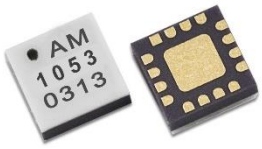
# AM1053 – Amplifier

## 5 GHz to 20 GHz Gain Block

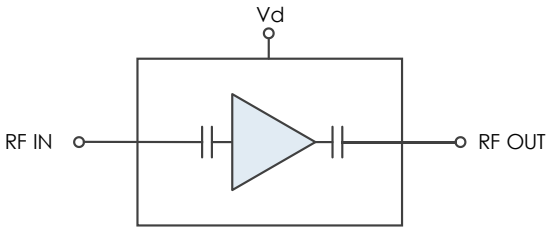



**The AM1053 is a high dynamic range cascadable gain block covering the 5 GHz to 20 GHz frequency range.** The device provides high gain and is capable of producing a +17 dBm output power with a single +3.3V supply, useful for many LO driver applications. The AM1053 exhibits a low noise figure, high third order intercept performance, and gain stability over the operating temperature range while offering internal 50Ω matching all packaged in a 3mm QFN or a shielded module.

### FEATURES

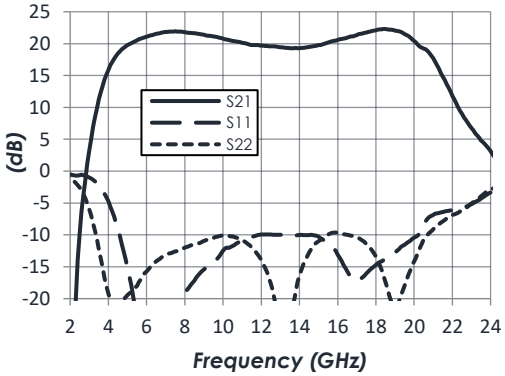
- 20 dB Gain TYP
- 2.5 dB Noise Figure
- +28 dBm OIP3
- +16 dBm P1dB
- +17 dBm Psat
- +3.3 V, 93 mA Supply
- 3mm QFN
- -40 C to +85 C Operation
- Unconditionally Stable
- No DC Blocking Caps Required

