

# Silicon Bipolar MMIC 5 GHz Active Double Balanced Mixer/ IF Amp

## Technical Data

IAM-82008

### Features

- **RF-IF Conversion Gain:**  
15 dB from 0.05-5 GHz
- **IF Conversion Gain from DC to 2 GHz**
- **IF Output  $P_{1dB}$ :**  
+8 dBm Typical
- **Single Polarity Bias Supply:**  
 $V_{CC} = 7$  to 13 V
- **Load Insensitive Performance**
- **Conversion Gain Flat over Temperature**

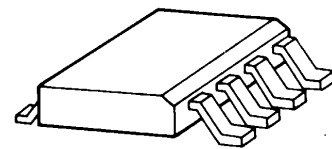
### Description

Hewlett-Packard's IAM-82008 is a complete moderate-power double-balanced active mixer housed in a miniature low cost surface mount package. It is designed for narrow or wide bandwidth commercial and industrial applications having RF inputs up to 5 GHz. Operation of RF and LO frequencies below 50 MHz can be achieved using optional external capacitors to ground. The IAM-82008 is particularly well suited for applications that require load-insensitive conversion gain and good spurious signal suppression and moderate dynamic range with

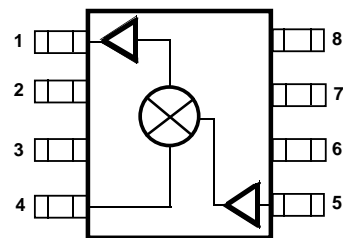
low LO power. Typical applications include frequency down-conversion, up-conversion, modulation, demodulation, and phase detection. Markets include fiber-optics, GPS satellite navigation, mobile radio, and communications transmitters and receivers.

The IAM series of Gilbert multiplier-based frequency converters is fabricated using Hewlett-Packard's 10 GHz  $f_T$  25 GHz  $f_{MAX}$  ISOSAT™-1 silicon bipolar process. This process uses nitride self-alignment, submicrometer lithography, trench isolation, ion implantation, gold metallization, and polyimide inter-metal dielectric and scratch protection to achieve excellent performance, uniformity and reliability.

### Plastic SO-8 Package



### Functional Block Diagram and Pin Configuration



| Pin Description                        |                        |
|--|------------------------|
| 1 IF Output                            | 8 RF Ground (optional) |
| 2 $V_{ee}$ , AC Ground                 | 7 $V_{CC}$             |
| 3 $V_{ee}$ , AC Ground Thermal Contact | 6 LO Ground (optional) |
| 4 RF Input                             | 5 LO Input             |

## Absolute Maximum Ratings<sup>[1]</sup> ( $T_A = 25^\circ\text{C}$ )

| Symbol             | Parameter   | Units              | Value       |
|--------------------|---|--------------------|-------------|
| $V_d$              | Device Voltage  | V                  | 15          |
| $P_t$              | Total Device Dissipation <sup>[2]</sup>               | mW                 | 1200        |
| $P_{in\text{ RF}}$ | RF Input Power  | dBm                | +14         |
| $P_{in\text{ LO}}$ | LO Input Power  | dBm                | +14         |
| $T_j$              | Junction Temperature                                  | $^\circ\text{C}$   | 150         |
| $T_{STG}$          | Storage Temperature                                   | $^\circ\text{C}$   | -65 to +150 |
| $\theta_{jc}$      | Thermal Resistance<br>Junction to Case <sup>[3]</sup> | $^\circ\text{C/W}$ | 92          |

### Notes:

1. Operation in excess of any one of these conditions may result in permanent damage to this device.
2. Derate at 10.9 mW/ $^\circ\text{C}$  for  $T_{PIN3} > 40^\circ\text{C}$ .
3.  $T_j = 150^\circ\text{C}$ .

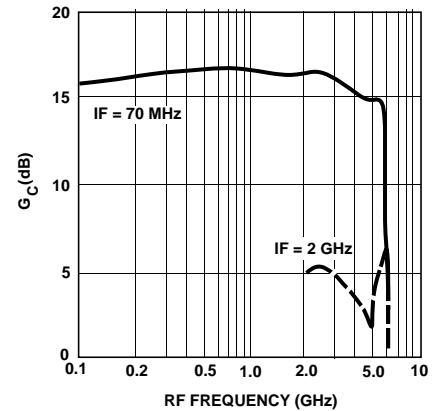


Figure 1. Typical RF to IF Conversion Gain vs. RF Frequency,  $T_A = 25^\circ\text{C}$ , Low Side LO.

