

# AP3501 Product Specification V3.0

## 35 GHz High-Speed Sampler

### Contents

1.	Introduction .....	2
2.	Pin description .....	3
3.	Absolute Maximum Ratings .....	4
4.	Operating Conditions .....	4
5.	Characteristics .....	5
6.	Document History .....	5



## 1. Introduction

The AnaPico AP3501 is a miniaturized 35 GHz bandwidth sampler allowing for up to 800 MSamples/s sampling rate. With a dedicated sample-and-hold/reset circuit the AP3501 can either be operated with integrating output (sample & hold) or with memory-free individual IF pulses (sample-hold-reset up to 60 MHz). The AP3501 enables high-speed sampling with an excellent spurious-free dynamic range. The aperture jitter is typically  $70 f_{sRMS}$ .

The AP3501 is highly integrated and includes strobe generation, sampling, and charge amplification and consumes 2 W. The AC-coupled strobe input is preferably differential and ECL compatible.

The sampler device is mounted in a connectorized package (approx. 30 x 30 x 10 mm) but can also be delivered in a small SMT package with excellent thermal properties if required.

Applications for the device include:

- sampling frequency converters
- sampling receivers
- down converters
- equivalent time sampling oscilloscopes

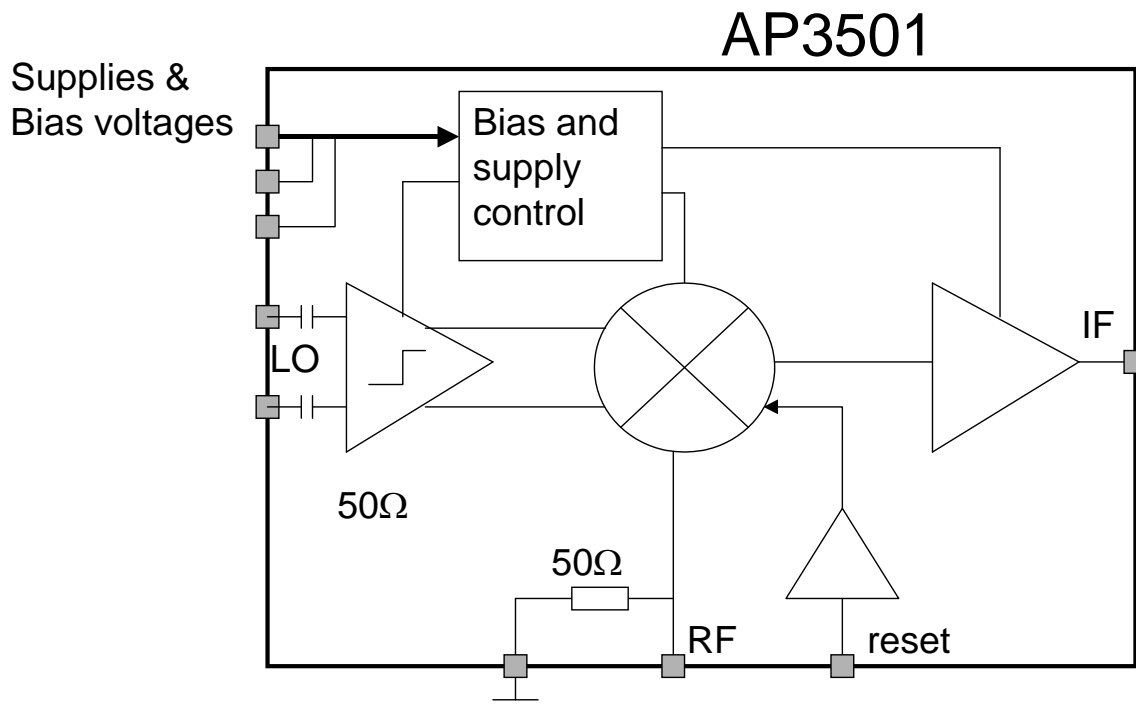
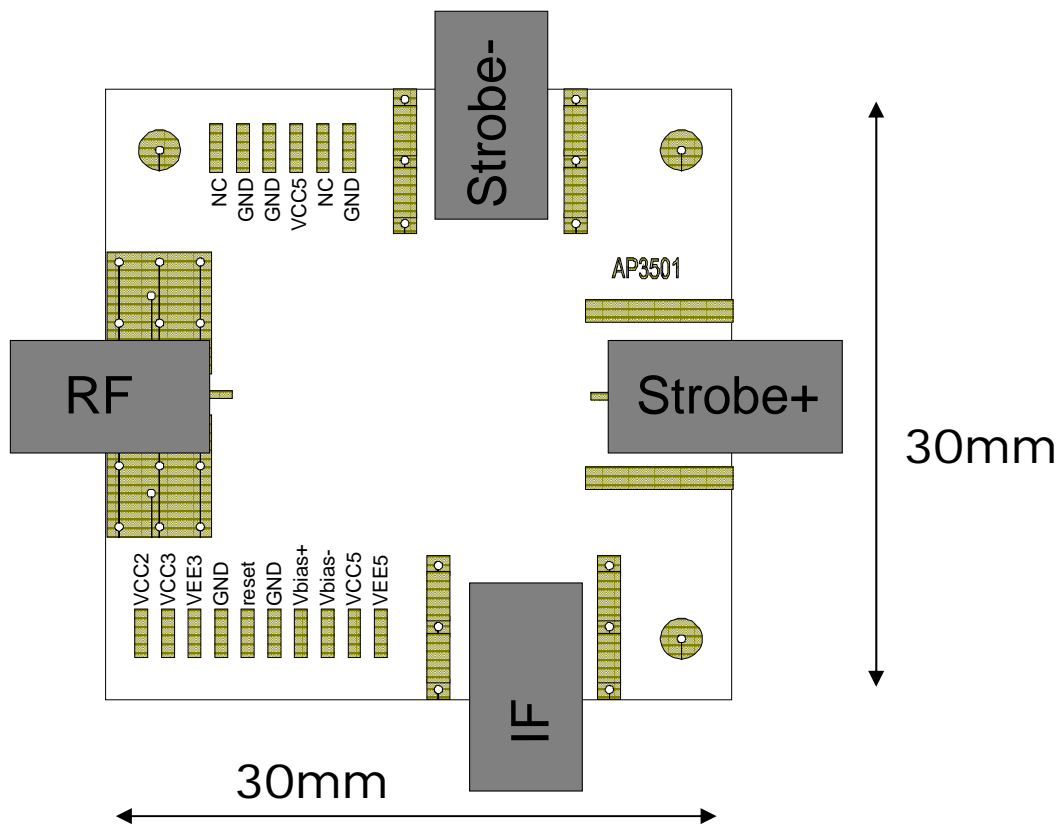