### FUNCTIONAL DIAGRAM

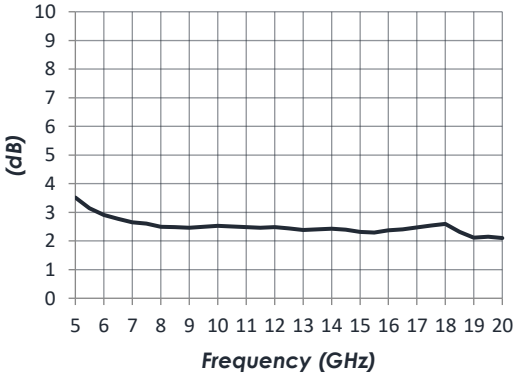



### CHARACTERISTIC PERFORMANCE

*Gain and Return Loss at +25C*




*Noise Figure at +25C*



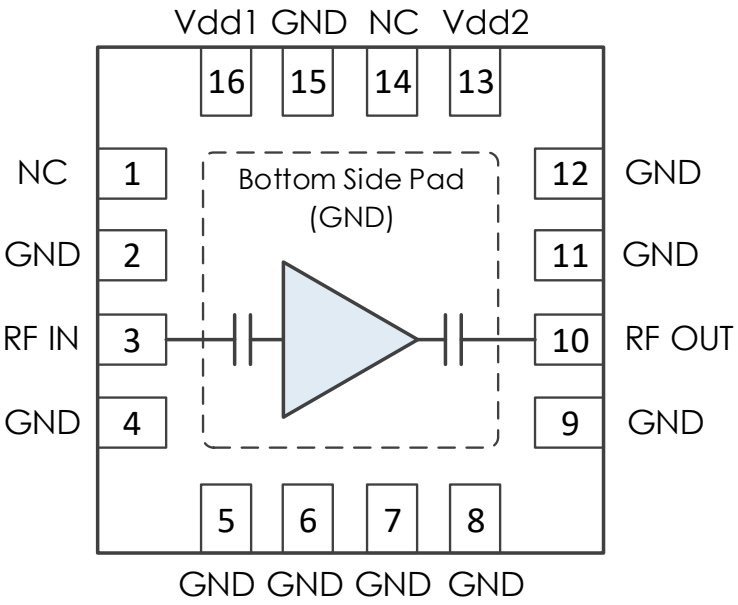
## CONTENTS



## REVISION HISTORY

| Date | Revision | Notes |
|---|---|---|
| January 20, 2017 | 5 | Office Location Updated |
| March 13, 2017 | 6 | Formatting Corrected, Typical Application Updated. |
| May 22, 2019 | 7 | Updated to Latest Datasheet Format. Various Plots Updated. |
| June 6, 2019 | 7A | Component Compliance Information Updated. |
| November 25, 2019 | 8 | RF-Shielded Module Information Added, Part Ordering Details Added |
| May 15, 2020 | 9 | Package and module information moved to main product page |
| November 7, 2024 | 10 | Changed to Mercury branding. No content changes. |

## PIN LAYOUT AND DEFINITIONS




| Pin | Name | Function |
|---|---|---|
| 1 | NC | Do Not Connect |
| 2 | GND | Ground - Common |
| 3 | RF In | RF Input – 50 Ohms – AC Coupled |
| 4-9 | GND | Ground - Common |
| 10 | RF Out | RF Output – 50 Ohms – AC Coupled |
| 11, 12 | GND | Ground - Common |
| 13 | VDD2 | DC Power Input |
| 14 | NC | Do Not Connect |
| 15 | GND | Ground - Common |
| 16 | VDD1 | DC Power Input |
| Case GND | GND | Ground - Common |

## SPECIFICATIONS

### Absolute Maximum Ratings

| | Minimum | Maximum |
|---|---|---|
| Supply Voltage | -0.3 V | +3.7 V |
| RF Input Power | | +13 dBm |
| Operating Junction Temperature | -40 C | +150 C |
| Storage Temperature Range | -50 C | +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 | +3.3 V | +3.5 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 ($\theta_{JC}$) | 83.8 |

## DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

| Param | Testing Conditions | Min | Typical | Max |
|---|---|---|---|---|
| DC Supply Voltage | | | +3.3 V | |
| DC Supply Current | VDD1 = VDD2 = +3.3 V | 85 mA | 93 mA | 101 mA |
| Power Dissipated | VDD1 = VDD2 = +3.3 V | 0.28 W | 0.31 W | 0.33 W |

## RF Performance

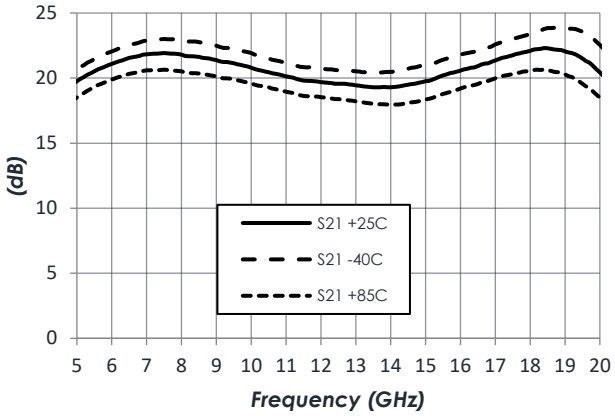
(T = 25 °C unless otherwise specified)

| Param | Testing Conditions | Min | Typical | Max |
|---|---|---|---|---|
| Frequency Range | | 5 GHz | | 20 GHz |
| Gain | VDD1 = VDD2 = +3.3 V | | 20 dB | |
| Return Loss | VDD1 = VDD2 = +3.3 V | | 15 dB | |
| Reverse Isolation | VDD1 = VDD2 = +3.3 V | | 38 dB | |
| Output IP3 | VDD1 = VDD2 = +3.3 V | | +28 dBm | |
| Output P1dB | VDD1 = VDD2 = +3.3 V | | +16 dBm | |
| Output Power Saturation | VDD1 = VDD2 = +3.3 V | | +17 dBm | |
| Noise Figure | VDD1 = VDD2 = +3.3 V | | 2.5 dB | |

