

1. Device Overview

1.1 General Description

The AKA-1400 is a low-cost cascadable broadband InGaP HBT MMIC amplifier. This is a general-purpose gain block amplifier which provides high P1dB, high OIP3, and very small die size. The simple application circuit also requires minimal external components, allowing it to be used in a variety of applications. It is available in bare die form.



Bare Die

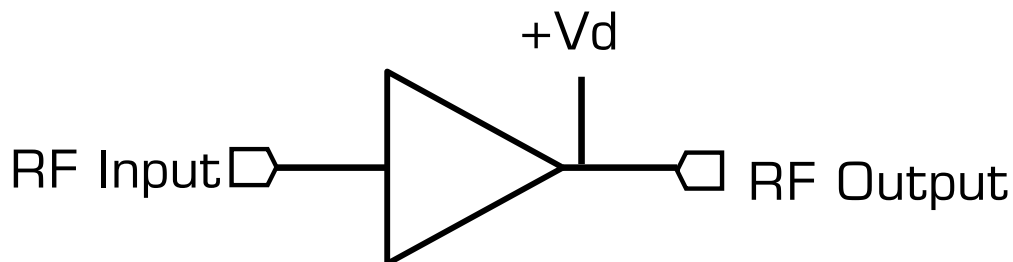
1.2 Features

- Small Die Size: 0.4 mm x 0.43 mm
- High P1dB
- +28 dBm OIP3, 17 dB Gain at 2 GHz
- Single Power Supply Operation
- Low-Cost
- S-parameters: [AKA-1400D](#)

1.3 Applications

- Mobile test and measurement equipment
- Radar and satellite communications
- 5G Transceivers
- Driver Amplifier L-Diode Mixer

1.4 Functional Block Diagram



1.5 Part Ordering Options¹

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
AKA-1400D	Wire Bondable Die	Bare Die	RoHS	Active	EAR99

¹ Refer to our [website](#) for a list of definitions for terminology presented in this table.

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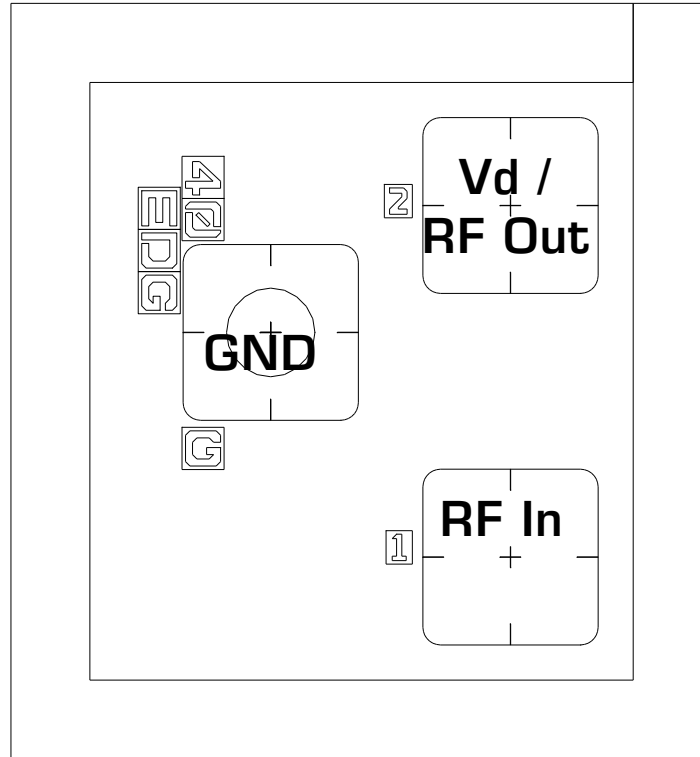
Revision History

Revision Code	Revision Date	Comment
-	May 2021	Datasheet Initial Release

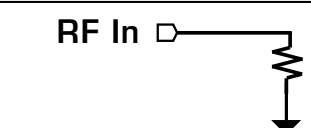
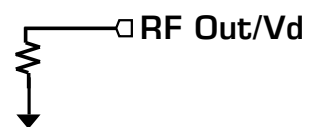

2. AKA-1400 Port Configurations and Functions

2.1 AKA-1400D Port Diagram

A port diagram of the AKA-1400D is shown below.



