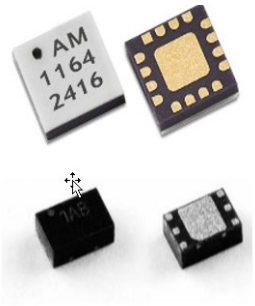
AM1164 – Amplifier

DC to 8 GHz Gain Block

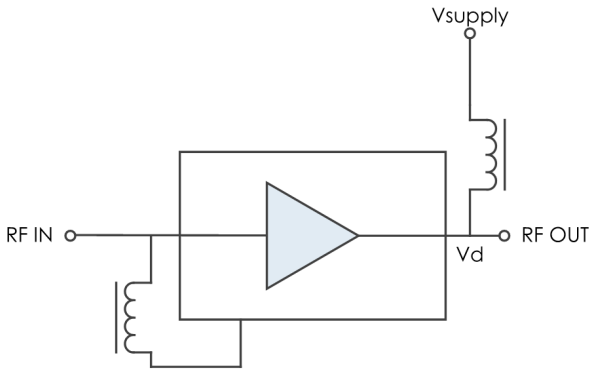


The AM1164 is a high dynamic range DC-coupled amplifier covering up to 8 GHz. The device exhibits a moderate positive gain-slope, providing frequency equalization useful in many broadband applications. AM1164 provides similar performance to Mercury's AM1064 with the benefit of improved low frequency NF. With internal 50Ω matching and packaged in a 1.3mm x 2.0mm DFN, a 3mm QFN or a shielded module, the AM1164 represents a compact total PCB footprint.

FEATURES

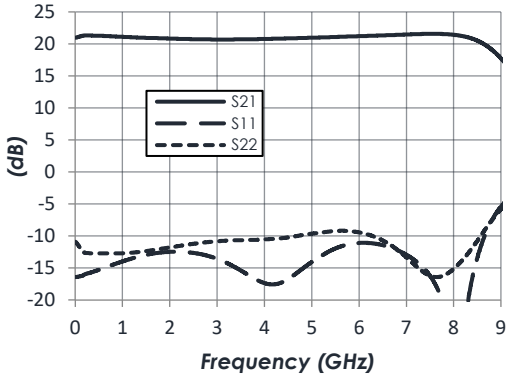
- 21 dB Gain
- 1.5 dB Noise Figure
- +33 dBm OIP3
- +18 dBm P1dB
- +3.3V or +5.0V Operation
- 3mm QFN or 1.3mm x 2mm DFN
- -40C to +85C Operation

FUNCTIONAL DIAGRAM

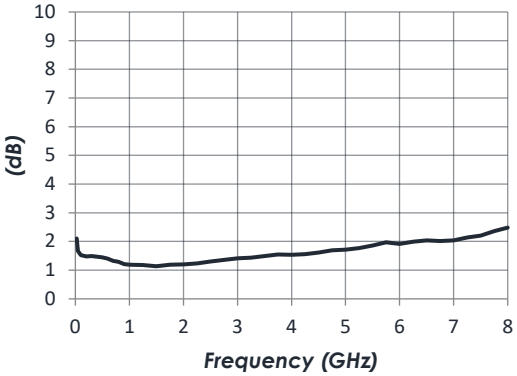


CHARACTERISTIC PERFORMANCE

Gain and Return Loss at +25C



Noise Figure at +25C



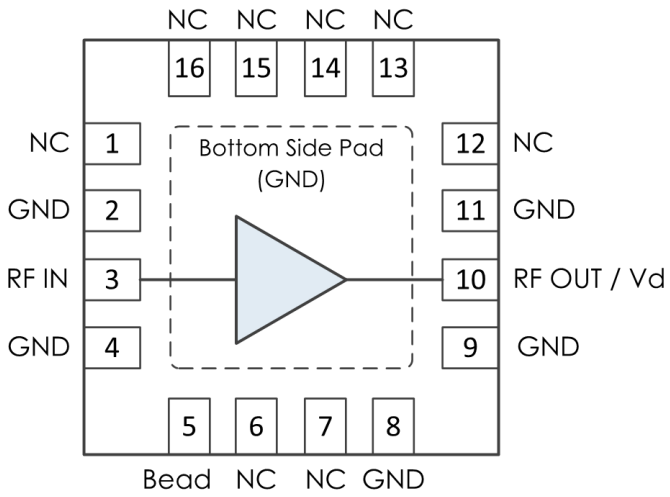
CONTENTS

REVISION HISTORY

Date	Revision	Notes
June 28, 2019	1	Preliminary Release
July 23, 2019	2	Added 1.3mm x 2mm DFN details.
September 6, 2019	2A	Added 1.3mm x 2mm DFN picture.
November 25, 2019	3	RF-Shielded Module Information Added, Updated packaging options in Description, Part Ordering Details Added
November 11, 2020	4	Package and Module information moved to main product page on website.
September 20, 2021	5	Updated s-parameter plots.
January 30, 2024	6	Updated thermal information and address.
June 18, 2024	7	Changed to Mercury branding. No content changes.
September 17, 2025	8	Updated image for Eval Board Rev2