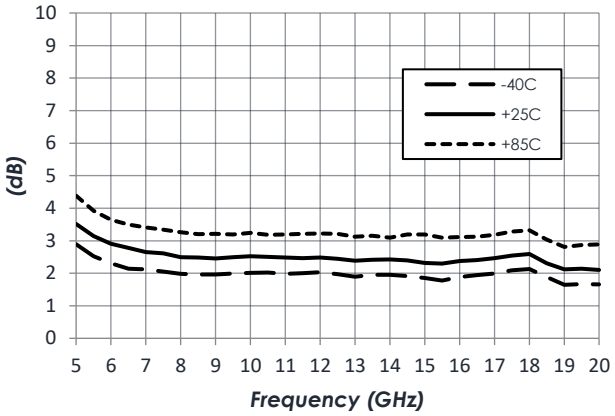
## TYPICAL PERFORMANCE

(VDD1 = VDD2 = +3.3 V, ID1 = 31 mA, ID2 = 62 mA)

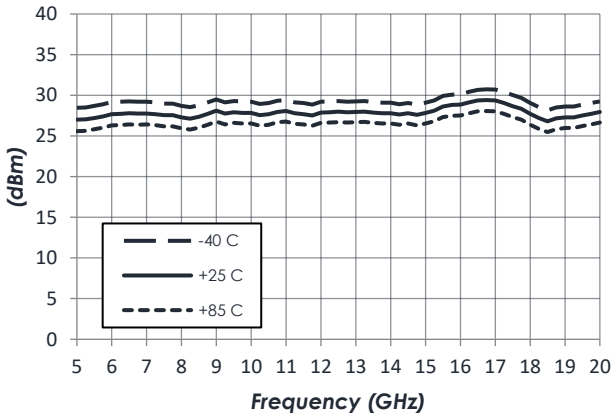
### Gain vs Temperature



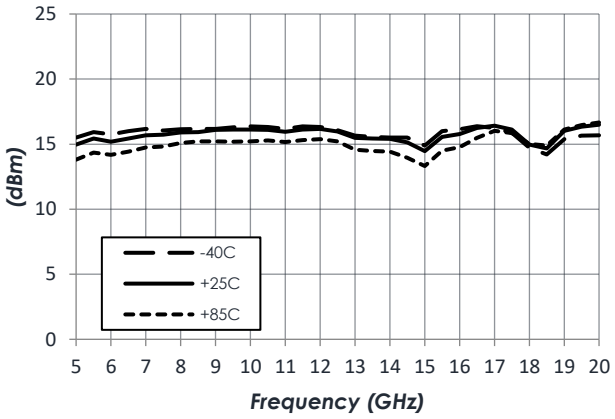

### Noise Figure vs Temperature



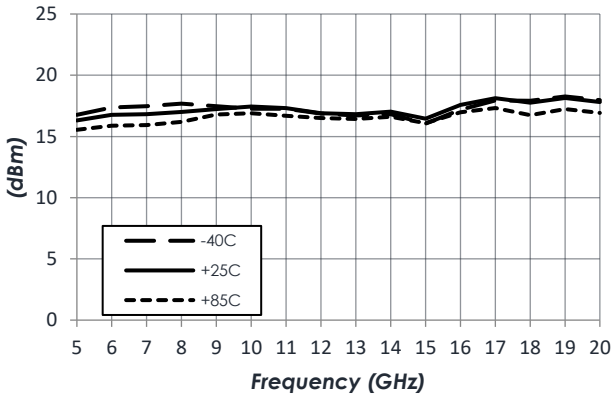

### Output IP3 vs Temperature



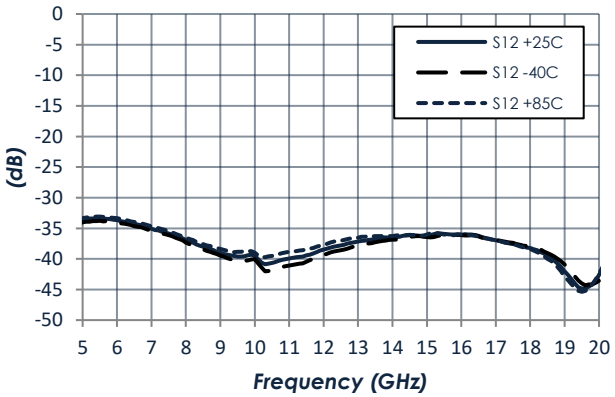

