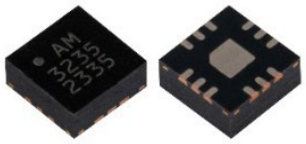
AM1135 – Amplifier

6 GHz to 26.5 GHz Variable Gain

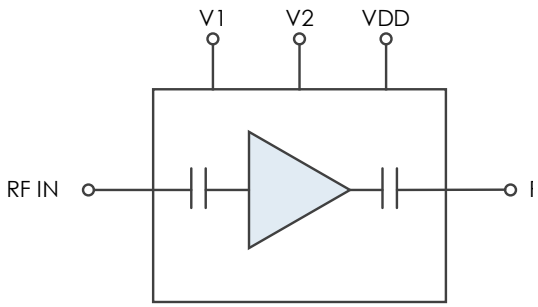


The AM1135 is a wideband digitally controlled variable gain amplifier that covers the 6-26.5 GHz frequency range. It provides 2dB of gain variation with approximately equal steps of 0.6dB. Output IP3, P1dB, and noise figure are decoupled from the gain variation, so the AM1135 provides consistent noise figure and nonlinear performance for any gain state. The device is packaged in a 3mm QFN with internal 50Ω matching and draws 140mW of DC power which makes the AM1135 ideal for demanding, low SWaP applications.

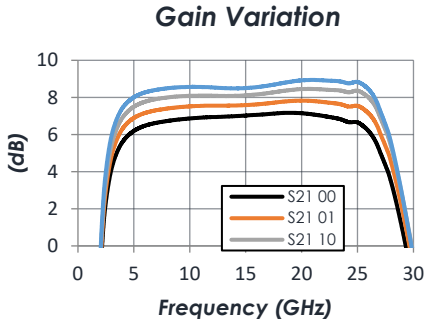
FEATURES

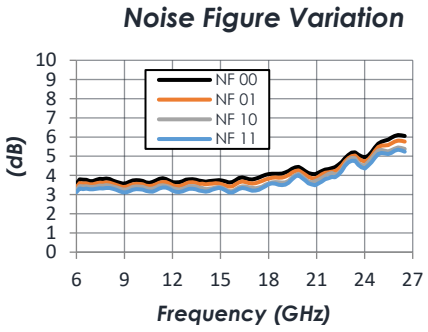
- 20 dB Gain 2 dB Gain Variation
- 7-9 dB Gain
- 3.5 dB Noise Figure
- +25 dBm OIP3
- +13 dBm P1dB
- 140 mW DC Power Consumption
- +3.3V VDD and Control
- 3mm QFN Package
- -40C to +85C Operation
- Unconditionally Stable

FUNCTIONAL DIAGRAM



CHARACTERISTIC PERFORMANCE



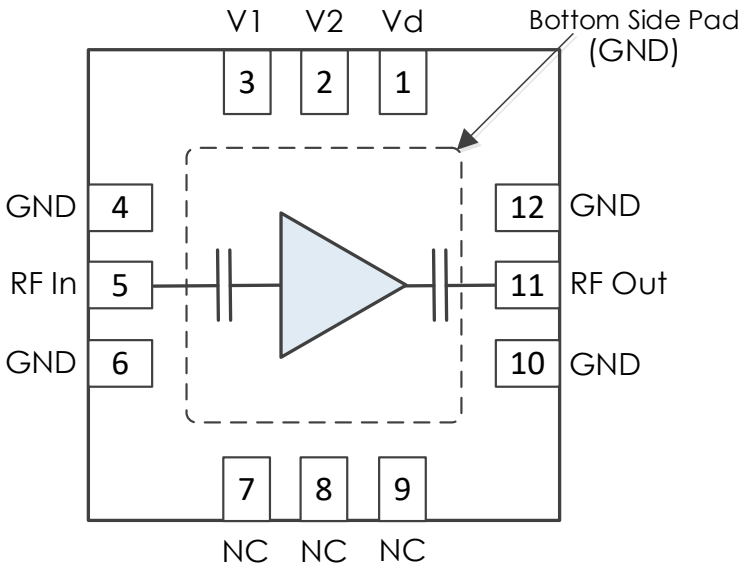


CONTENTS

REVISION HISTORY

Date	Revision	Notes
December 9, 2021	1	Initial Release
April 26, 2024	1.1	Various notes modified.
February 10, 2025	2.0	Changed to Mercury branding. No content changes.

