

## Product Description

ATEK355P4 is a wideband 4-bit Digital Step Attenuator with 45 dB attenuation range. Attenuator frequency of operation goes down to Low Frequency close to DC and goes up to 14 GHz. Usable bandwidth goes up to 20 GHz.

Bias and control voltages of the attenuator are positive, which eliminates the need for negative voltage rails.

Attenuator is housed in compact 4x4 mm low cost SMD package, input and output matched to 50 ohms internally.

Evaluation Board, bare die, custom package, and module options are available upon request.

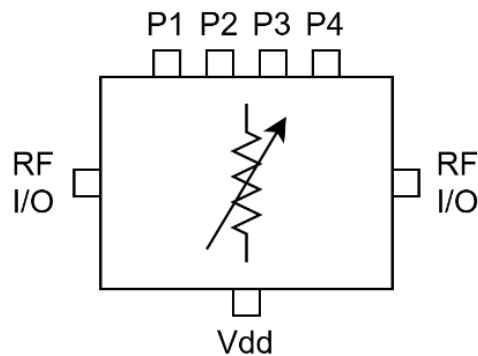
## Product Features

- Frequency Range: LF - 20 GHz
- Insertion Loss: 4 dB
- Attenuation Range: 45 dB
- Positive Supply
- Positive Control
- 4x4 mm compact size

## Applications

- Wideband Receivers
- Telecommunication
- Test Equipment
- Radar
- Electronic Warfare

## Functional Block Diagram



## Electrical Specifications

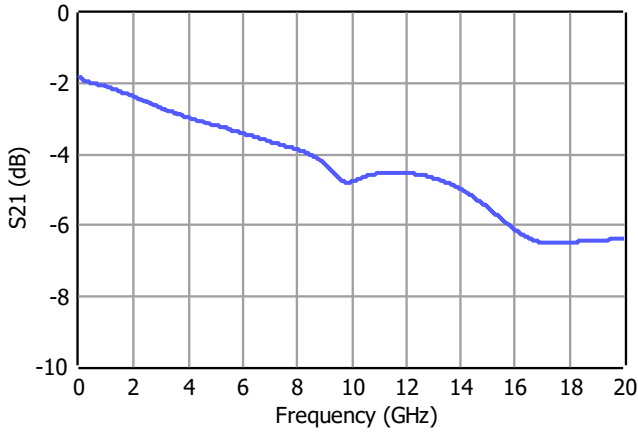
Conditions unless otherwise specified:  $V_{DD} = 5\text{ V}$ ,  $T = 25\text{ }^{\circ}\text{C}$ .

Parameter		Min	Typ	Max	Units
Operational Frequency Range		LF		20	GHz
Insertion Loss	2 GHz		2.3		dB
	4 GHz		2.9		
	8 GHz		3.8		
	10 GHz		4.7		
	12 GHz		4.5		
Attenuation Range	2 GHz		44		dB
	4 GHz		44		
	8 GHz		43.6		
	10 GHz		46		
	12 GHz		44		
Step Error			2		
Input Return Loss			-14		dB
Output Return Loss			-14		dB
Input P1dB					dBm
Input IP3					dBm
DC Supply Voltage (Vdd)					V
DC Supply Current					mA
Control Voltage (P1-4)	Low	0		1	V
	High	2		5	
Operating Temperature		-40		85	$^{\circ}\text{C}$

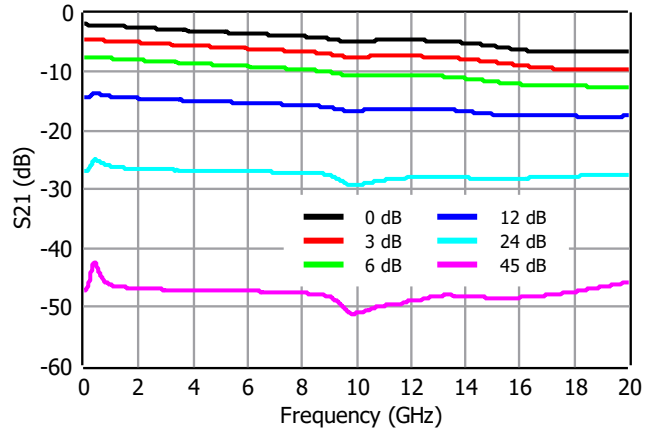
## Typical Performance Plots

Conditions unless otherwise specified:  $V_{DD} = 5\text{ V}$ ,  $T = 25\text{ C}$ .