2.2 AKA-1400D Port Functions

Port	Function	Description	Equivalent Circuit for Package
RF In (1)	RF Input	This is the RF Input port of the amplifier die. It is RF matched to $50\ \Omega$ and requires an external DC blocking capacitor.	
Vd/RF Out (2)	RF Output and Positive Device Voltage Supply Port	This is the amplifier die's RF Output and positive supply voltage port, Vd. It is RF matched to $50\ \Omega$ and is DC coupled.	
GND (G)	Ground	Backside of the IC must be connected to a DC/RF ground with high thermal and electrical conductivity. Ground pad connected to IC backside with via.	

3. Specifications

3.1 Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may become inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Units
Positive Bias Current (I _{cc})	80	mA
Power Dissipation	312	mW
RF Input Power	+20	dBm
Operating Temperature	-40 to +85	°C
Storage Temperature	-65 to +150	°C
θ_{JC} , Junction to Case Thermal Resistance	215	°C/W
Max Junction Temperature for MTTF > 1E6 hours	150	°C

3.2 Package Information

Parameter	Details	Rating
ESD	Human Body Model (HBM), per MIL-STD-750, Method 1020	Class 1A

3.3 Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications. Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

	Min	Nominal	Max	Units
T _A , Ambient Temperature	-40	+25	+85	°C
Positive DC Device Voltage (V _d)	+3.7	+3.8	+3.9	V
Positive DC Current (I _{cc})	35	50	80	mA

3.4 Sequencing Requirements

There is no sequencing required to power up or power down the amplifier.