PIN LAYOUT AND DEFINITIONS



Pin	Name	Function
1	Vd	DC Power Input
2	V2	Control Voltage 2
3	V1	Control Voltage 1
4	GND	Ground – Common
5	RF In	RF Input – 50 Ohms – AC Coupled
6	GND	Ground – Common
7-9	NC	Not Connected *
10	GND	Ground – Common
11	RF OUT	RF Output – 50 ohms – AC Coupled
12	GND	Ground – Common

* NC pins may be grounded or left floating.

SPECIFICATIONS

Absolute Maximum Ratings

	Minimum	Maximum
Supply Voltage	-0.3 V	+3.6 V
RF Input Power		+20 dBm
Storage Temperature Range	-55C	+150 C

Note: Any device operation beyond the Absolute Maximum Ratings may result in permanent damage to the device. The values listed in this table are extremes and do not imply functional operation of the device at these or any other conditions beyond what is listed under Recommended Operating Conditions. Devices subjected to conditions outside of what is recommended for extended periods may affect device reliability.

Handling Information

	Minimum	Maximum
Moisture Sensitivity Level	MSL 3	

Mercury products are electrostatic sensitive.
Follow safe handling practices to avoid damage.

Recommended Operating Conditions

	Minimum	Typical	Maximum
Supply Voltage		+3.3 V	
Operating Case Temperature	-40 C		+85 C

Thermal Information

	Thermal Resistance (°C / W)
Thermal Resistance (channel to center ground paddle)	445 C/W
Nominal Junction Temperature at +85C Ambient	+147 C
Channel Temperature to Maintain 1 Million Hour MTTF	+175 C

DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

Param	Testing Conditions	Min	Typical	Max
DC Supply Voltage			+3.3 V	
DC Supply Current	All States, VDD = +3.3V		42 mA	
Power Dissipated	VDD = +3.3V		140 mW	0.35 W
Logic Level Low		-0.1 V		+0.4 V
Logic Level High		+2.0 V		+3.3 V
DC Control Current	VDD = +3.3V		<100 µA	

Timing Characteristics

(T = 25 °C unless otherwise specified)

Param	Minimum	Typical	Maximum
Switching Speed		20 ns	

Note: Timing Characteristics measured from 50% control to 90% RF.

State Table

(T = 25 °C unless otherwise specified)

V1	V2	Gain (20 GHz)
Low	Low	7.1 dB
Low	High	7.8 dB
High	Low	8.5 dB
High	High	8.9 dB

RF Performance

(T = 25 °C unless otherwise specified)

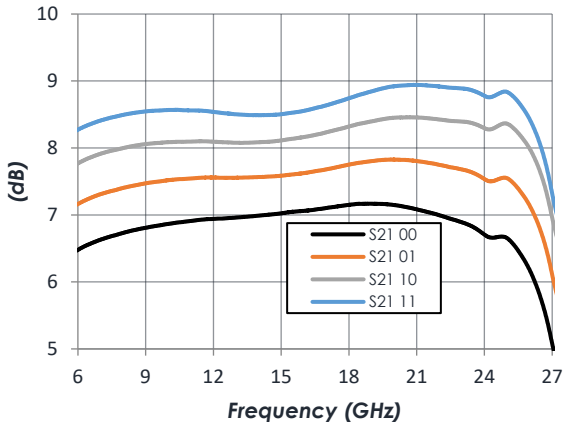
Param	Testing Conditions	Min	Typical	Max
Frequency Range		6 GHz		26.5 GHz
Gain	State 00, f=16 GHz		7.0 dB	
	State 01, f=16 GHz		7.6 dB	
	State 10, f=16 GHz		8.1 dB	
	State 11, f=16 GHz		8.6 dB	
Return Loss	State 00, f=16 GHz		-10.5 dB	
	State 01, f=16 GHz		-9.4 dB	
	State 10, f=16 GHz		-8.8 dB	
	State 11, f=16 GHz		-7.9 dB	
Output IP3	f = 16 GHz		+25 dBm	
Output P1dB	f = 16 GHz		+13 dBm	
Noise Figure	State 00, f=16 GHz		3.8 dB	
	State 01, f=16 GHz		3.7 dB	
	State 10, f=16 GHz		3.4 dB	
	State 11, f=16 GHz		3.3 dB	