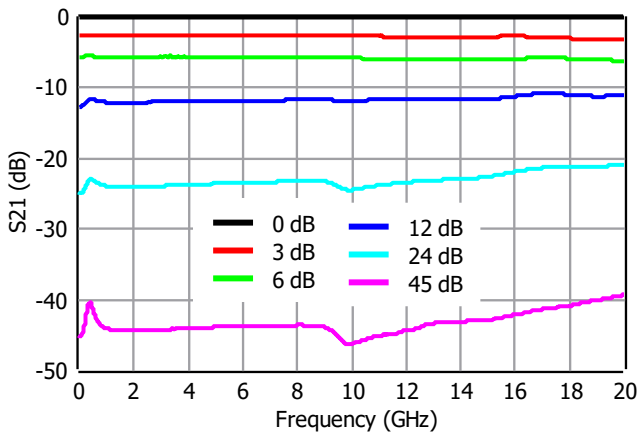
Insertion Loss



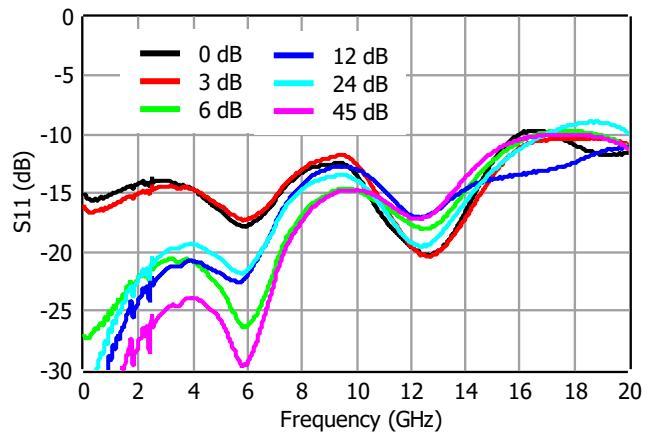
Insertion Loss vs. Attenuation State



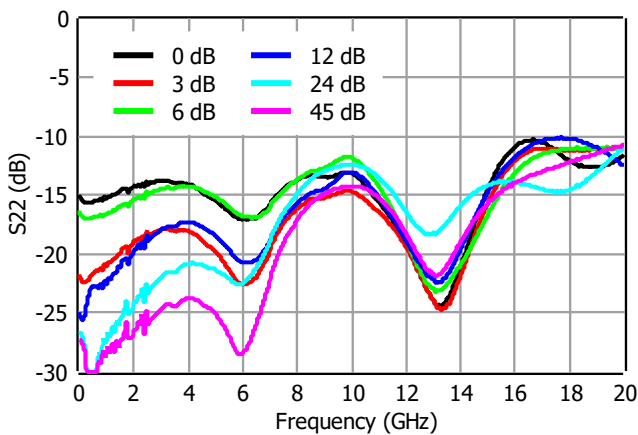
Normalized Attenuation



Input Return Loss



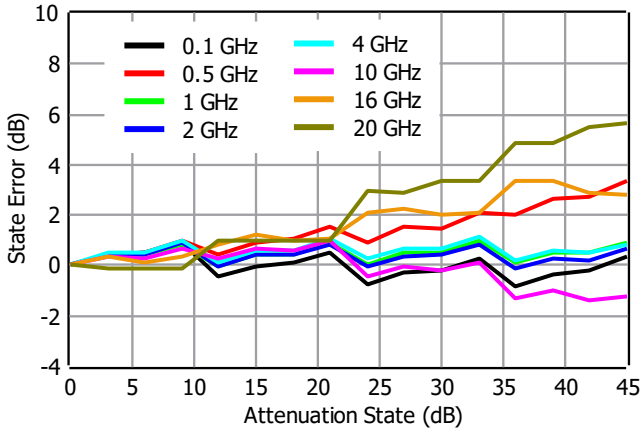