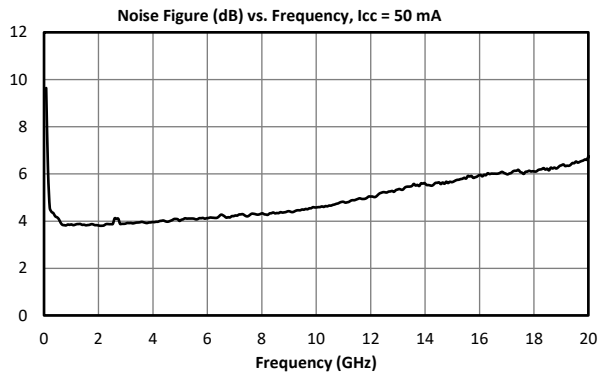
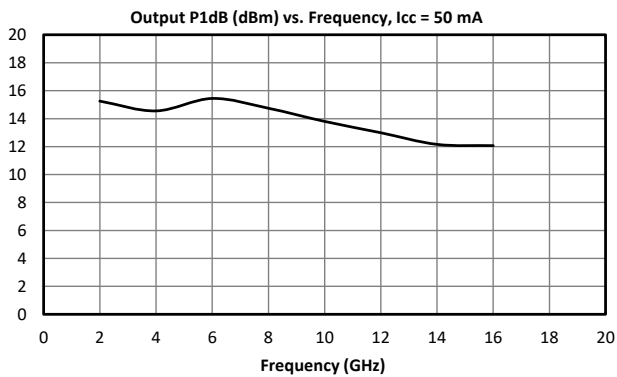
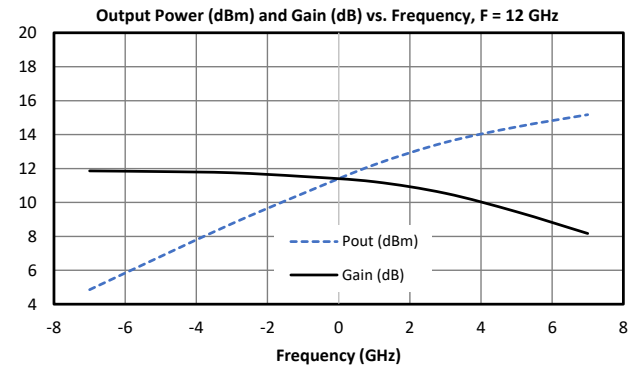
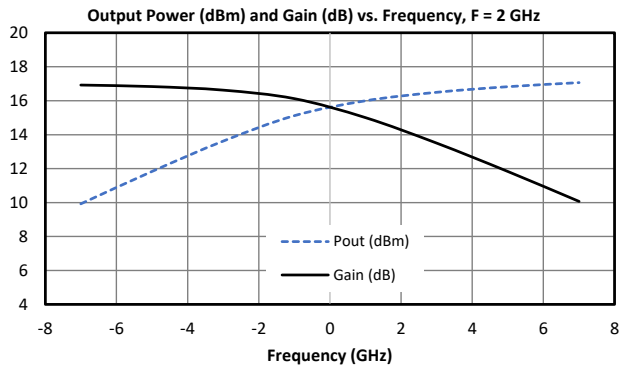
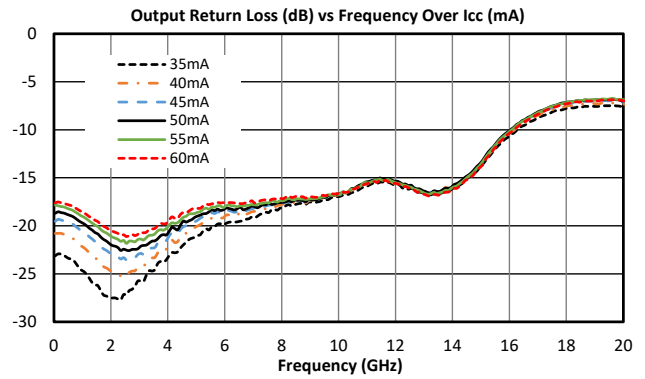
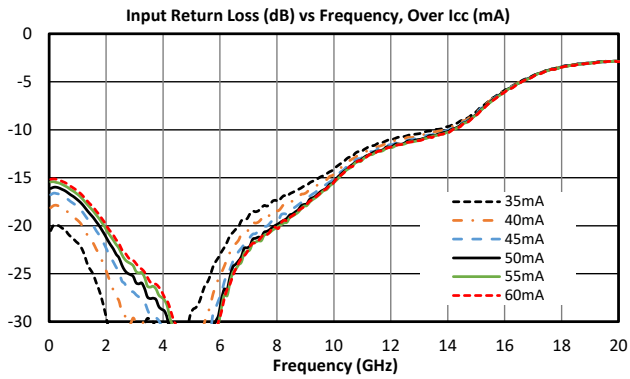
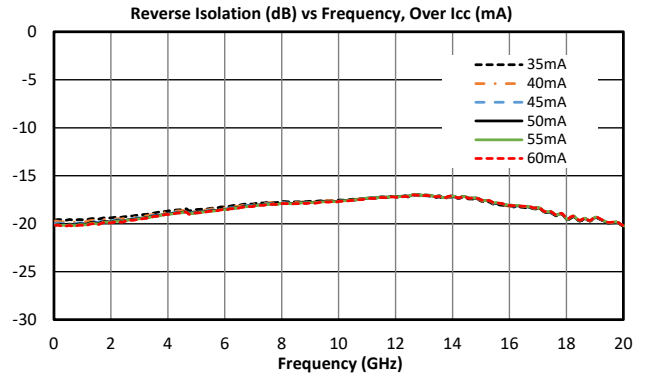
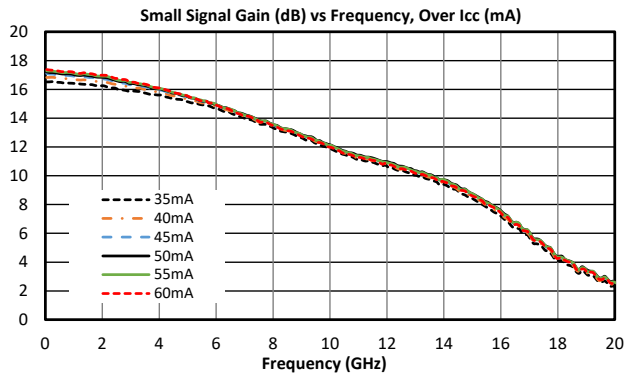
3.5 Electrical Specifications

