Sales: 408-778-9952 | General: 408-778-4200 | Fax: 408-778-4300
Sales & Customer Support: sales@markimicrowave.com
Tech Support: support@markimicrowave.com

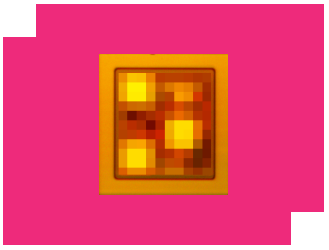
AKA-1400D

DC – 14 GHz Cascadable Broadband InGaP MMIC Amplifier

DEVICE OVERVIEW

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.



Features

- Small Die Size: 0.4mm x 0.43mm
- High P1dB
- +28dBm OIP3, 17dB Gain at 2GHz
- Single Power Supply Operation
- Low-Cost

Applications

- 5G transceivers
- Radar
- SATCOM
- Driver Amplifier L-Diode Mixers
- Mobile test and measurement equipment

Functional Block Diagram

N/A

Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
AKA-1400D	DC – 14 GHz Cascadable Broadband InGaP MMIC Amplifier	CH	REACH RoHS	Released	EAR99

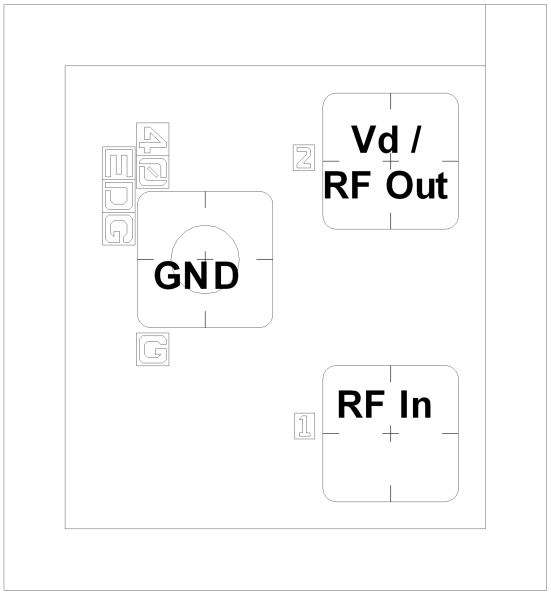
Table Of Contents

Revision History

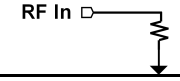
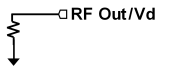
Revision Code	Revision Date	Comment
-	2021-05-01	Datasheet Initial Release

Port Configuration and Functions

Port Diagram



Port Functions

Port	Function	Description	Equivalent Circuit for Package
GND	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.	
RF In (1)	RF Input	This is the RF Input port of the amplifier die. It is RF matched to 50 Ω 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 Ω and is DC coupled.	

Specifications

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	Unit
Maximum Operating Temperature	85	°C
Maximum Storage Temperature	150	°C
Max Junction Temperature for MTTF > 1E6 Hours	150	°C
Minimum Operating Temperature	-40	°C
Minimum Storage Temperature	-65	°C
Positive Bias Current (Icc)	80	mA
Power Dissipation	312	mW
RF Input Power	20	dBm
θ_Jc, Junction to Case Thermal Resistance	215	ºC/W

Package Information

Parameter	Details	Rating
ESD	250 to < 500 Volts	HBM Class 1A
Dimensions	-	0.40 x 0.43 mm

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.

Parameter	Min	Nominal	Max	Unit
Ambient Temperature	-40	25	85	°C
Positive DC Device Voltage (Vd)	3.7	3.8	3.9	V
Positive DC Current (Icc)	35	50	80	mA

Sequencing Requirements

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

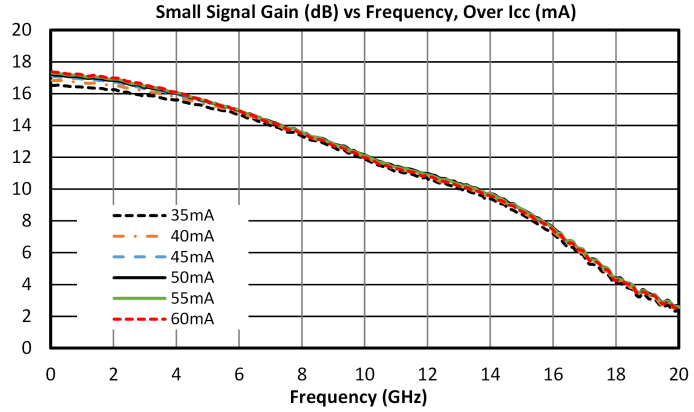
Electrical Specifications

The electrical specifications apply at TA=+25°C in a 50Ω system. Die are 100% DC tested and RF tested on a per lot basis.