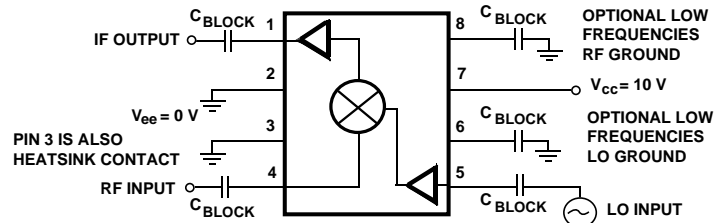
## IAM-82008 Electrical Specifications

$V_{CC} = 10\text{ V}$ ,  $Z_0 = 50\ \Omega$ , LO = 0 dBm, RF = -20 dBm,  $T_A = 25^\circ\text{C}$

| Symbol               | Parameter   | Units | Minimum | Typical | Maximum |
|----------------------|---|-------|---------|---------|---------|
| $G_C$                | Conversion Gain, RF = 2 GHz,<br>LO = 1.75 GHz                       | dB    | 13      | 15      | 17      |
| $f_{3\text{ dB RF}}$ | RF Bandwidth ( $G_C$ 3 dB down),<br>IF = 250 MHz                    | GHz   |         | 5.5     |         |
| $f_{3\text{ dB IF}}$ | IF Bandwidth ( $G_C$ 3 dB down),<br>LO = 2 GHz                      | GHz   |         | 0.5     |         |
| $P_{1\text{ dB}}$    | Output Power at 1 dB Gain Compression,<br>RF = 2 GHz, LO = 1.75 GHz | dBm   |         | 8       |         |
| $IP_3$               | Third Order Inpercept Point,<br>RF = 2 GHz, LO = 1.75 GHz           | dBm   |         | 18      |         |
| NF                   | SSB Noise Figure  | dB    |         | 19      |         |
| VSWR                 | RF Port VSWR  |       |         | 1.5:1   |         |
|                      | LO Port VSWR  |       |         | 2.0:1   |         |
|                      | IF Port VSWR  |       |         | 2.5:1   |         |
| $RF_{if}$            | RF Feedthrough at IF Port   | dBc   |         | -30     |         |
| $LO_{if}$            | LO Leakage at IF Port   | dBm   |         | -15     |         |
| $LO_{rf}$            | LO Leakage at RF Port   | dBm   |         | -22     |         |
| $I_{CC}$             | Supply Current  | mA    | 40      | 55      | 65      |

### Note:

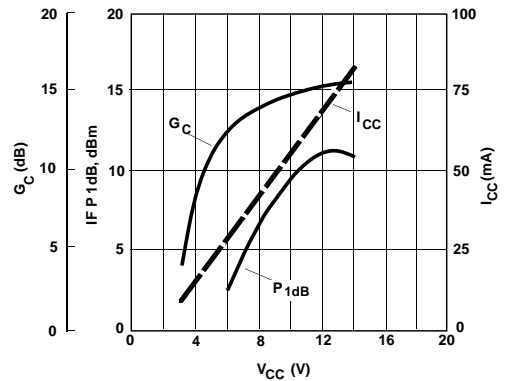
1. The recommended operating voltage range for this device is 7 to 13 V. Typical performance as a function of voltage is shown on the following page.



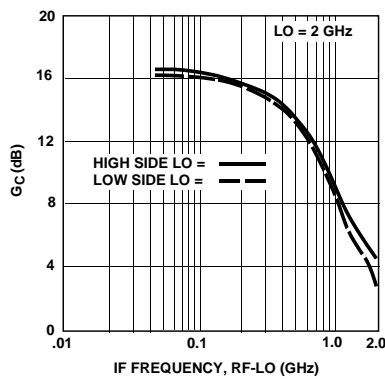
**Notes:**

1. No external baluns are required.
2. Good heatsinking required on Pin 3 for specified performance.

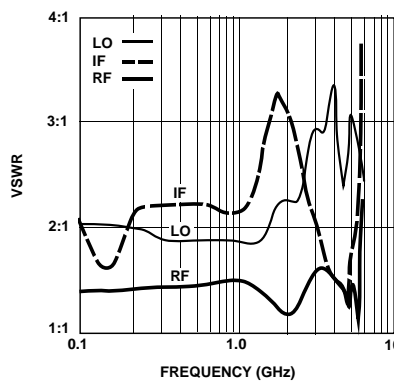
**Figure 2. IAM-82008 Typical Biasing Configuration.**



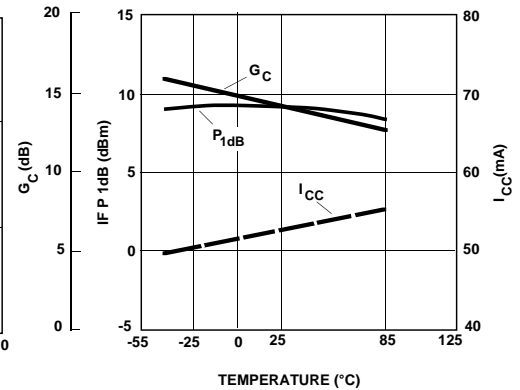
**Figure 3. Typical Conversion Gain, IF P<sub>1</sub> dB, and I<sub>CC</sub> Current vs. V<sub>CC</sub> Bias Voltage, T<sub>A</sub> = 25°C, RF: -20 dBm at 2 GHz, LO: 0 dBm at 1.75 GHz.**