Output Return Loss



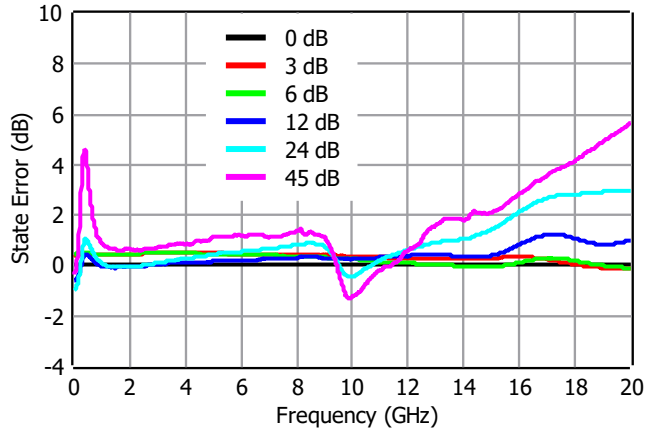
**Typical Performance Plots**

Conditions unless otherwise specified:  $V_{DD} = 5V$ ,  $T=25\text{ C}$ .

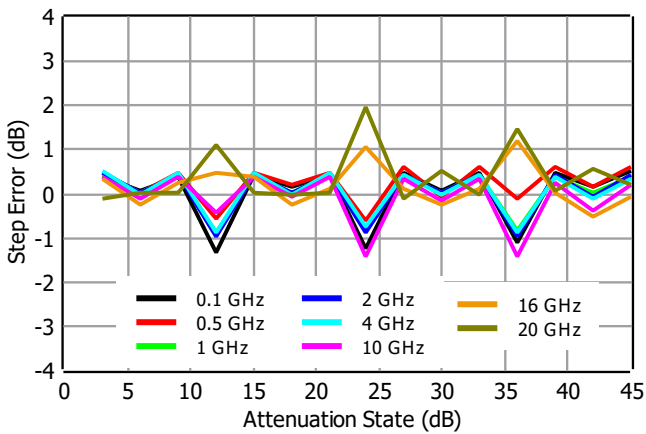
State Error vs. Attenuation State, Frequency



