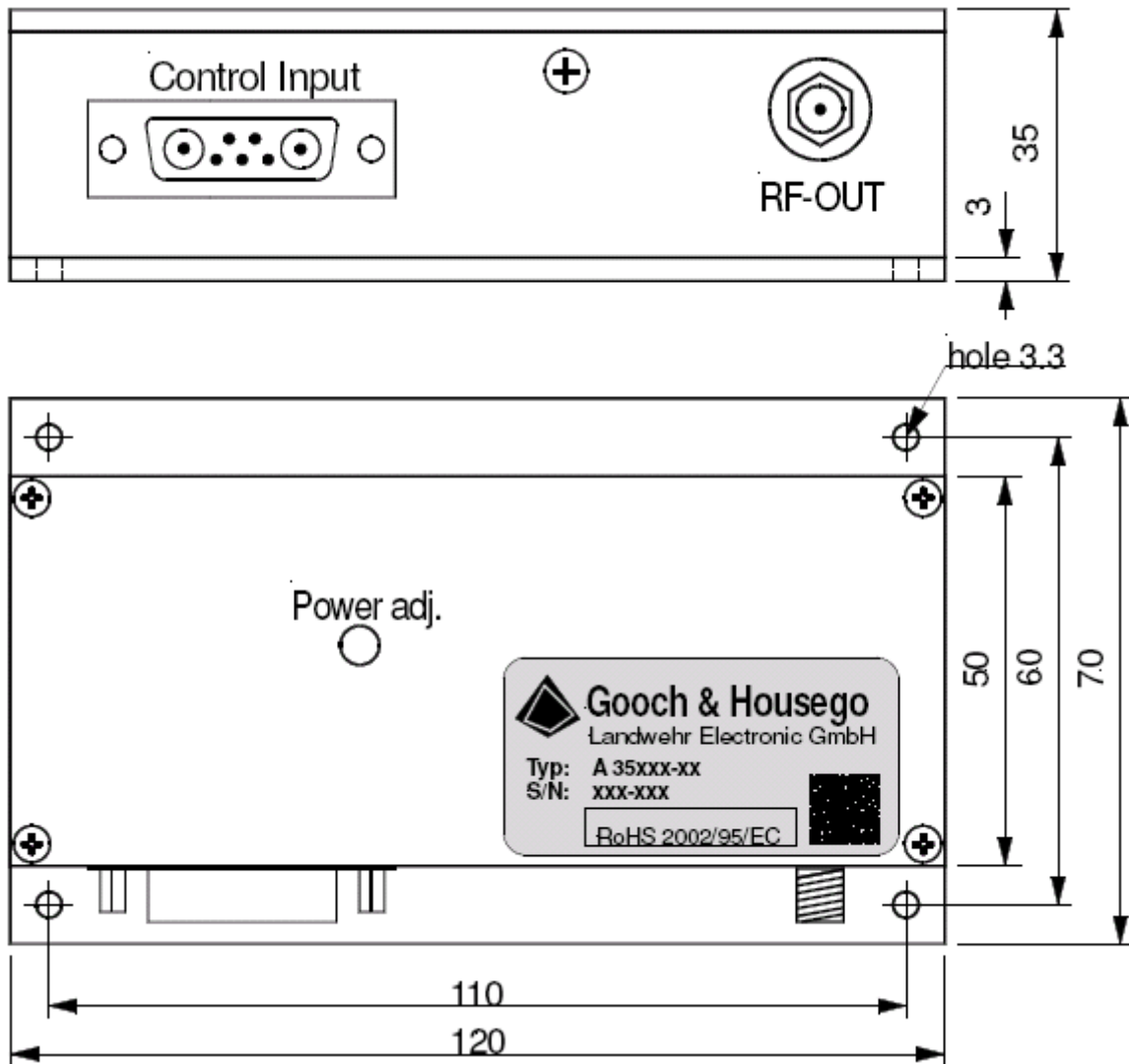
Level	-0.5 V ... +5.5 V
Maximum operating temperature	+50°C base plate temperature

