10Gb/s surface mount coplanar APD preamp receiver with integrated MEMS VOA

ATV10GC

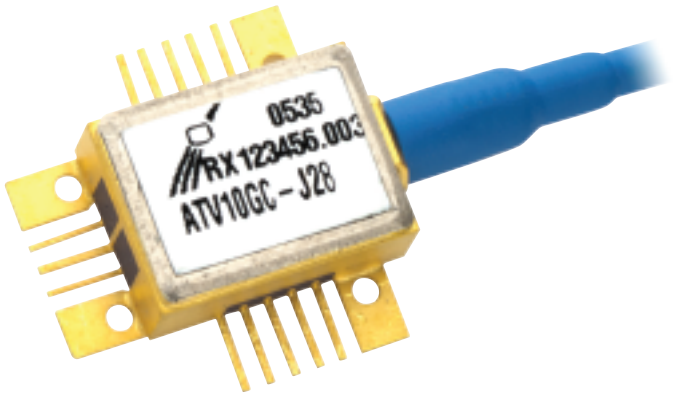
The ATV10GC receiver consists of an avalanche photodiode, a low-noise preamplifier, a MEMS variable optical attenuator (VOA), and a precision NTC thermistor in a hermetic coplanar package with a connectorized single-mode fiber pigtail. Differential outputs are provided to improve noise rejection for enhanced sensitivity. It has been optimised for use in 10Gb/s metro or long-haul applications, either as a discrete device or within a transponder, using NRZ modulation, with or without FEC, at data rates up to 10.709Gb/s.

Features:

- High sensitivity, -26.5dBm typical
- Integrated MEMS VOA extends overload beyond +10dBm
- Low capacitance high speed InGaAs APD photodetector
- Supports FEC rates up to 10.709Gb/s
- Best in class power consumption, only 350mW
- Designed to exceed the environmental requirements of Telcordia GR-468-CORE
- RoHS 5/6 compliant

Applications:

- Client or line side links
- DWDM TDM transponder applications



Operating Characteristics

Case Temperature = 25°C unless otherwise specified

Parameter	Symbol	Measurement Conditions	Min	Typ	Max	Unit
Optical sensitivity BOL [1] [2]	Sens	2^{31}-1 PRBS BER<10^{-12} $V_{APD}=VM_{10}$		-26.5	-25.0	dBm
Sensitivity penalty EOL over temperature [1] [2]		2^{31}-1 PRBS BER<10^{-12} $V_{APD}=VM_{10}$ T=-5 to +75°C		0.75	1.0	dB
Deviation from linear phase		DC - 6GHz	-10		+10	°
High frequency -3dB corner	f_H	$V_{APD}=V_{M10}$ Small signal	7	7.5		GHz
Low frequency -3dB corner	f_L				40	kHz
Transimpedance gain [3] [4] [5]	T_Z	Small signal	1.1	1.6	2.3	kΩ
Maximum output voltage6	V_{OUT}	Peak-to-peak		600	700	mV
Return loss	S_{22}	DC to 7.0GHz			-8	dB
Optical overload [2]	P_{SAT}	0dB Attenuation $V_{APD}=V_{M3}$ BER<10^{-12}	-3	-1		dBm
Optical overload extension		With VOA actuated	+13			dBm
APD breakdown voltage	V_{br}	T=25°C I_{APD}=10mA	25		40	V
APD breakdown voltage temperature coefficient	T_{Vbr}		0.030	0.045	0.061	V/°C
Dark current	I_d	At 90% of V_{br}			100	nA
Amplifier bias current	I_{cc}			75	95	mA
Input current for output limiting	$I_{In\ lim}$	Peak-to-peak		0.5		mA
VOA maximum attenuation	Att		20	30		dB
VOA control voltage [7]	V_{Att}	Attenuation = 20dB		5.5	9	V
VOA current	I_{Att}	Attenuation = 20dB		6	7.2	mA
VOA power dissipation (continuous)	P_{Att}	Attenuation = 20dB		33	65	mW
VOA response time [8]		From attenuation = 1dB to 20dB		5	10	ms
Polarisation dependent loss	PDL	VOA unbiased			0.15	dB
Polarisation dependent loss	PDL	VOA biased			0.4	dB
Thermistor resistance	R_{TH}	T=25°C		10		kΩ

Notes:
[1] Optical Wavelength between 1525-1575nm. Data to 1610nm available on request.
[2] Measured with 9.95328Gb/s NRZ 1031-1 PRBS data and no FEC.
[3] Load impedance is 50Ω AC-coupled.
[4] Excludes APD responsivity.
[5] Differential.
[6] Single ended.
[7] Not polarity sensitive.
[8] Response time quoted is to achieve 99% of the desired attenuation value.