PIN LAYOUT AND DEFINITIONS

AM1164-1: 3mm QFN

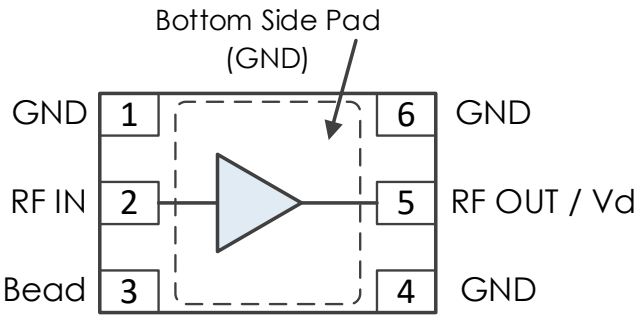


Pin	Name	Function
1	NC	Not Connected *
2	GND	Ground – Common
3	RF IN	RF Input – 50 ohms – DC Coupled, External DC Block Required
4	GND	Ground – Common
5	Bead	Connect to RF In through external ferrite bead or large inductor
6, 7	NC	Not Connected *
8, 9	GND	Ground – Common
10	RF Out / Vd	DC Power Input
11	GND	Ground – Common
12-16	NC	Not Connected *
Case GND	GND	Ground – Common

* NC pins may be grounded or left open.

PIN LAYOUT AND DEFINITIONS (CONTINUED)

AM1064-2: 1.3mm x 2mm DFN



Pin	Name	Function
1	GND	Ground – Common
2	RF IN	RF Input – 50 ohms – DC Coupled, External DC Block Required
3	Bead	Connect to RF In through external ferrite bead or large inductor
4	GND	Ground – Common
5	RF Out	RF Output – 50 Ohms – DC Coupled. External DC Blocking Capacitor Required
6	GND	Ground – Common

SPECIFICATIONS

Absolute Maximum Ratings

	Minimum	Maximum
Supply Voltage	-0.3 V	+8.0 V
RF Input Power		+20 dBm
Operating Junction Temperature	-40 C	+150 C
Storage Temperature Range	-50C	+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
Storage Temperature Range (Recommended)	-50 C	+125 C
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	+2.7 V		+5.2 V
Operating Case Temperature	-40 C		+85 C
Operating Junction Temperature	-40 C		+125 C

Thermal Information

	Thermal Resistance (°C / W)
Junction to Case Thermal Resistance (θ_{JC})	103 C/W
Nominal Junction Temperature at +85C Ambient	129 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		+3.0 V	+4.7 V	+5.0 V
DC Supply Current	Vd = 3.1 V		35 mA	
	Vd = 3.3 V		40 mA	
	Vd = 4.7 V		77 mA	
	Vd = 5.0 V		85 mA	
Power Dissipated	Vd = 3.1 V		0.11 W	
	Vd = 3.3 V		0.13 W	
	Vd = 4.7 V		0.36 W	
	Vd = 5.0 V		0.43 W	

RF Performance

((T = 25 °C unless otherwise specified)

Param	Testing Conditions	Min	Typical	Max
Frequency Range		DC		8 GHz
Gain	Vd = 5.0 V		21 dB	
Return Loss	Vd = 5.0 V		11 dB	
Output IP3			+32 dBm	
Output P1dB			+18 dBm	
Noise Figure			1.5 dB	

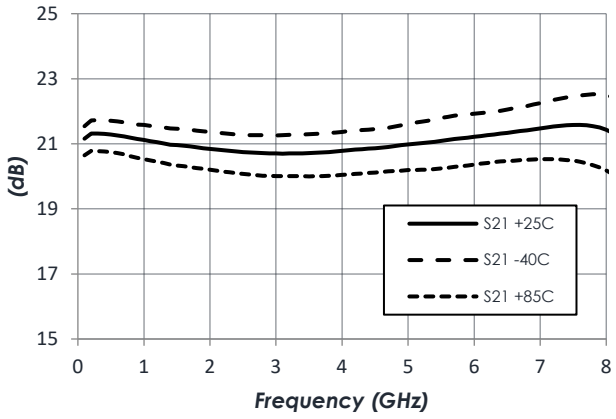
Notes:

1. OIP3 shown was measured at 10 MHz input tone spacing.
2. All performance metrics were measured using the recommended MMZ1005A222E ferrite bead connecting RF In and the Bead pin (see Typical Application section).