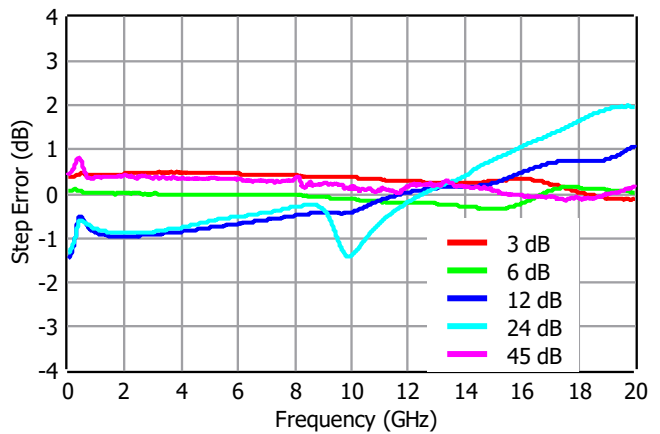
State Error vs. Attenuation State



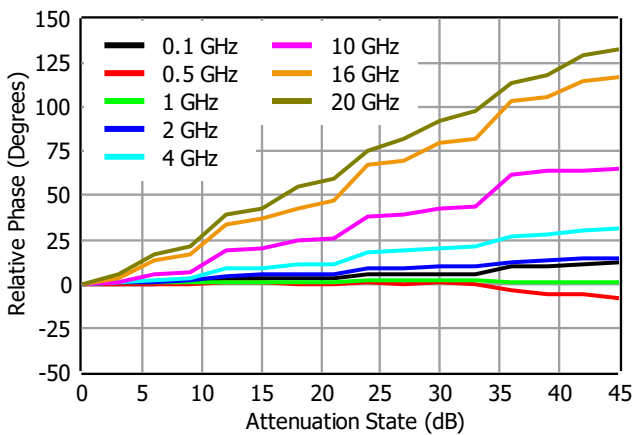
Step Error vs. Attenuation State, Frequency



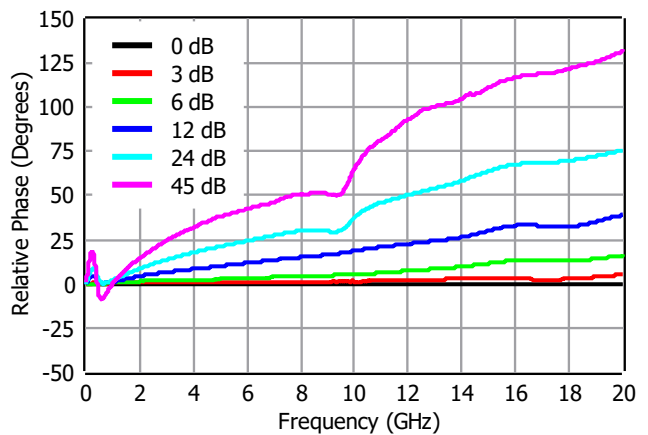
Step Error vs. Attenuation State



Relative Phase vs. Attenuation State, Frequency



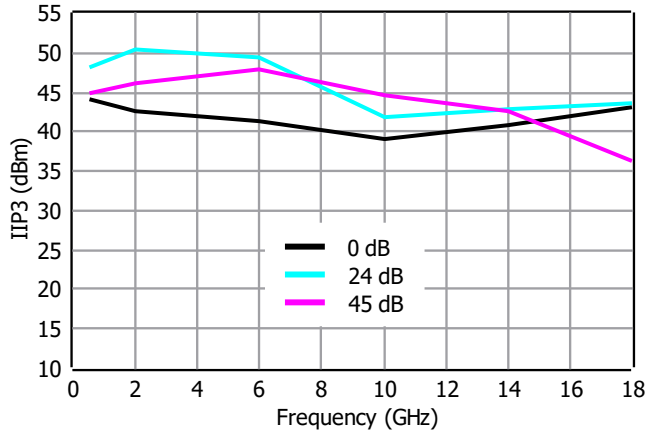
Relative Phase vs. Attenuation State



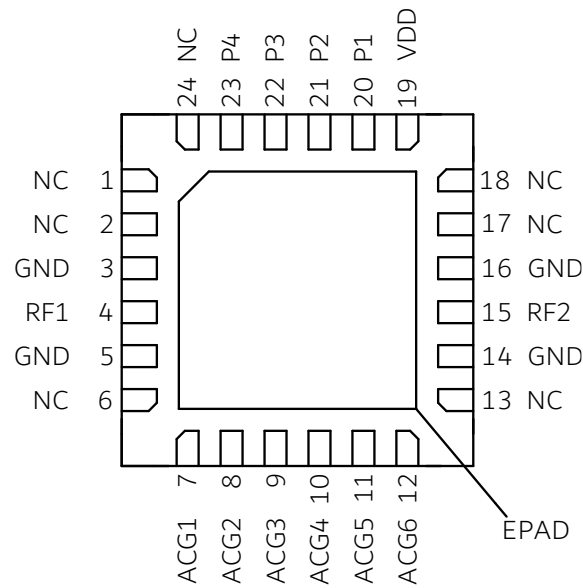
## Typical Performance Plots

Conditions unless otherwise specified:  $V_{DD} = 5\text{ V}$ ,  $T = 25\text{ C}$ .