Absolute Maximum Ratings

The table below provides maximum and/or minimum values of critical parameters which will not permanently damage the device, but for which the operating specification may not hold

Parameter	Symbol	Min	Max	Unit
Amplifier bias voltage	VCC	-6	0.5	V
Operating temperature [1]	Top	-40	+85	°C
Storage temperature [2]	Tstg	-40	+85	°C
Input photocurrent [3]	IPD		3	mA
APD bias voltage	VAPD	0	V_{br}	V
VOA control voltage [4]	VATT	0	9	V
Fiber bend radius		20		mm

Notes:

[1] The operating temperature is defined as the temperature of the module case.

[2] The rating is referred to the ambient temperature.

[3] $V_{APD} \cdot V_{M3}$. Although implementation of a current limit is intuitive, it is not recommended as biasing below the specified M = 3 voltage in the presence of a high optical power has been shown to cause device damage.

[4] Polarity Independent.

Class 2 ESD precautions must be observed when handling these devices.

Pin Out

Pin #	Symbol	Parameter	Pin #	Function	Parameter
1	V_{ATT}	VOA control	10	Out_P	Positive RF data output
2	V_{APD}	APB bias voltage	11	GND	Case RF ground
3	NC	No connection	12	GND	Case ground
4	V_{ee}	Amplifier supply (-5.2V)	13	FB_in	Output offset control
5	NC	No connection	14	NC	No connection
6	GND	Case ground	15	NC	No connection
7	GND	Case RF ground	16	RTH	Thermistor
8	Out_N	Negative RF data output	17	GND	Case ground
9	GND	Case ground			

Circuit Schematic

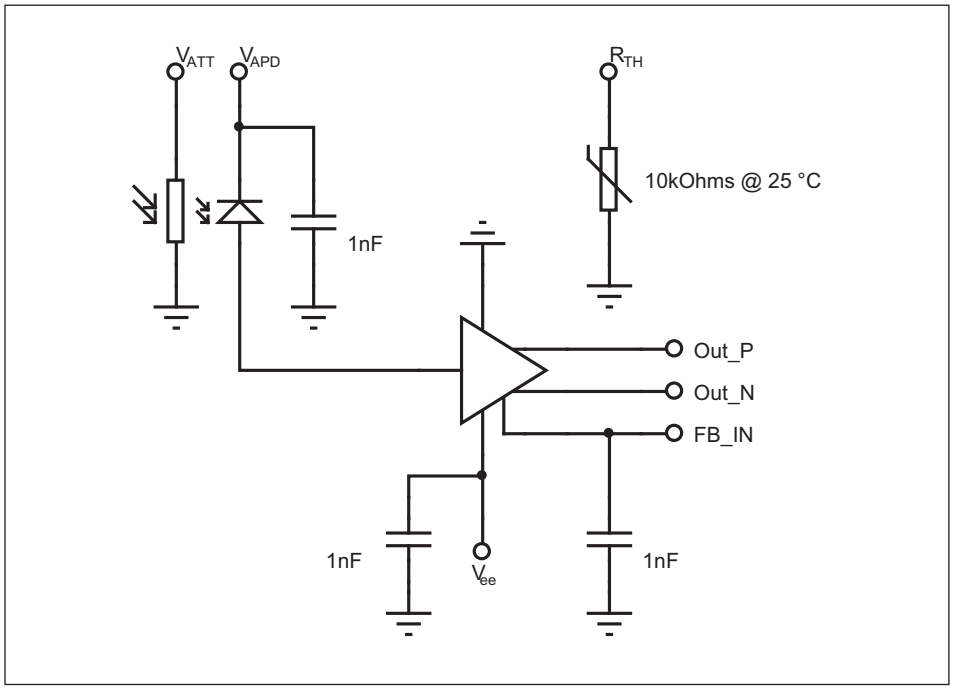


Figure [1] ATV10GC Circuit schematic.