### P1dB vs Temperature




### Psat vs Temperature

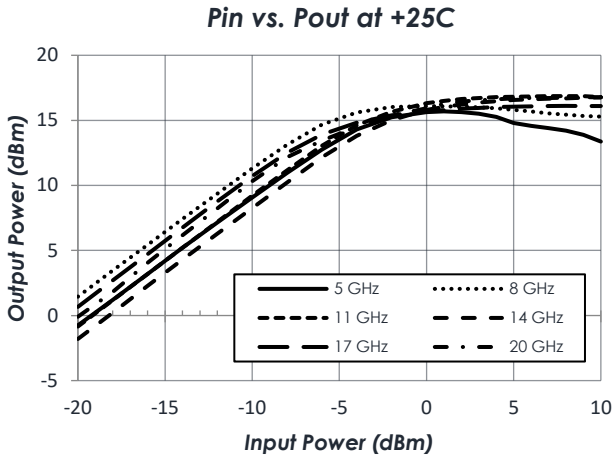


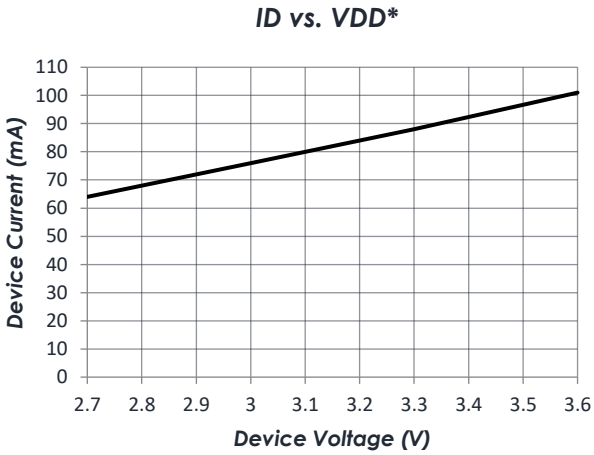

### Reverse Isolation vs Temperature



## TYPICAL PERFORMANCE (CONTINUED)

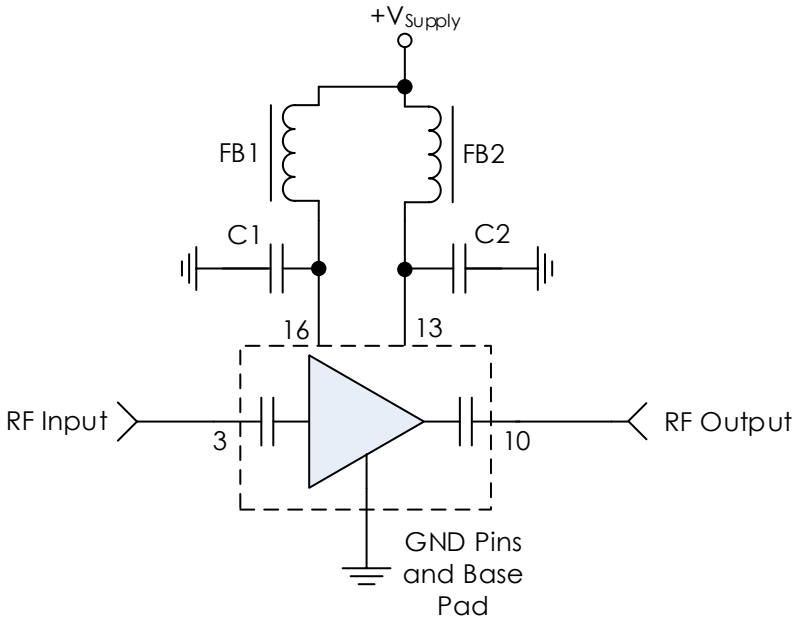
(VDD1 = VDD2 = +3.3 V, ID1 = 31 mA, ID2 = 62 mA)