**Quality Standards**

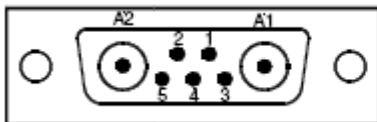
EU 2002/95/EC (RoHS)	compliant
EMC standards	VDE 0871-B FCC Rules Part 15-B
Thermal test	2h @ 70°C passive
Burn-in test	30 minutes @ maximum RF power output

**Outline Drawings**

Dimensions in mm  
Standard casing

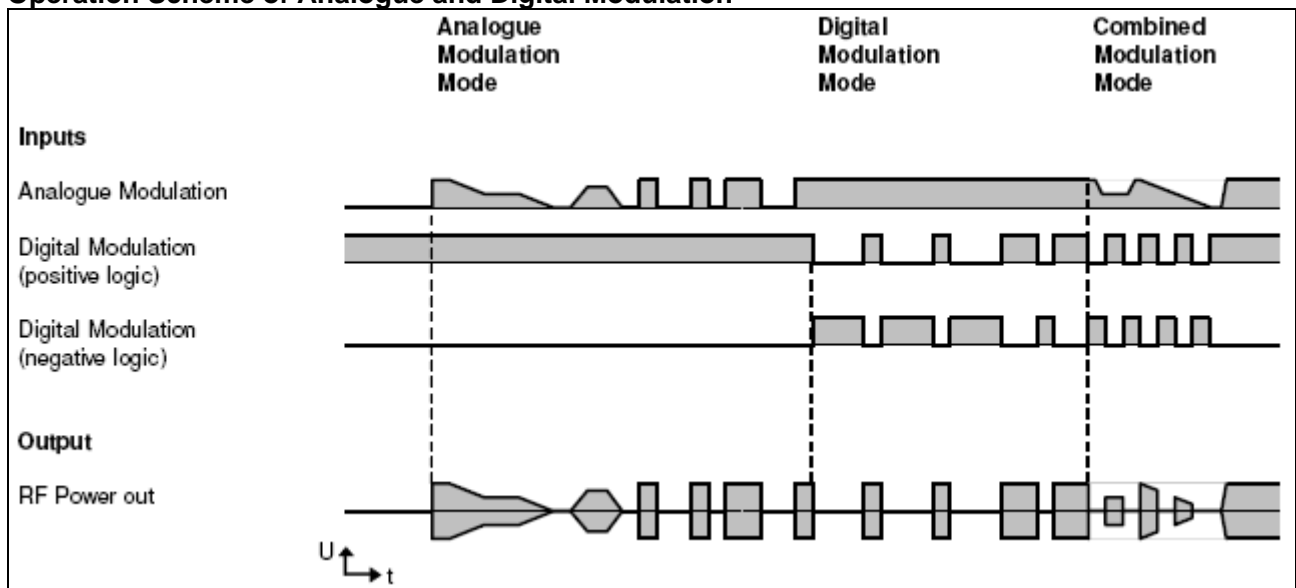


**Control Input**



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

**Operation Scheme of Analogue and Digital Modulation**



**Variants List / Ordering Codes**

**A35** [ ] - [ ] - [ ] - [ ]

Frequency [MHz]	Base Plate ) <sup>1</sup>	Analogue Modulation Input ) <sup>2</sup> ) <sup>4</sup>		Digital Modulation Input ) <sup>4</sup>		
		Voltage Range	Impedance	Logic	Impedance ) <sup>3</sup>	
080	s 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 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)			
<b>Analogue modulation</b>				
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			
<b>Digital modulation</b>				
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