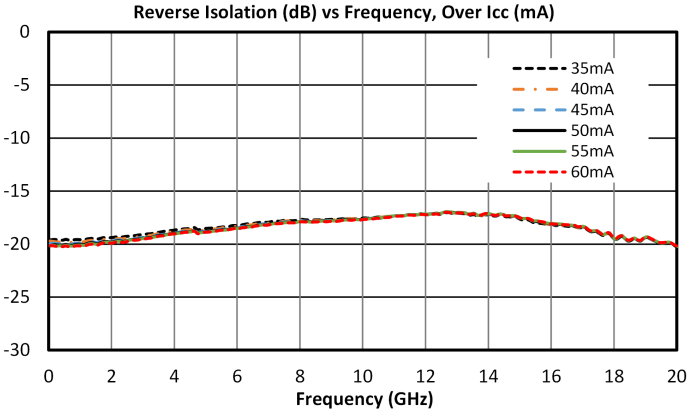
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Device Current, Icc	Vd = +3.8V	-	-	-	50	-	mA
Input Return Loss	Vd = +3.8 V, Icc = 50 mA	0.1	14	-	20	-	dB
Noise Figure	Vd = +3.8 V, Icc = 50 mA	3	3	-	4	-	dB
Output IP3	Vd = +3.8 V, Icc = 50 mA	2	2	-	28	-	dBm
Output P1dB	Vd = +3.8 V, Icc = 50 mA	6	14	-	13	-	dBm
Output P1dB	Vd = +3.8 V, Icc = 50 mA	2	6	-	15	-	dBm
Output Return Loss	Vd = +3.8 V, Icc = 50 mA	0.1	14	-	18	-	dB
Reverse Isolation	Vd = +3.8 V, Icc = 50 mA	0.1	14	-	18	-	dB
Small Signal Gain	Vd = +3.8 V, Icc = 50 mA	12	14	9	10	-	dB
Small Signal Gain	Vd = +3.8 V, Icc = 50 mA	0.1	1	16	17	-	dB
Small Signal Gain	Vd = +3.8 V, Icc = 50 mA	6	12	11	12	-	dB
Small Signal Gain	Vd = +3.8 V, Icc = 50 mA	4	6	14	15	-	dB
Small Signal Gain	Vd = +3.8 V, Icc = 50 mA	1	4	15	16	-	dB

Typical Performance Plots

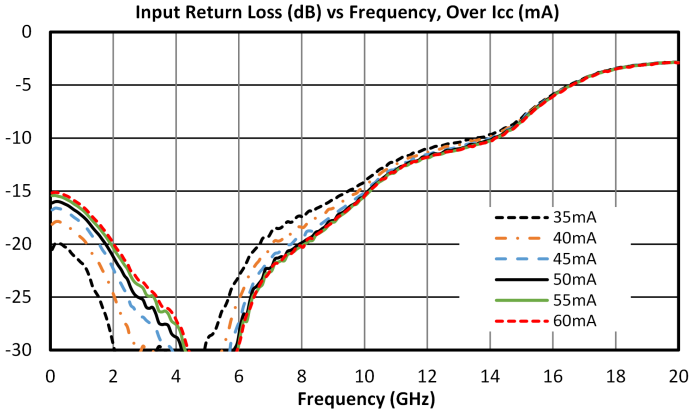
Small Signal Gain (dB) vs Frequency, Over Icc (mA)



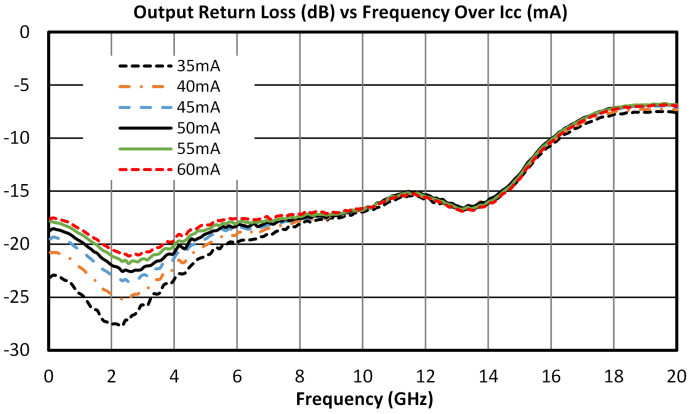
Reverse Isolation (dB) vs Frequency, Over Icc (mA)