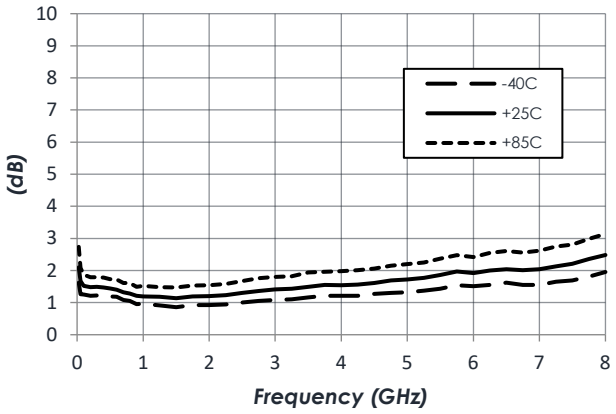
TYPICAL PERFORMANCE

(Vd = +5.0 V, Id = 85 mA)

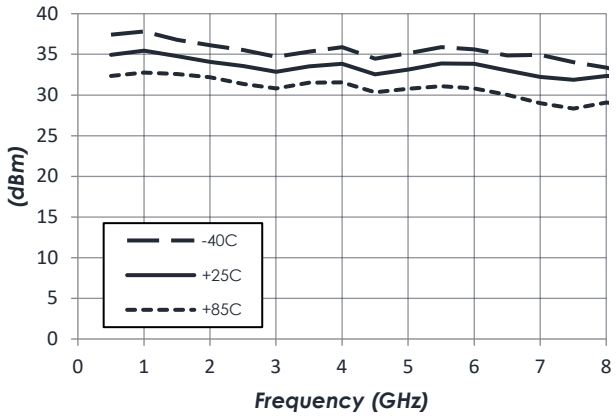
Gain vs Temperature



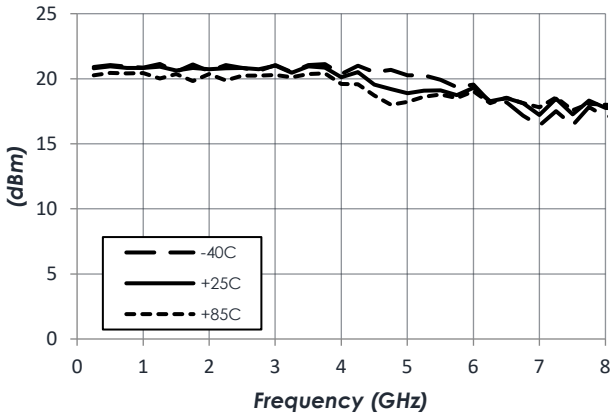
Noise Figure vs Temperature



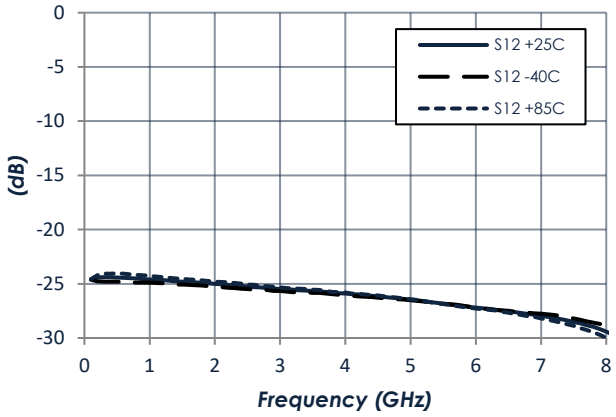
Output IP3 vs Temperature



P1dB vs Temperature



Reverse Isolation vs Temperature

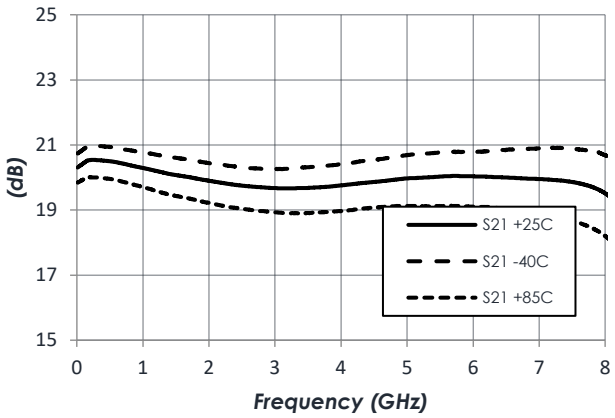


*Note: ID = ID2 + IDSW

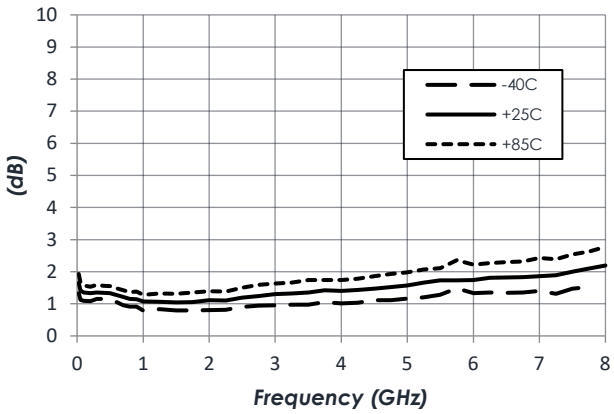
TYPICAL PERFORMANCE (CONTINUED)

Vd = +3.3 V, Id = 40 mA)