Outline Drawing

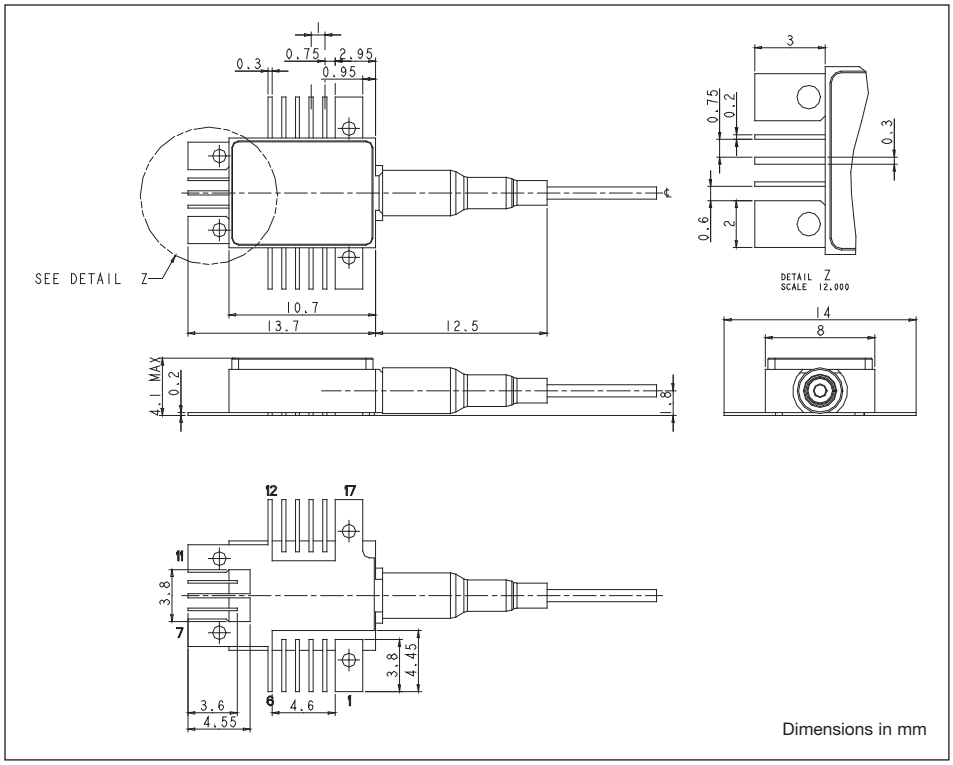


Figure [2] Outline diagram (Illustration only. For full details, refer to appropriate assembly drawing).
Note: Fiber is 900mm secondary coated single-mode fiber, length = 1200 +0/-200mm.