*Note: OIP3 measured with 10MHz tone spacing

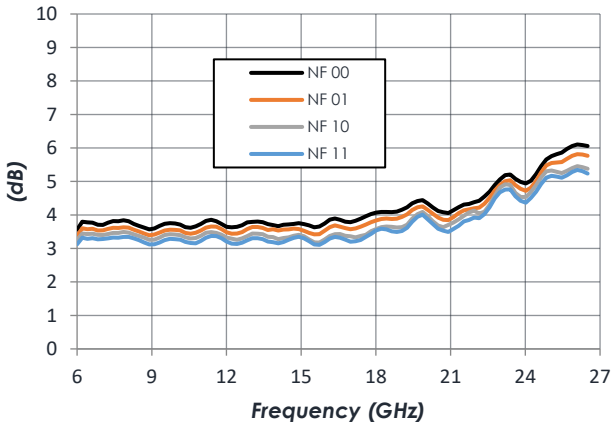
TYPICAL PERFORMANCE

(T = 25 °C unless otherwise specified)

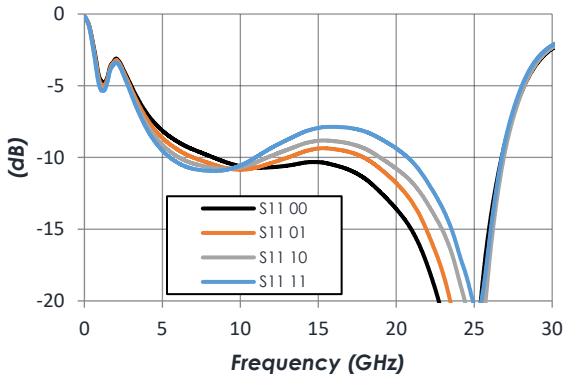
Gain Variation



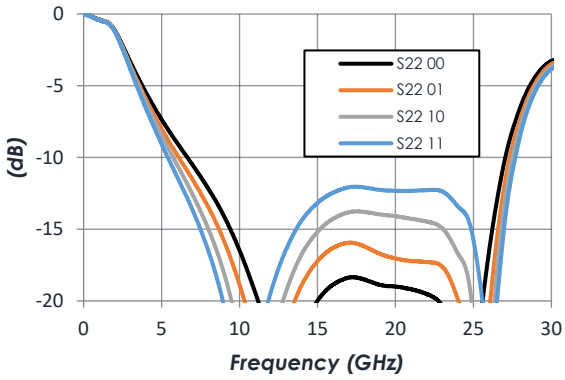
Noise Figure Variation



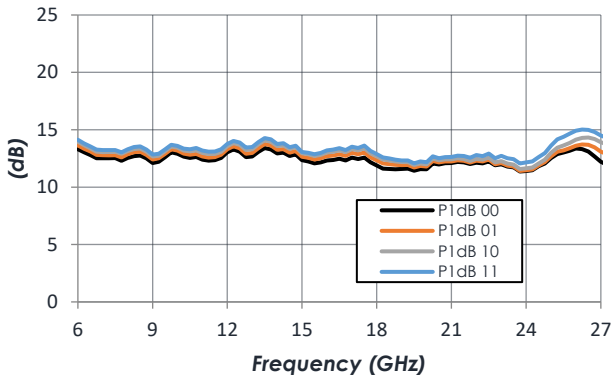