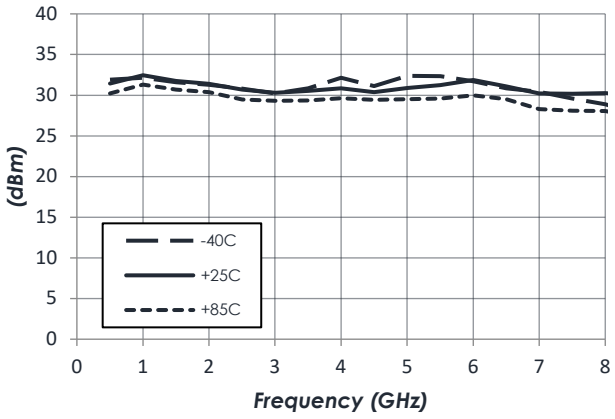
Gain vs Temperature



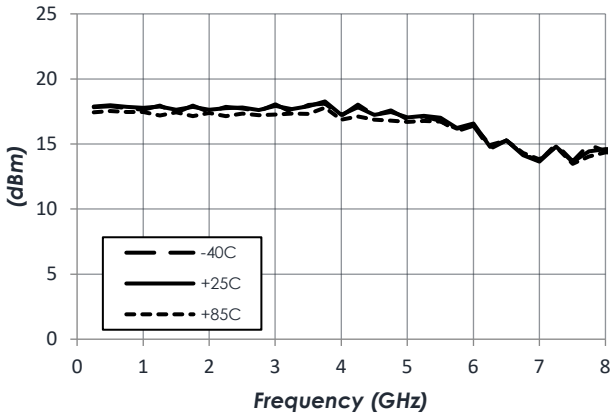
Noise Figure vs Temperature



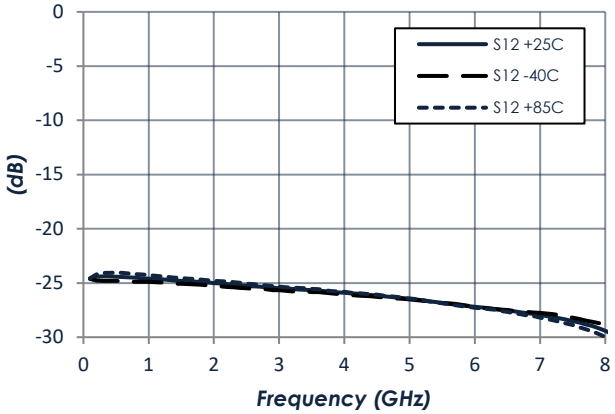
Output IP3 vs Temperature



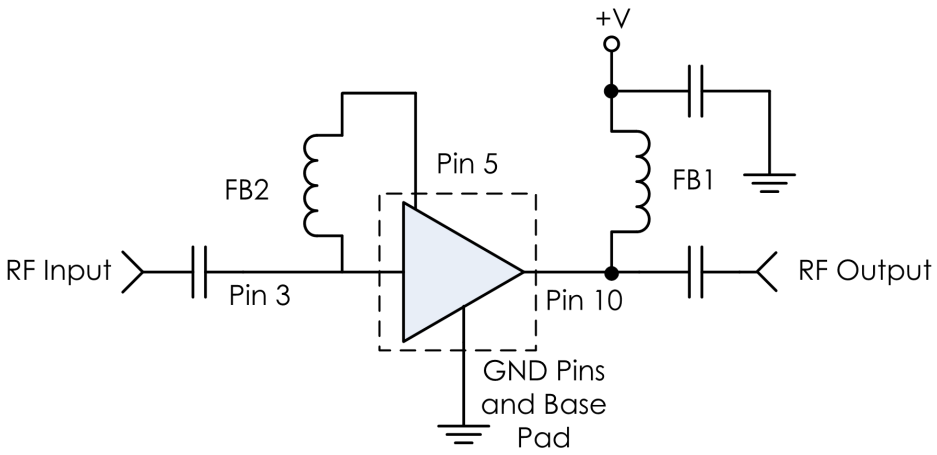
P1dB vs Temperature



Reverse Isolation vs Temperature



TYPICAL APPLICATION



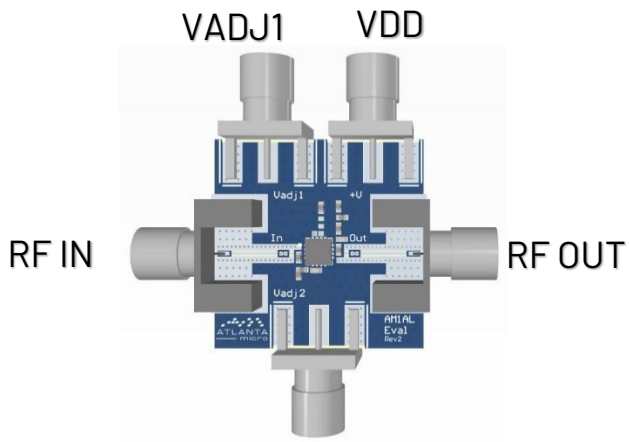
Recommended Component List (or Equivalent)

Part	Value	Part Number	Manufacturer
C1, C2	0.1 µF	0402BB104KW160	Passives Plus
C3	0.1 µF	GRM155R71C104KA88	Murata
FB1		MMZ1005A222E	TDK
FB2		MMZ1005A222E	TDK

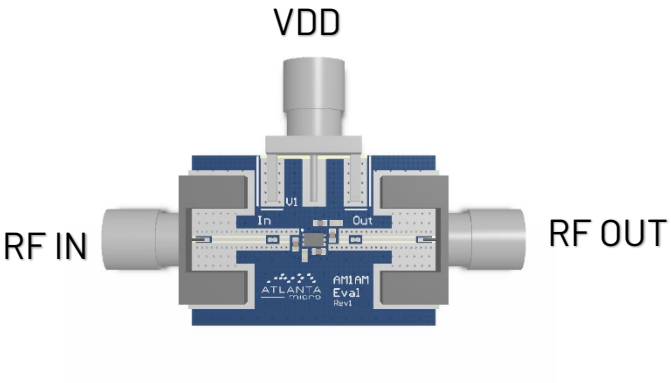
Notes:

1. NC pins may be grounded or left open.
2. RF blocking capacitors should be high performance, low-loss, broadband capacitors for optimum performance.
3. FB2 can be substituted for a different bead or inductor to extend performance to lower frequencies.

EVALUATION PC BOARD



AM 1164-1 Eval



AM 1164-2 Eval