Typical Performance Characteristics

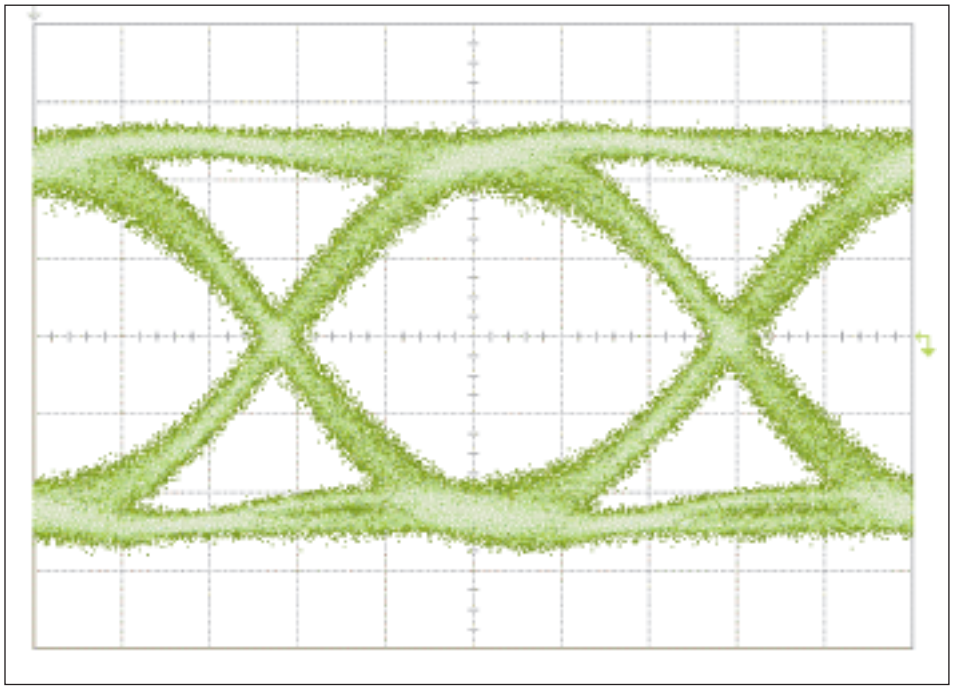


Figure [3] Electrical output data eye, M = 10, 10Gb/s 2^{31}-1 PRBS, -20dBm optical input.

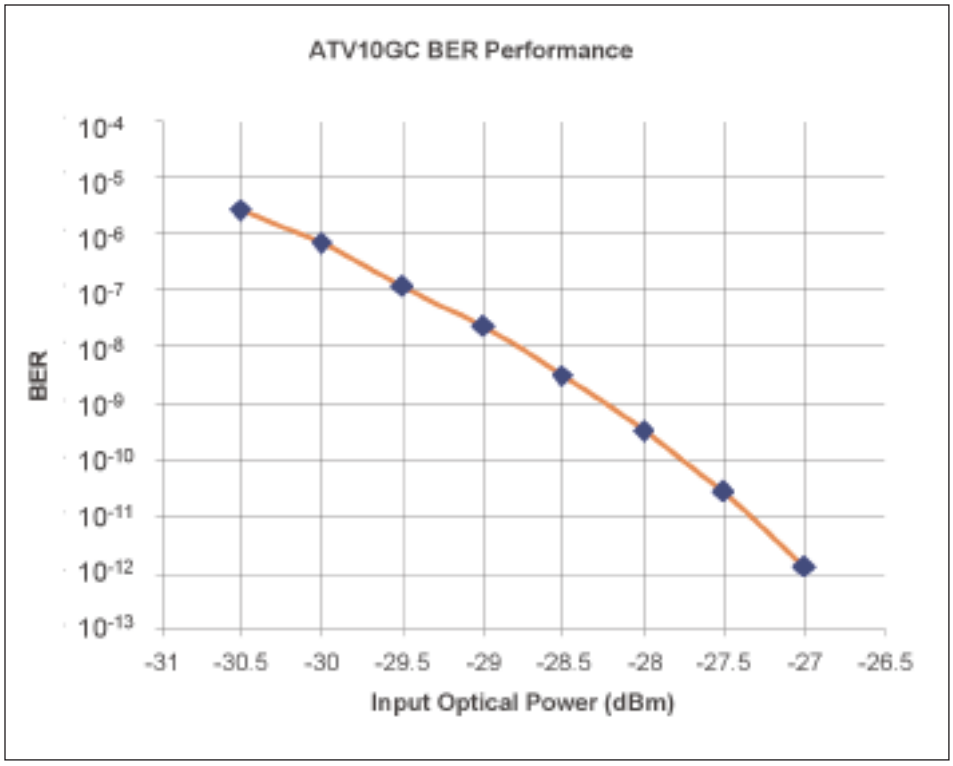


Figure [4] Typical BER performance, M = 10, 10Gb/s 2^{31}-1 PRBS, optical extinction ratio = 12dB.

Typical Performance Characteristics (continued)