Input Return Loss Variation



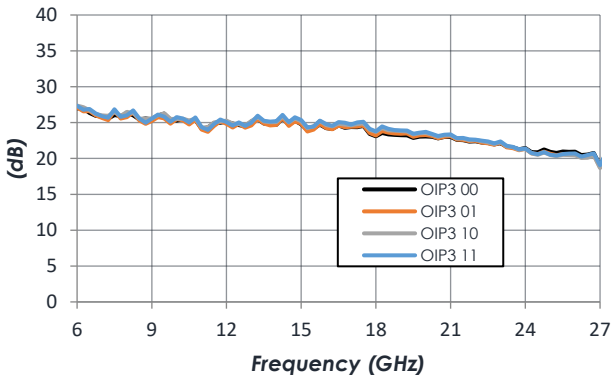
Output Return Loss Variation



P1dB Variation



OIP3 Variation

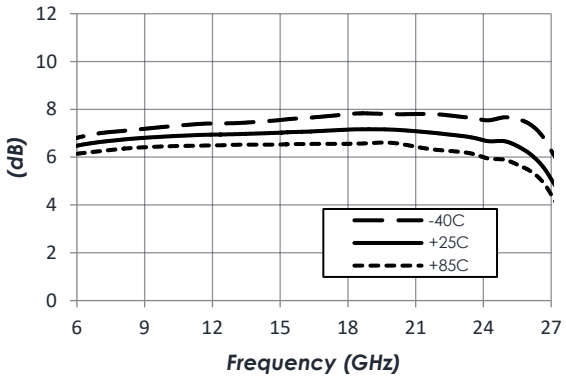


*Note: ID = ID2 + IDSW

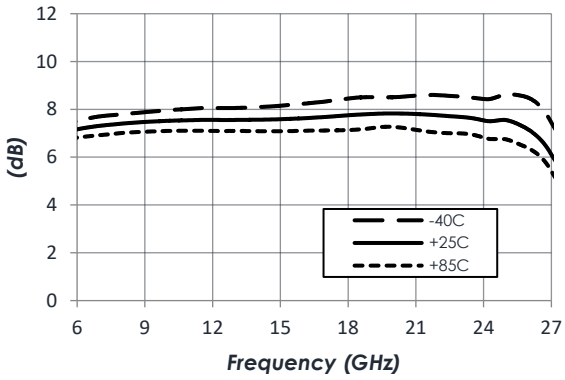
TYPICAL PERFORMANCE (CONTINUED)

(T = 25 °C unless otherwise specified)