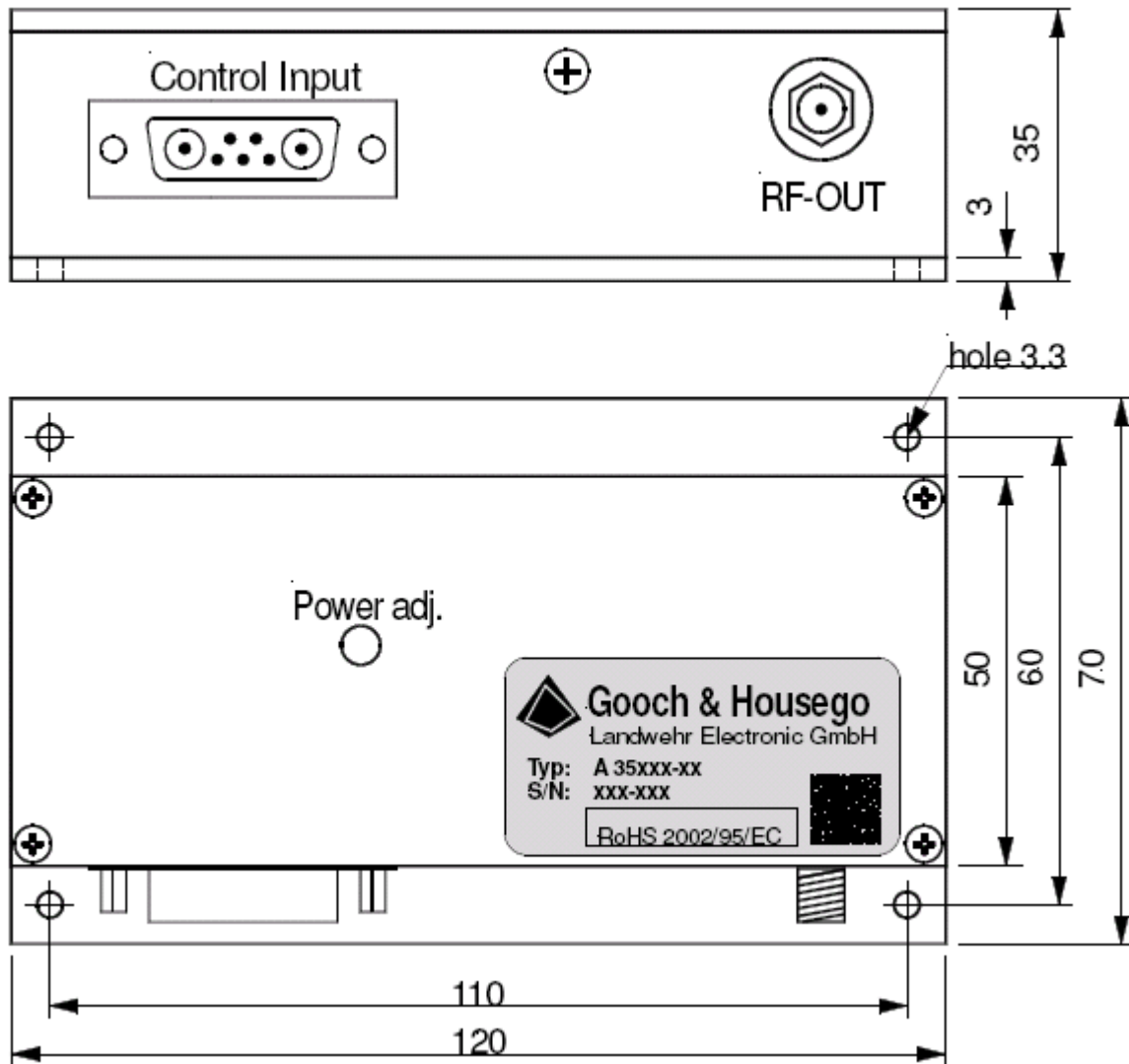
### Quality Standards

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

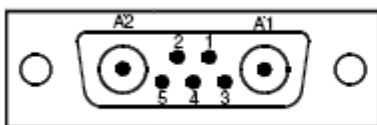
**Outline Drawings**

Dimensions in mm

Standard casing

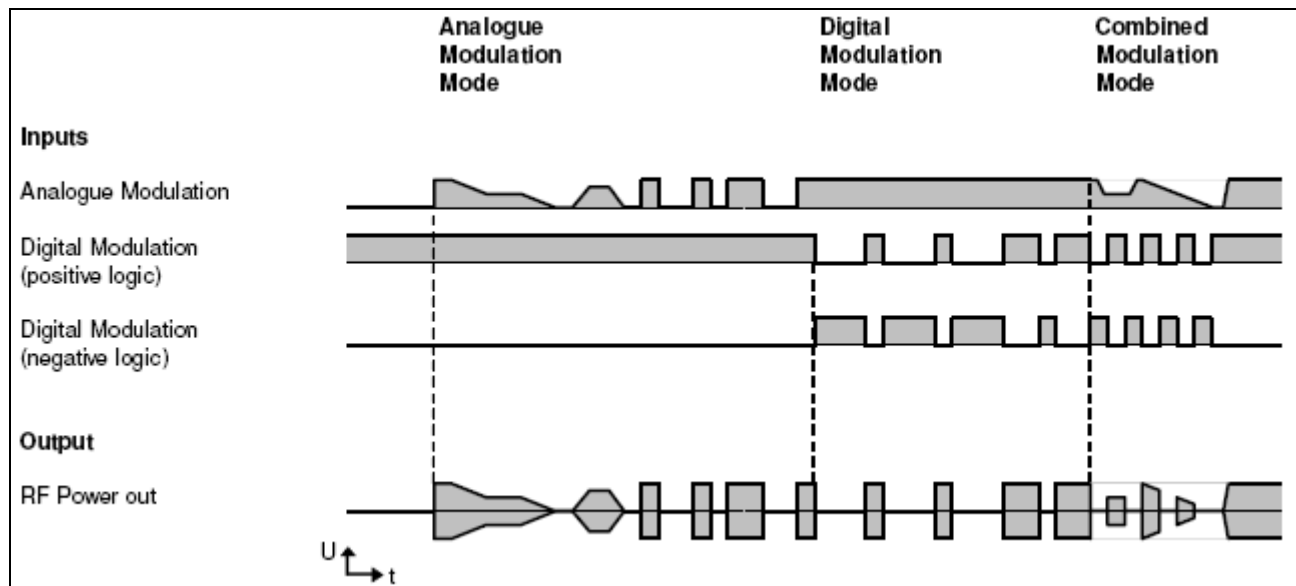


**Control Input**



- |      |                           |    |                     |
|------|---------------------------|----|---------------------|
| 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 ) <sup>1</sup> ) <sup>3</sup>		Digital Modulation Input ) <sup>3</sup>	
		Voltage Range	Impedance	Logic	Impedance ) <sup>2</sup>
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	SiO <sub>2</sub>	SiO <sub>2</sub>
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	SiO <sub>2</sub>	SiO <sub>2</sub>
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

<b>Model</b>	<b>12050-3-BR-TE</b>	<b>12050-3-TE</b>
Interactive Material	SiO <sub>2</sub>	SiO <sub>2</sub>
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	Used for Various $\lambda$ Specifications shown for 1.06 $\mu$ m	1.06 $\mu$ m
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 $\mu$ m	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

<b>Model</b>	<b>12080-3-BR-TE</b>	<b>12080-3-TE</b>
Interactive Material	SiO <sub>2</sub>	SiO <sub>2</sub>
Acoustic Mode	Longitudinal	Longitudinal
Operating Wavelength	Used for Various $\lambda$ Specifications shown for 1.06 $\mu$ m	1.06 $\mu$ m
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 $\mu$ m	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	SiO <sub>2</sub>	GaP
Acoustic Mode	longitudinal	Longitudinal
Operating Wavelength	Used for Various $\lambda$ Specifications shown for 633 nm	1.06 $\mu$ m
Window Configuration	Brewster, $\lambda/10$ 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 $\mu$ m in air	300 $\mu$ m
Rise Time	<6 ns	10 nsec*
Optical Waist Size to achieve Rise Time	44 $\mu$ m	100 microns
Deflection Angle	41 mrad @ 633 nm	28.7 mrad
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 $\mu$ m
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	TeO <sub>2</sub>	TeO <sub>2</sub>	TeO <sub>2</sub>
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 μm	55 μm
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	TeO <sub>2</sub>	TeO <sub>2</sub>	TeO <sub>2</sub>
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 μm	0.055 mm	55 μm
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 $\mu$ m	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 $\mu$ m	70 $\mu$ m	70 $\mu$ m
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 $\mu$ m	35 $\mu$ m	35 $\mu$ m
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 Module Driver: 31085-6AM Digital System Driver: 31085-6DS Digital Module Driver: 31085-6DM	Analog Driver System: 31085-6AS Analog Driver Module: 31085-6AM Digital Driver System: 31085-6DS 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