***Note:** VDD = VDD1 = VDD2

## TYPICAL APPLICATION




**Recommended Component List (or Equivalent)**

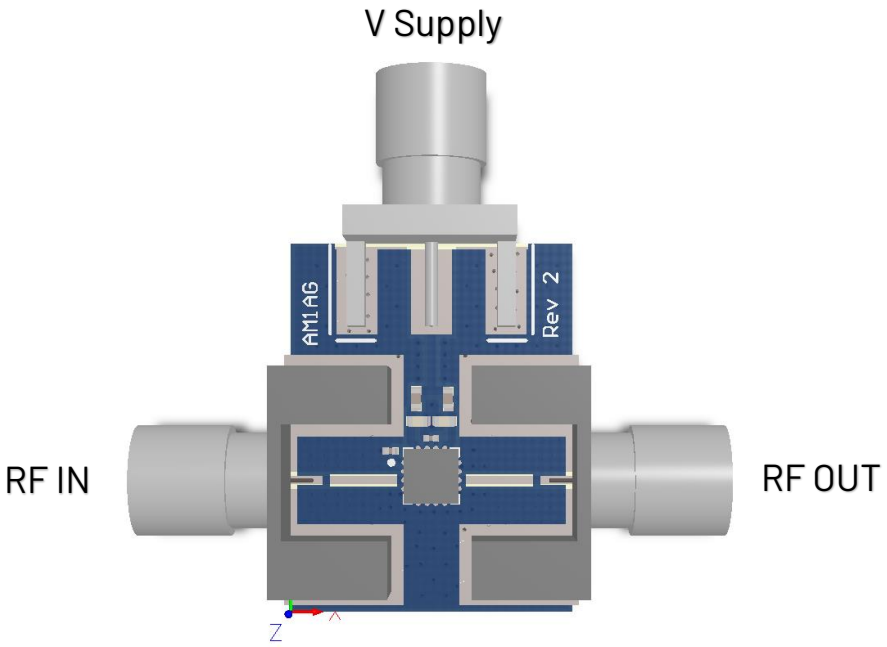
| Part | Value | Part Number | Manufacturer |
|---|---|---|---|
| FB1, FB2 | - | MMZ1005A222E | TDK |
| C1, C2 | 0.1µF | C1005X7R1H104K050BB | TDK |

Note:

1. RF Input and RF Output pins are internally DC blocked.

.

## EVALUATION PC BOARD




**Note:** Some of the components shown may not be installed.

## PARTS ORDERING DETAILS

| Description | Part Number |
|---|---|
| 3mm 16 Lead QFN | AM1053 |
| AM1053 Evaluation Board | AM1053 Eval |
| AM1053 in 0.95" x 1.13" x 0.6" RF-Shielded Module with Integrated Bias Tee and Field Replaceable SMA Connectors | AM1053-M |

## RELATED PARTS

| Part Number | | Description |
|---|---|---|
| AM1067 | 5 GHz to 20 GHz | Bypassable Gain Block |
| AM1075 | 5 GHz to 26.5 GHz | Bypassable Gain Block |
| AM1077 | 5 GHz to 20 GHz | Bypassable Gain Block w/ Isolation State |
| | | |
| AM1064-1 | DC to 8 GHz | Gain Block |
| AM1064-2 | DC to 8 GHz | Miniature Gain Block |
| AM1070 | DC to 18 GHz | +3.3V Broadband Gain Block |
| AM1071 | DC to 18 GHz | +5.0V Broadband 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 (CrVl) | <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.**

**Corporate Headquarters**

50 Minuteman Road
Andover, MA 01810 USA
+1 978.967.1401 tel
+1 866.627.6951 tel
+1 978.256.3599 fax

**International Headquarters**
**Mercury International**

Avenue Eugène-Lance, 38
PO Box 584
CH-1212 Grand-Lancy 1
Geneva, Switzerland
+41 22 884 5100 tel

**Learn more**
**Visit**: mrcy.com
For pricing details, contact: MMICsales@mrcy.com
For technical details, contact: MMICsupport@mrcy.com