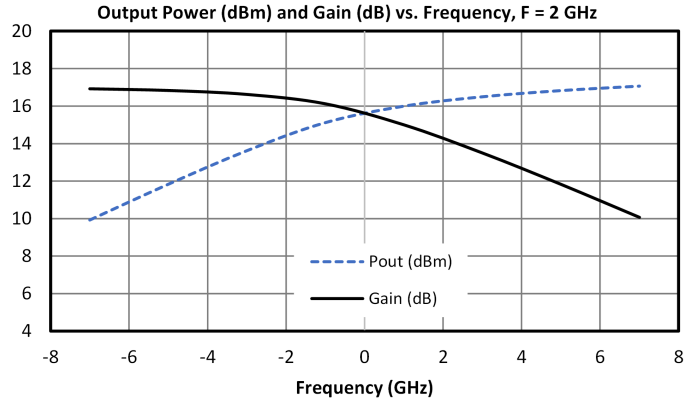
Input Return Loss (dB) vs Frequency, Over Icc (mA)



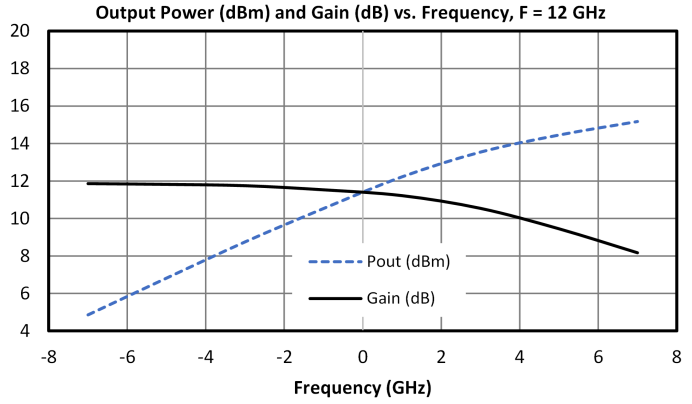
Output Return Loss (dB) vs Frequency Over Icc (mA)



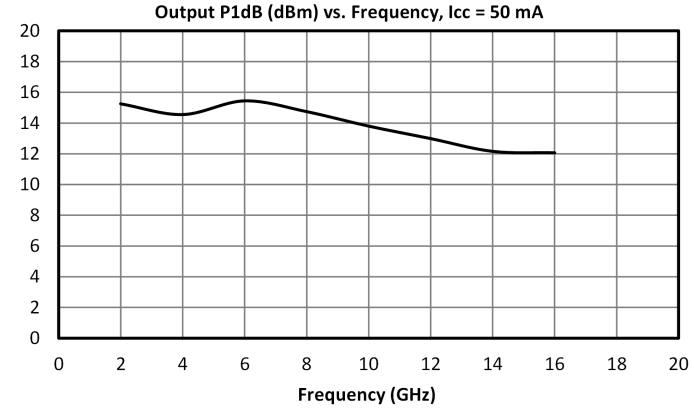
Output Power (dBm) and Gain (dB) vs. Frequency, F = 2 GHz



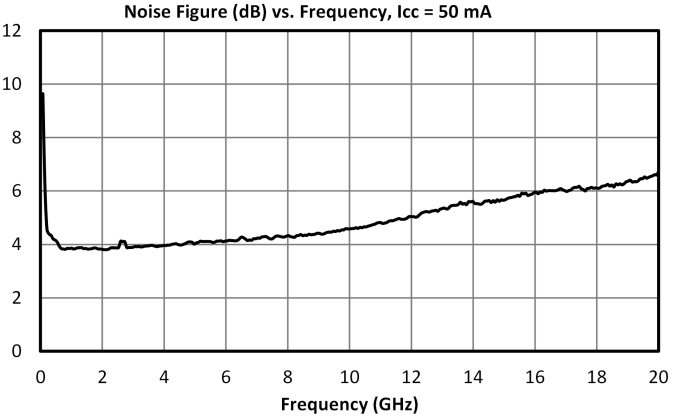
Output Power (dBm) and Gain (dB) vs. Frequency, F = 12 GHz