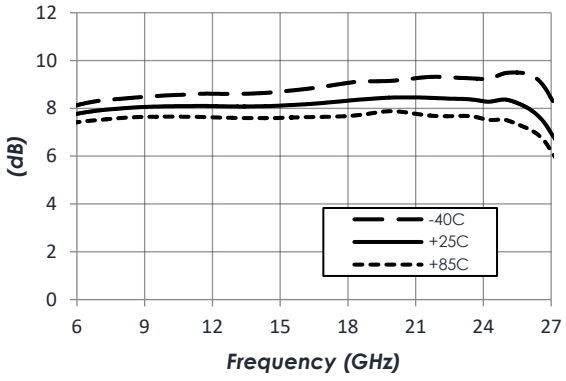
Gain vs Temperature State 00



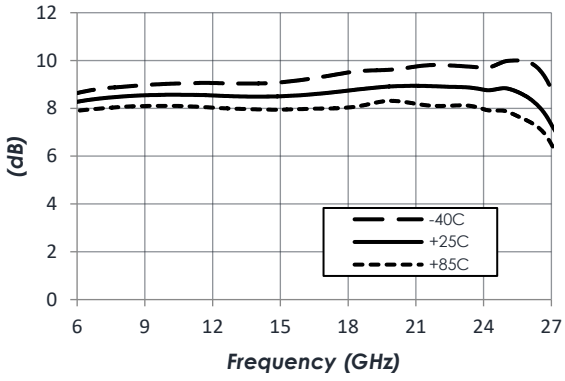
Gain vs Temperature State 01



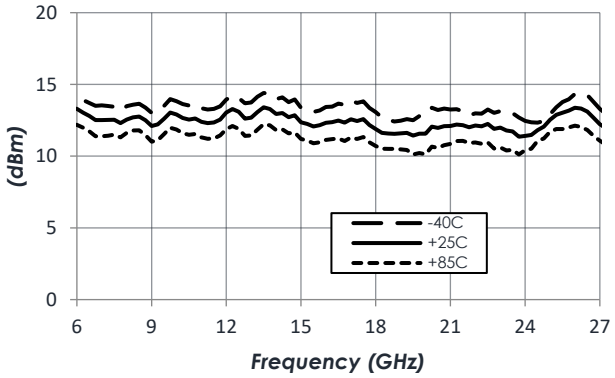
Gain vs Temperature State 10



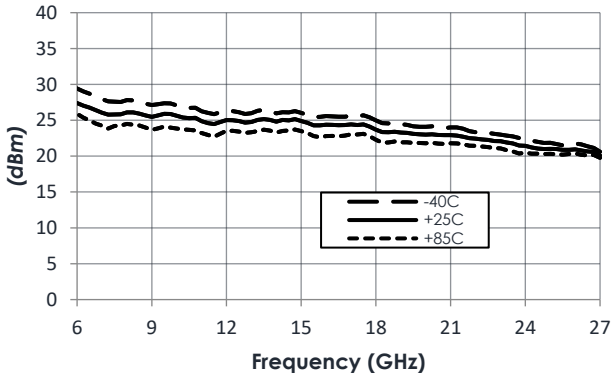
Gain vs Temperature State 11



P1dB vs Temperature



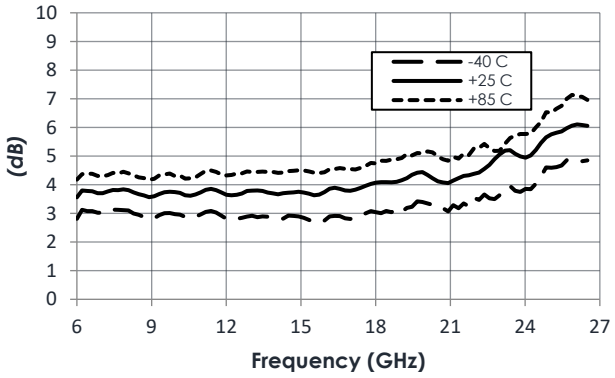
Output IP3 vs Temperature



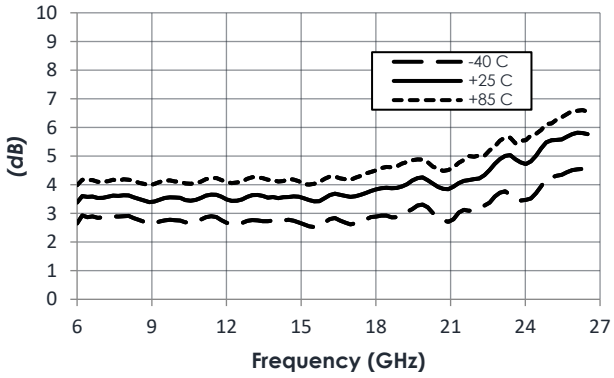
TYPICAL PERFORMANCE (CONTINUED)

(T = 25 °C unless otherwise specified)