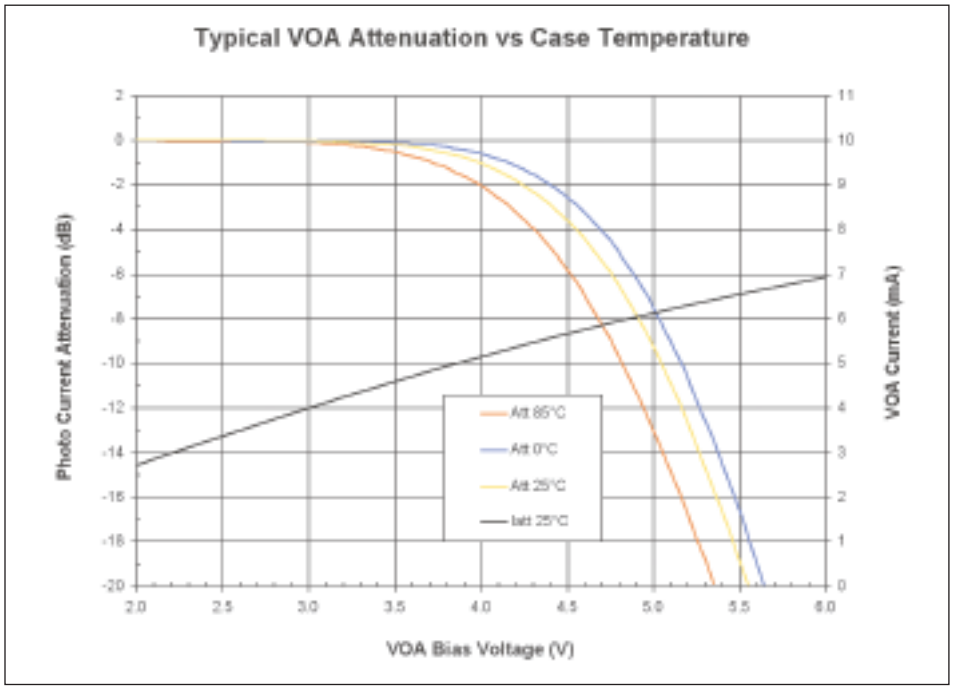


Figure [5] Typical VOA attenuation.

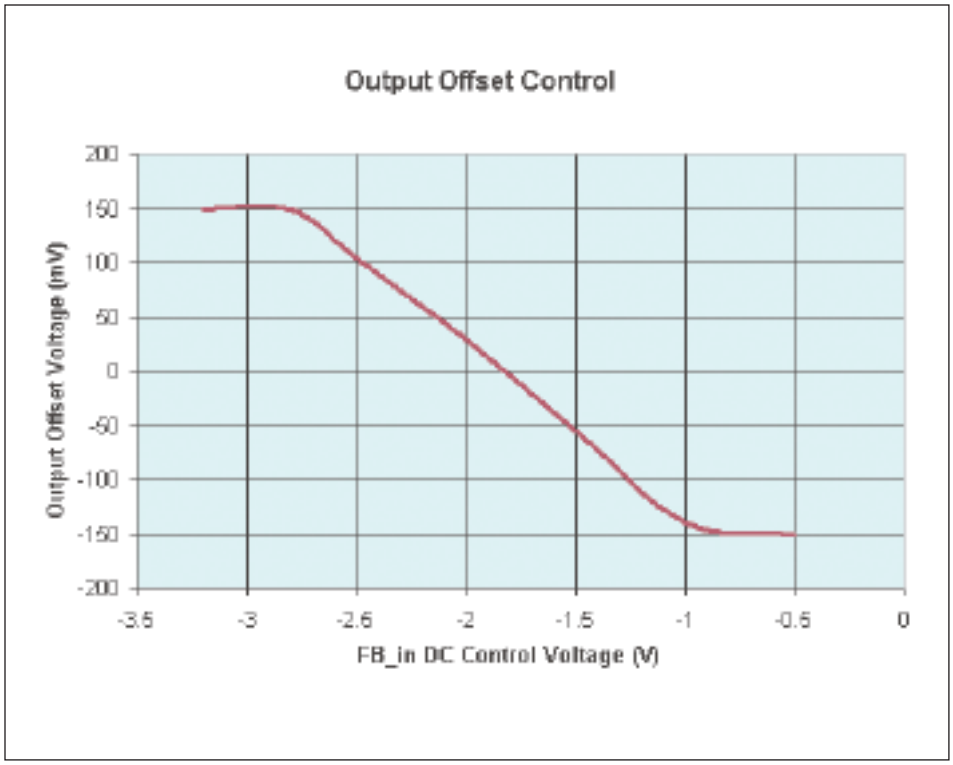


Figure [6] FB_in transfer function.

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Ordering Information:

ATV10GC	- (Connector) J28 = SC/PC J57 = LC

e.g. ATV10GC-J28 is an ATV10GC with an SC/PC connector.

Other options available on request.

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