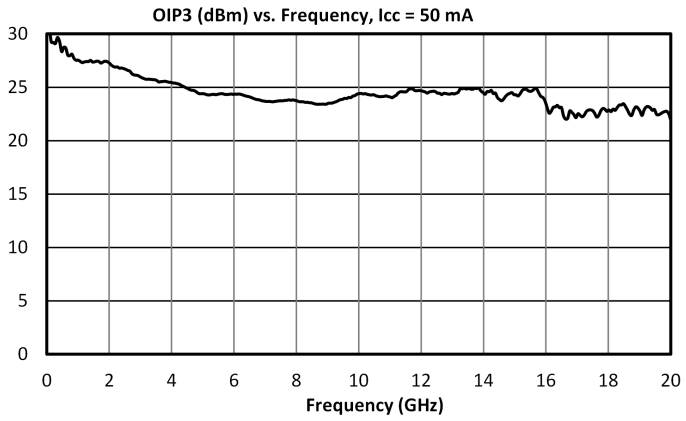


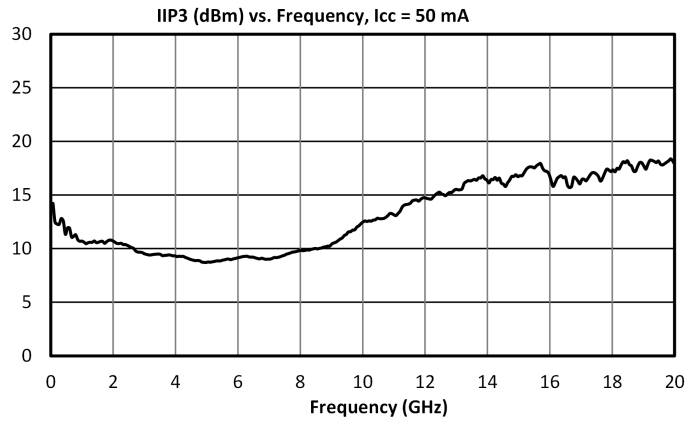
Output P1dB (dBm) vs. Frequency, Icc = 50 mA



Noise Figure (dB) vs. Frequency, Icc = 50 mA



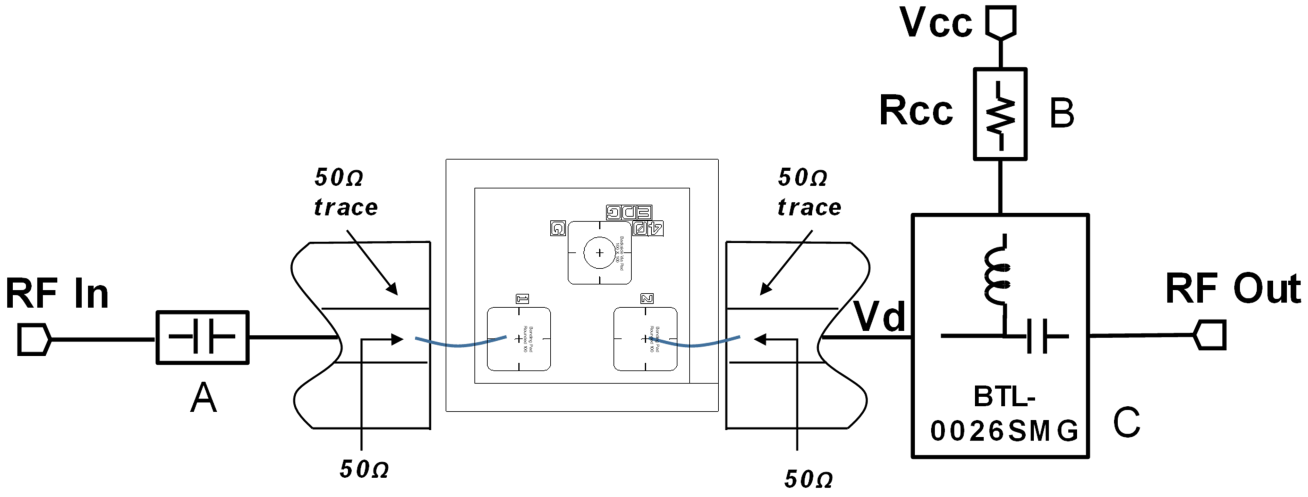




Application Information

Below is the recommended application circuit for the AKA-1400D. Application circuit not drawn to scale. AKA-1400D chip is enlarged for viewing purposes.