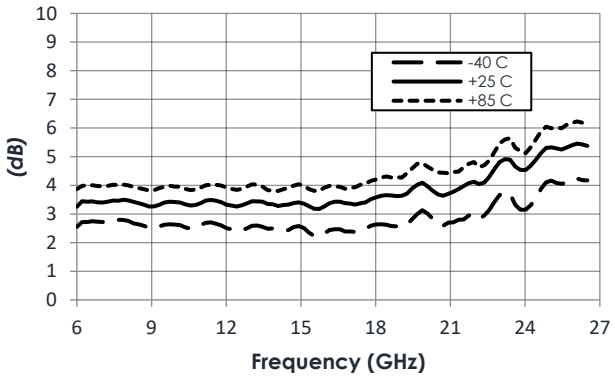
Noise Figure vs Temperature State 00



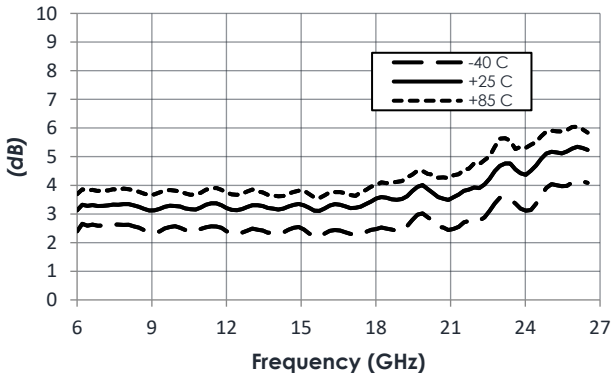
Noise Figure vs Temperature State 01



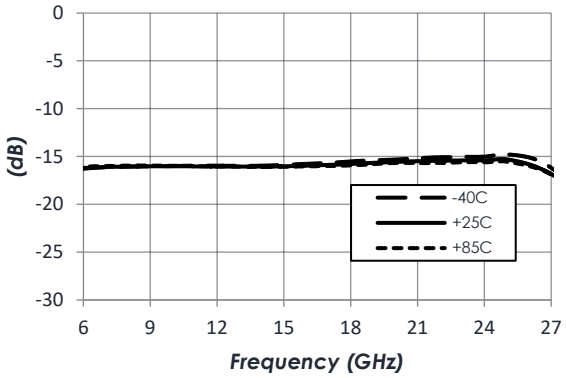
Noise Figure vs Temperature State 10



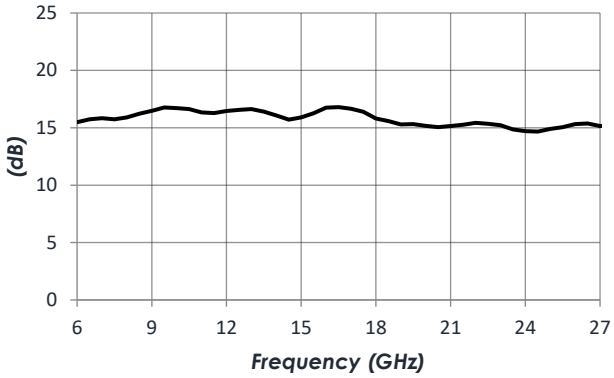
Noise Figure vs Temperature State 11



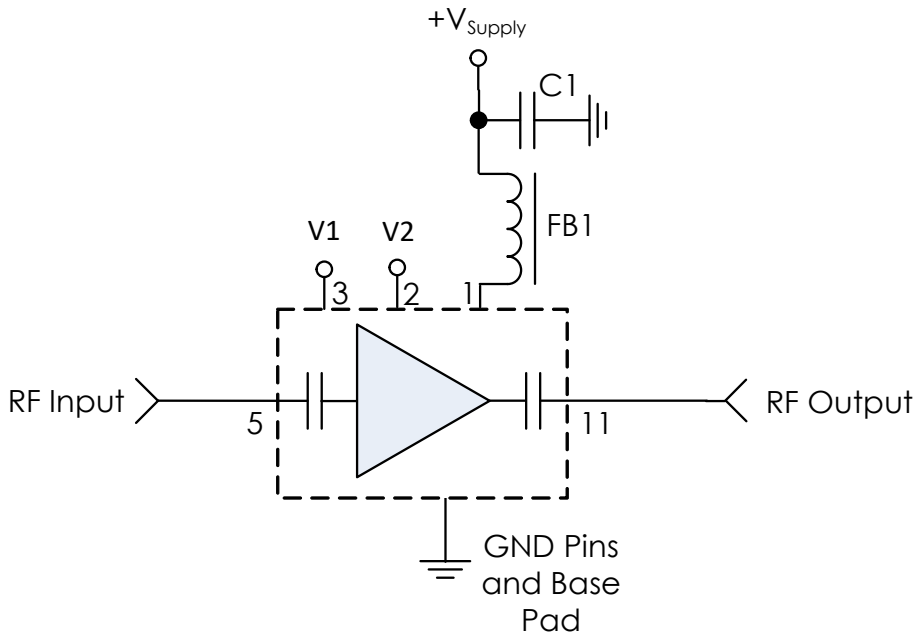
Typical Reverse Isolation vs Temperature