PART ORDERING DETAILS

Part Number	Description
AM1164-1	3mm 16 Lead QFN
AM1164-2	1.3mm x 2mm 6 Lead DFN
AM1164-1 Eval	AM1164-1 Evaluation Board
AM1164-2	AM1164-2 Evaluation Board
AM1164-M	AM1164-1 in 0.95" x 1.13" x 0.6" RF-Shielded Module with Integrated Bias Tee and Field Replaceable SMA Connectors

RELATED PARTS

Part Number		Description
AM1163	DC to 10 GHz	Gain Block with External Bead
AM1163-1	DC to 10 GHz	Gain Block
AM1063-2	DC to 10 GHz	Miniature Gain Block
AM1064-1	DC to 8 GHz	Gain Block
AM1064-2	DC to 8 GHz	Bypassable Gain Block
AM1016B	20 GHz to 6 GHz	+3.3V Gain Block
AM1018C	20 MHz to 6 GHz	+5.0V Gain Block
AM1025B	20 MHz to 3 GHz	+8.0V Gain Block (High P1dB)
AM1031C	20 MHz to 8 GHz	+3.3V Gain Block
AM1065	DC to 8 GHz	Bypassable Gain Block
AM1073	DC to 8 GHz	Bidirectional / Bypassable Gain Block

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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