IIP3



## Pin Description



Pin Number	Pin Name	Description
4	RF1	RF input/output pin. If the DC voltage level on RF lines is not equal to 0 V, an external DC block capacitor is required.
15	RF2	RF input/output pin. If the DC voltage level on RF lines is not equal to 0 V, an external DC block capacitor is required.
19	VDD	Vdd bias pin.
20	P1	Control voltage pin for parallel control interface.
21	P2	Control voltage pin for parallel control interface.
22	P3	Control voltage pin for parallel control interface.
23	P4	Control voltage pin for parallel control interface.
7	ACG1	AC ground pin. External shunt capacitor is required.
8	ACG2	AC ground pin. External shunt capacitor is required.
9	ACG3	AC ground pin. External shunt capacitor is required.
10	ACG4	AC ground pin. External shunt capacitor is required.
11	ACG5	AC ground pin. External shunt capacitor is required.
12	ACG6	AC ground pin. External shunt capacitor is required.
1, 2, 6, 13, 17, 18, 24	NC	These pins are not internally connected. Can be grounded on the PCB.
3, 5, 14, 16	GND	Ground.
25	EPAD	Exposed Pad on the bottom of the package should be connected to ground with multiple number of vias to reduce the inductance to the GND.

## Control Interface

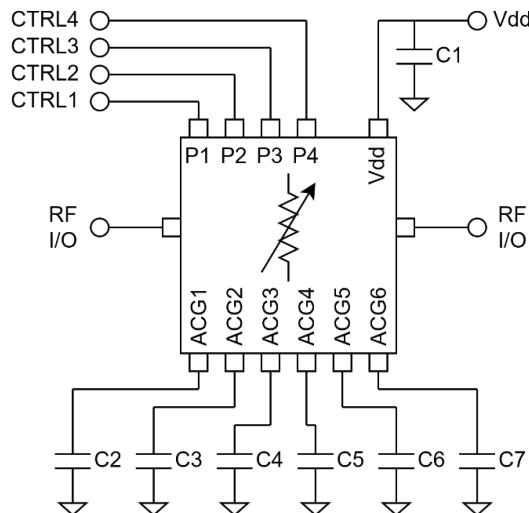
P4	P3	P2	P1	Attenuation State
HIGH	HIGH	HIGH	HIGH	0 dB
HIGH	HIGH	HIGH	LOW	3 dB
HIGH	HIGH	LOW	HIGH	6 dB
HIGH	LOW	HIGH	HIGH	12 dB
LOW	HIGH	HIGH	HIGH	24 dB
LOW	LOW	LOW	LOW	45 dB

## Applications Information

Signal entering from RF IN goes to RF OUT with an attenuation level set by control pins.

Vdd bias is 5 V and control voltages are CMOS compatible. Attenuation level can be set by switching control voltages between 0 V to 5 V. Operating the attenuator is done with positive voltage rails without the need for negative voltage levels.

Typical application schematic to operate the attenuator is given below.



C1 is used to filter out the ripples and unwanted signals coming from the Vdd supply. Using additional capacitors in parallel to C1 will improve this filtering. If this filtering is of no concern, then attenuator can be operated without C1.

If needed, to filter out the ripples and unwanted signals on the external CTRL1 signal, a low pass filter in series R, shunt C configuration can be implemented on the CTRL1 line. Note that external RC filtering limits the attenuation switching speed of the attenuator.

C2, C3, C4, C5, C6 and C7 are AC ground capacitors. Values of these capacitors should be chosen considering the lowest operation frequency of the application. 100 nF is used for ACG capacitors to generate the measurement results in this document.

CTRL1-4 voltages are used for setting the attenuation level.

All measurement results presented on this document are taken with a set-up, where RF1 is an input and RF2 is an output.

Insertion Loss, Attenuation and IP3 performance is measured with connectorized evaluation PCB. Then the loss of the PCB is de-embedded to generate the data presented in this document.