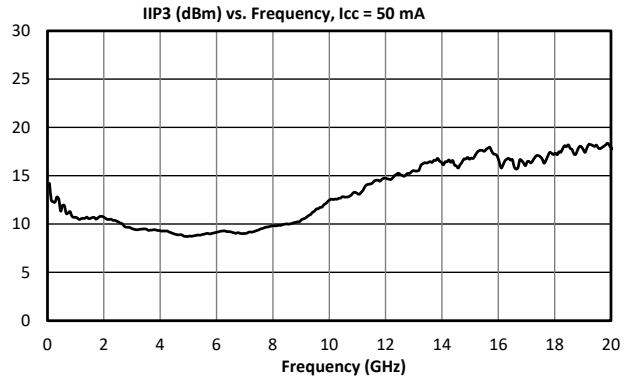
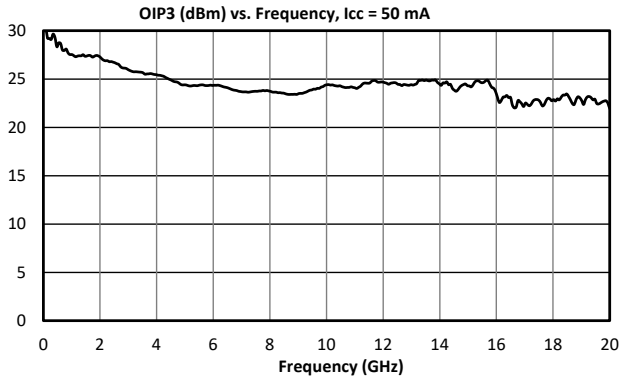
The electrical specifications apply at $T_A=+25^{\circ}\text{C}$ in a 50Ω system.

Die are 100% DC tested and RF tested on a per lot basis.

Parameter	Test Conditions	Frequency	Min	Typical	Units	
Small Signal Gain	Vd = +3.8 V, Icc = 50 mA	0.1 – 1.0 GHz	16	17	dB	
		1.0 – 4.0 GHz	15	16		
		4.0 – 6.0 GHz	14	15		
		6.0 – 12.0 GHz	11	12		
		12.0 – 14.0 GHz	9	10		
Output P1dB		2.0 – 6.0 GHz		15	dBm	
		6.0 - 14.0 GHz		13		
Input Return Loss			0.1 – 14.0 GHz		20	dB
Output Return Loss					18	
Reverse Isolation					18	
Noise Figure	3.0 GHz				4	
Output IP3 (OIP3)	2.0 GHz			+28	dBm	
Device Current, Icc	Vd = +3.8V				50	mA

3.6 AKA-1400D Typical Performance Plots

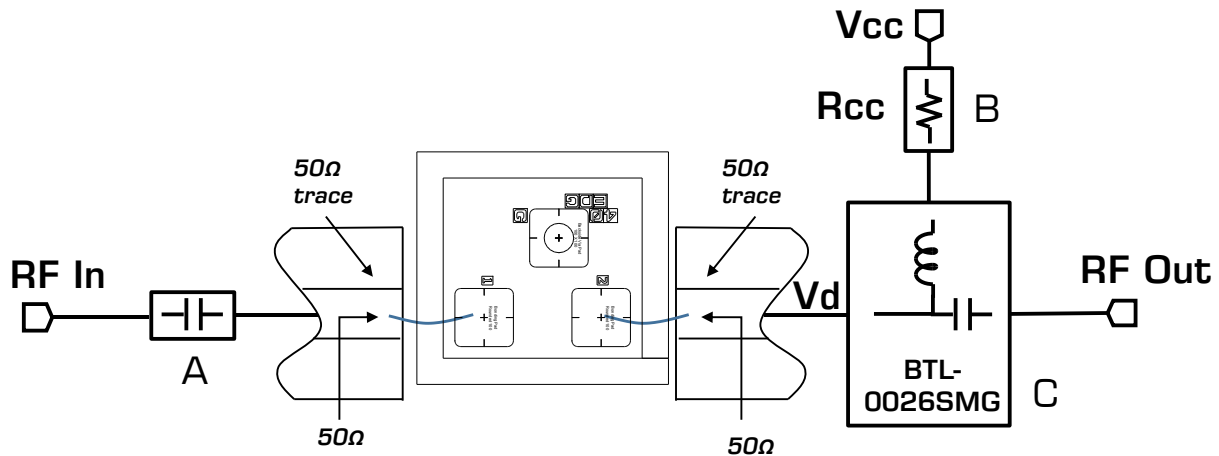




4. Application Information

4.1 AKA-1400D Application Circuit²

Below is the recommended application circuit for the AKA-1400D.