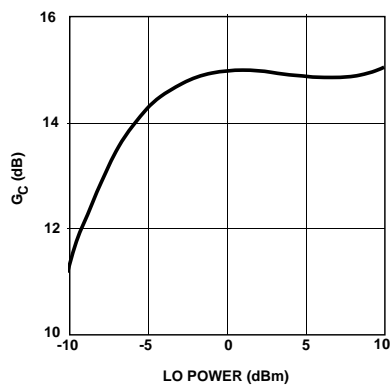
**Figure 4. Typical RF to IF Conversion Gain vs. IF Frequency, T<sub>A</sub> = 25°C, V<sub>CC</sub> = 10 V, LO: 0 dBm at 2 GHz.**



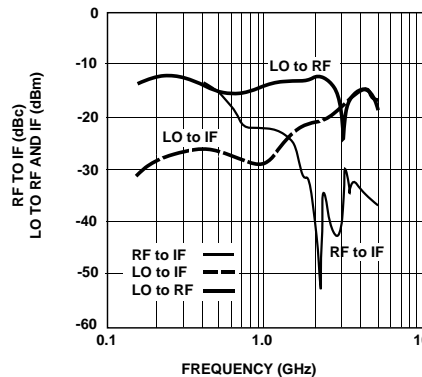
**Figure 5. RF, LO, and IF Port VSWR vs. Frequency, T<sub>A</sub> = 25°C, V<sub>CC</sub> = 10 V.**



**Figure 6. Typical Conversion Gain, IF P<sub>1</sub> dB, and I<sub>CC</sub> Current vs. Case Temperature, T<sub>A</sub> = 25°C, V<sub>CC</sub> = 10 V, RF: -20 dBm at 2 GHz, LO: 0 dBm at 1.75 GHz.**



**Figure 7. Typical RF to IF Conversion Gain vs. LO Power, T<sub>A</sub> = 25°C, V<sub>CC</sub> = 10 V, RF: -10 dBm at 2 GHz, LO: 0 dBm at 1.75 GHz.**



**Figure 8. Typical RF Feedthrough Relative to IF Carrier, LO to RF and LO to IF Leakage vs. Frequency, T<sub>A</sub> = 25°C, V<sub>CC</sub> = 10 V, RF: -20 dBm at 2 GHz, LO: 0 dBm at 1.75 GHz.**

| HARMONIC LO ORDER | 0  | 1  | 2  | 3   | 4   | 5   |
|-------------------|----|----|----|-----|-----|-----|
| 0                 | -  | 21 | 40 | 73  | >75 | >75 |
| 1                 | 12 | 0  | 51 | 60  | >75 | >75 |
| 2                 | 6  | 22 | 41 | >75 | >75 | >75 |
| 3                 | 24 | 18 | 40 | 74  | >75 | >75 |
| 4                 | 22 | 33 | 52 | 75  | >75 | >75 |
| 5                 | 41 | 36 | 55 | >75 | >75 | >75 |

HARMONIC RF ORDER  
X<sub>mn</sub> = P<sub>if</sub> - P<sub>(m\*rf-n\*lo)</sub>

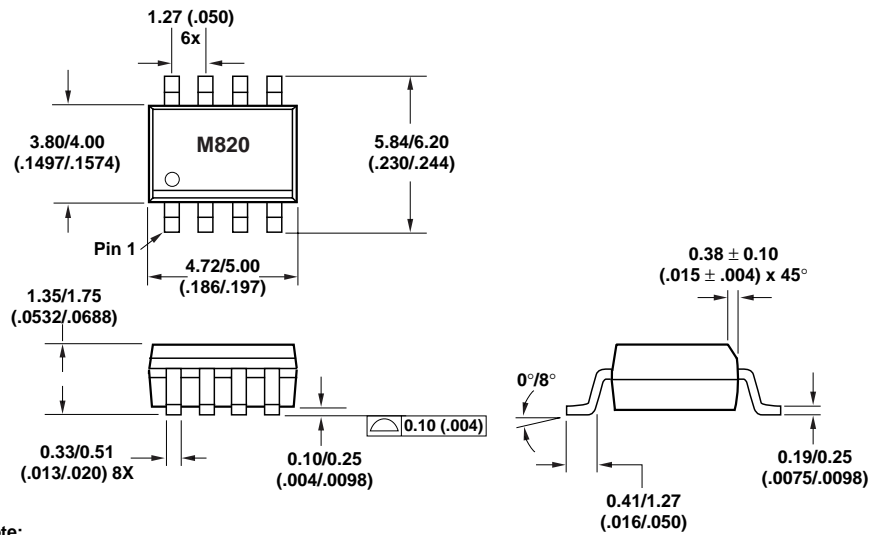
**Figure 9. Harmonic Intermodulation Suppression (dB Below Desired Output) RF at 1 GHz, LO at 0.752 GHz, IF at 0.248 GHz.**

## Part Number Ordering Information

| Part Number   | No. of Devices | Container |
|---------------|----------------|-----------|
| IAM-82008-TR1 | 1000           | 7" Reel   |
| IAM-82008-STR | 10             | Strip     |

## Package Dimensions

### SO-8 Plastic Package



**Note:**

1. Dimensions are shown in millimeters (inches).