Figure 1 Equivalent circuit of the AP3501 Sampler



## 2. Pin description

Pin Name	Type	Description
RF	RF Signal input	Single-ended high-speed signal input
Strobe+	ECL input	Strobe input, positive (internally AC-coupled)
Strobe-	ECL input	Strobe input, negative (internally AC-coupled)
IF	Analog output	IF output
Vbias+	Analog input	External threshold adjust for sampler
Vbias-	Analog input	External threshold adjust for sampler
reset	Analog input	Reset signal input (100 $\Omega$ , internally AC-coupled)
VCC2	Supply	Positive 6V supply
VCC3	Supply	Positive 2.5V supply
VCC5	Supply	Positive 5V supply
VEE3	Supply	Negative 3V supply
VEE5	Supply	Negative 5V supply
GND	Supply	Ground, 0V reference

### 3. Absolute Maximum Ratings

Stress beyond the values stated below may cause permanent damage to the device. Functional operation is not implied under these conditions. Exposure to absolute maximum ratings for extended periods may adversely affect reliability.

Parameter	Symbol	Min.	Max.	Units	Note
Positive Supply voltage	$V_{CC2}$	-0.5	+10	V	
Positive Supply Voltage	$V_{CC3}$	-0.5	+5	V	
Positive Supply Voltage	$V_{CC5}$	-0.5	+6.75	V	
Negative Supply Voltage	$V_{EE3}$	-5	+1	V	
Negative Supply Voltage	$V_{EE5}$	-6.75	+1	V	
Sampler positive bias	$V_{bias+}$	-0.5	+7.5	V	
Sampler negative bias	$V_{bias-}$	-7.5	0.5	V	
RF input signal voltage range	$V_{RF}$	-2	+2	V	
IF signal voltage	$V_{IF}$	-5	+5	V	
Continuous Input Current at RF input	$I_{RF}$	-25	+25	mA	
Continuous output current at IF output	$I_{IF}$	-80	80	mA	
Storage Temperature	$T$	-40	130	°C	

### 4. Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Positive Supply Voltage	$V_{CC2}$	+5.5	+6	+8	V	
Positive Supply Voltage	$V_{CC3}$	+1.5	+2.5	+3.5	V	
Positive Supply Voltage	$V_{CC5}$	+4.7	+5	6	V	
Negative Supply Voltage	$V_{EE5}$		-5		V	
Negative Supply Voltage	$V_{EE3}$	-2	-3	-4	V	
Sampler positive bias	$V_{bias+}$	0	+0.8	+2.5	V	
Sampler negative bias	$V_{bias-}$	-2.5	-1.4	0	V	
Operating Temperature Range		10		55	°C	
Sampling rate	$S$	0		60 (800)	MHz	a
Strobe input amplitude		0.3	0.8	1.5	V	b
Strobe pulse rise/fall time			100	200	ps	
Strobe duty cycle		40	50	60	%	
Reset input amplitude			0.4	1.0	V	
Reset pulse rise/fall time			200	500	ps	c
Reset duty cycle		10	50	70	%	

Notes:

- Sampling rates up to 800 MS/s are possible when used as a sampling phase detector or harmonic mixer. "memory-free" sampling is possible up to 60 MS/s
- differential peak-peak amplitude
- for the typical amplitude, larger amplitude allows slower rise/fall times

## 5. Characteristics

All characteristics specified at operating conditions but guaranteed and tested at typical bias conditions and 25 °C.

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
input bandwidth	<i>BW</i>		35		GHz	
Spurious free dynamic range	<i>SFDR</i>		65		dB	1
IF bandwidth			tbd		MHz	
Input voltage range		-1.5 -1		1.5 1	V	2a 2b
Output offset				tbd	mV	
Aperture jitter				0.2	ps <sub>RMS</sub>	
Output noise level			0.5		mV <sub>RMS</sub>	3
RF Input impedance			50		Ohm	
Input return loss	<i>S11</i>			-15		4
Strobe input impedance			100		Ohm	differential
IF output impedance			50		Ohm	
Conversion gain		0.7	1	1.2		
Latency			6		ns	
Supply Current into V <sub>CC2</sub>	<i>I<sub>CC2</sub></i>		230	255	mA	
Supply Current into V <sub>CC3</sub>	<i>I<sub>CC3</sub></i>			15	mA	
Supply Current into V <sub>CC5</sub>	<i>I<sub>CC5</sub></i>		170	190	mA	
Current from V <sub>EE5</sub>	<i>I<sub>EE5</sub></i>			25	mA	
Current from V <sub>EE3</sub>	<i>I<sub>EE3</sub></i>			15	mA	

Notes:

1.  $P_{in} < -10$  dBm,  $f_{RF} = 5.001$  GHz,  $f_{LO} = 100$  MHz
2. a) <10% error b) for  $\leq \pm 2\%$  linearity error
3. noise integrated up to sampling rate
4. package and connector dependent, up to 25GHz

## 6. Document History

Version/Status	Date	Author	Notes
V10	2006-3-12	jk	first release
V12	2006-5-31	jk	Included pinout
V13	2006-7-17	ul	Pin assignment updated
V14	2006-8-31	jk	Adjusted bias voltages, minor changes in performance numbers based on characterization
V20	2006-09-12	jk	Add. data
V21	2007-04-16	ul	editorial update
V22	2007-06-28	jk	editorial update
V30	2010-02-20	jk	New RF connector