Designator	Description	Sample Part Number
A	0402 1.0 μ F SMT Capacitor	CL05A105KO5NNNC
B	0402 SMT Resistor	CPF0402B20RE1
C	Marki Surface-Mount Bias Tee; 500 kHz – 26 GHz	BTL-0026SMG

² Application circuit not drawn to scale. AKA-1400D chip is enlarged for viewing purposes.

The supply voltage, V_{cc} , is dropped to the device voltage, V_d , through the biasing resistor, R_{cc} . To calculate the appropriate value of this resistor, the designer simply uses the available power supply voltage and chosen bias current as follows.

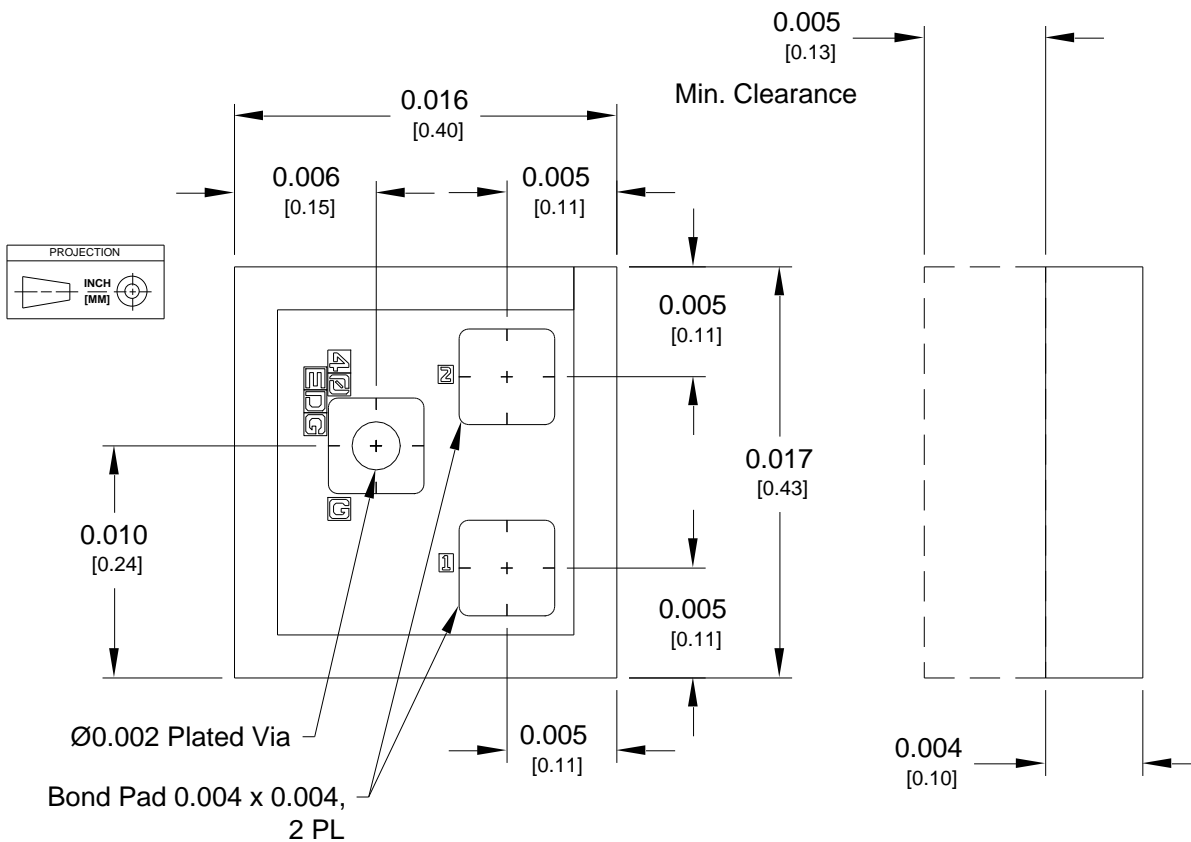
$$R_{cc} = \frac{V_{cc} - V_d}{I_{cc}}$$

Below is table of possible R_{cc} values.

Recommended Bias Resistor Values, $I_{cc} = 50\text{ mA}$, $V_d = 3.8\text{ V}$						
Power Supply Voltage, V_{cc} (V)	5	8	10	12	15	20
Bias Resistor, R_{cc} (Ω)	24	84	124	164	224	324

5. Mechanical Data

5.1 AKA-1400D Outline Drawing



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