Application Circuit



Application Circuit Description

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

The supply voltage, Vcc, is dropped to the device voltage, Vd, through the biasing resistor, Rcc. To calculate the appropriate value of this resistor, the designer simply uses the available power supply voltage and chosen bias current as follows.

$$Rcc = \frac{Vcc - Vd}{Icc}$$

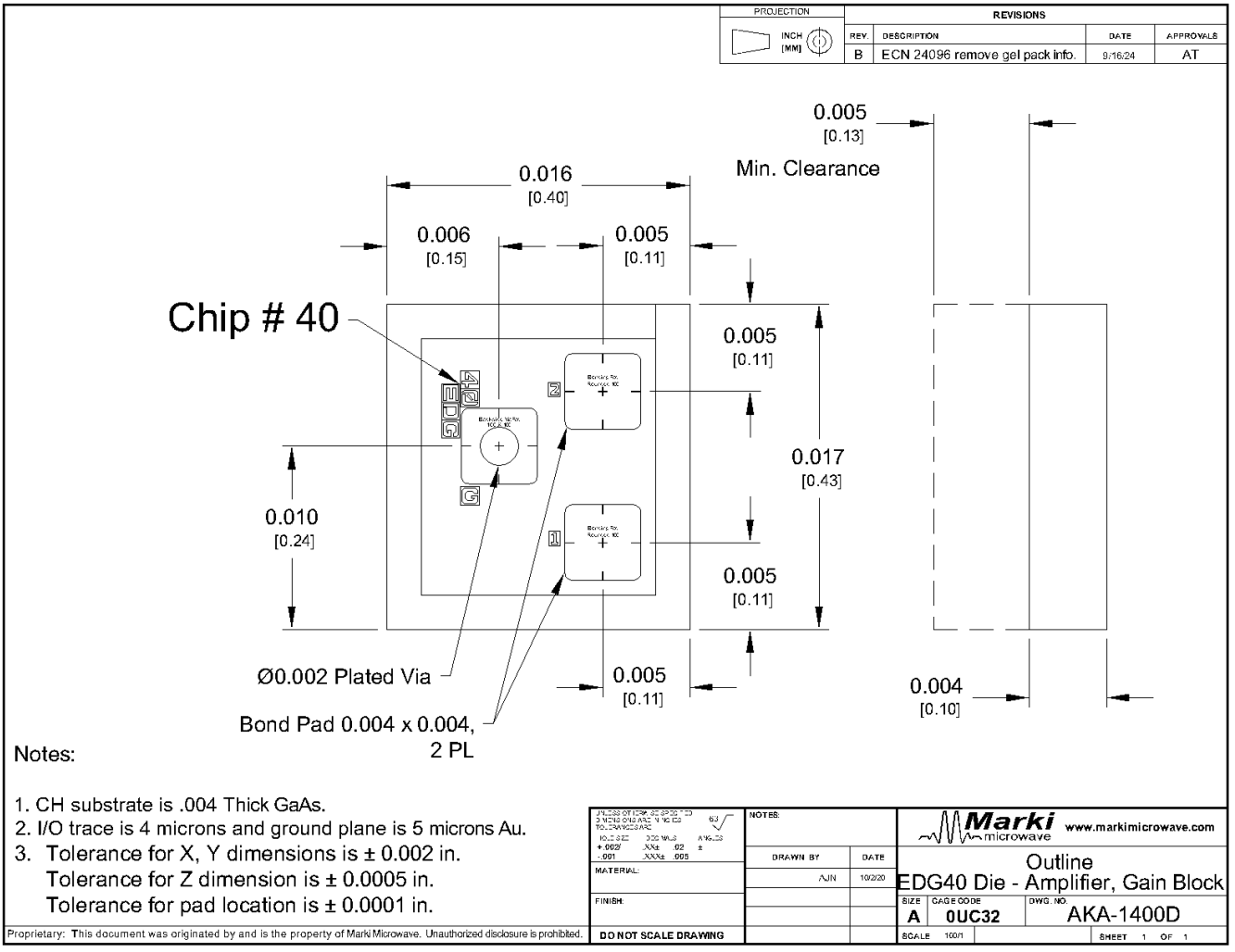
Below is table of possible Rcc values.

Recommended Bias Resistor Values, Icc = 50 mA, Vd = 3.8 V						
Power Supply Voltage, Vcc (V)	5	8	10	12	15	20
Bias Resistor, Rcc (Ω)	24	84	124	164	224	324

Mechanical Data

Outline Drawing

Download : Outline 2D Drawing



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