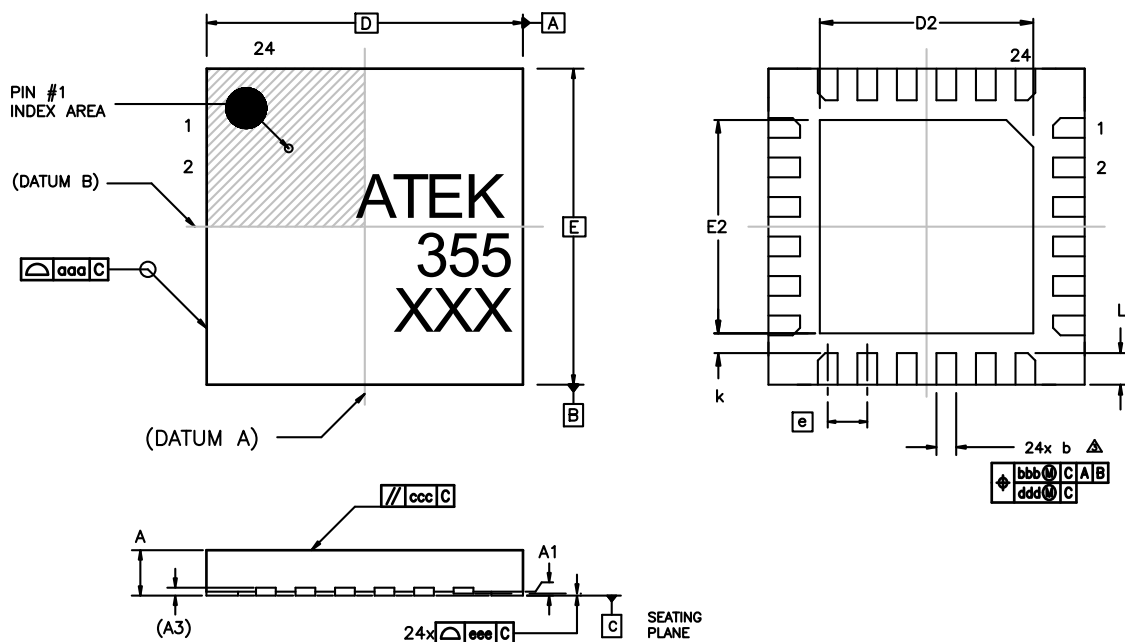
The NC pins of the attenuator are connected to the GND on the PCB used to generate the plots shown in this document.

## Absolute Maximum Ratings

Parameter	Value/Range
Supply Voltage (Vdd)	TBD
Control Voltages (P1-P4)	TBD
RF Input Power	TBD
Storage Temperature	-55 to +125°C

Operation of this device outside the parameter ranges given above may cause damage. These parameters should not be applied simultaneously.

## Mechanical and Marking Information



NOTES:  
 1) ALL DIMENSIONS IN MM  
 2) DIMENSIONING AND TOLERANCING PER ASME Y14.5-2009  
 3) DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP

SYMBOL	MIN	MAX	SYMBOL	MIN	MAX
A, V	0.80	1.00	E2	2.60	2.80
A, W	0.70	0.80	e	0.50	BSC
A, L	1.40	1.70	k	0.20	-
A1	0.00	0.05	L	0.35	0.45
A3	0.20	REF	aaa	0.10	
b	0.18	0.30	bbb	0.10	
D	4.00	BSC	ccc	0.10	
D2	2.60	2.80	ddd	0.05	
E	4.00	BSC	eee	0.08	



## Handling Precautions



Caution!  
ESD-Sensitive Device  
Handle Accordingly

## Contact Information

For the latest specifications, additional product information, support, and sales.

Web: [www.atekmidas.com](http://www.atekmidas.com)

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Email: [support@atekmidas.com](mailto:support@atekmidas.com)

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## Revisions

Revision No	Revision Date	Revision Reason	Section / Page No
1.0	23.02.2021	Initial Version	
1.1	14.07.2021	Drawing Added	5/9