Power Saturation State 11



TYPICAL APPLICATION



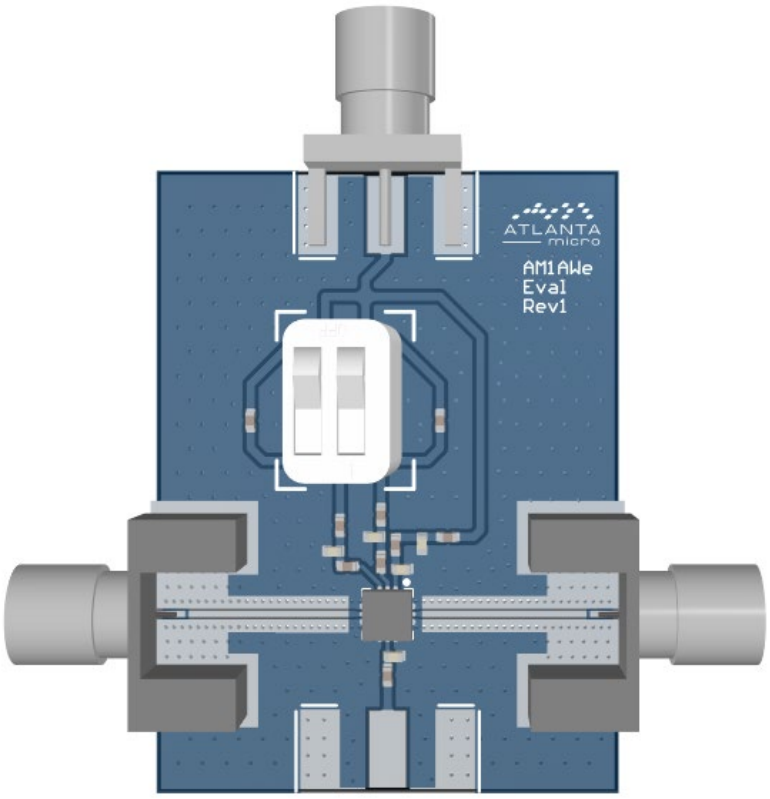
Recommended Component List (or Equivalent)

Part	Value	Part Number	Manufacturer
C1	0.1 µF	C1005X7R1H104K05BB	TDK
FB1	-	MMZ1005A222E	TDK

Notes:

1. Control lines are filtered internally providing high frequency isolation.
2. AM1135 is AC coupled. No external DC blocking caps are required.

EVALUATION PC BOARD



RELATED PARTS

Part Number		Description
AM1101	2 GHz to 26.5 GHz	Bypassable Amplifier
AM1134	6 GHz to 26.5 GHz	Low Noise Amplifier
AM1145	2 GHz to 18 GHz	Variable Slope Amplifier
AM1146	2 GHz to 18 GHz	Variable Gain Amplifier

COMPONENT COMPLIANCE INFORMATION

RoHS: Mercury Systems, Inc. hereby certifies that all products comply with the EC Directive 2011/65/EC on the Restriction of Hazardous Substances, commonly known as EU-RoHS 6 and 10. All products supplied by Mercury shall be compliant with the European Directive 2011/65/EC based on the following substance list.

Substance List	Allowable Maximum Concentration
Lead (Pb)	<1000 PPM (0.1% by weight)
Mercury (Hg)	<1000 PPM (0.1% by weight)
Cadmium (Cd)	<75 PPM (0.0075% by weight)
Hexavalent Chromium (CrVI)	<1000 PPM (0.1% by weight)
Polybrominated Biphenyls (PBB)	<1000 PPM (0.1% by weight)
Polybrominated Diphenyl ethers (PBDE)	<1000 PPM (0.1% by weight)
Decabromodiphenyl Deca BDE	<1000 PPM (0.1% by weight)
Bis (2-ethylheyl) Phthalate (DEHP)	<1000 PPM (0.1% by weight)
Butyl Benzyl Phthalate (BBP)	<1000 PPM (0.1% by weight)
Dibutyl Phthalate (DBP)	<1000 PPM (0.1% by weight)
Diisobutyl Phthalate (DIBP)	<1000 PPM (0.1% by weight)

REACH: Mercury Systems, Inc. neither uses nor intentionally adds any of the substances considered to be a Substance of Very High Concern (SVHC) as defined by the EU Regulation (EC) No. 1907-2006 on Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH).

Conflict Materials: Mercury does not knowingly use materials that are sourced from the Democratic Republic of Congo (DRC) or any other known conflict regions. Mercury's supply chain is comprised of sources that are both environmentally and socially responsible. We periodically review this requirement with our vendors to ensure continued compliance.

Mercury takes its responsibility as a global partner seriously and will use due diligence within our supply chain to ensure all standards are met to the best of our knowledge.

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