22 GHz to 38 GHz, GaAs, MMIC, Double Balanced Mixer

Preliminary Technical Data

HMC560A

FEATURES

Downconverter
- **Conversion loss**
  - **10 dB typical for 22 GHz to 29 GHz**
  - **11 dB typical for 29 GHz to 38 GHz**
- **LO to RF isolation**
  - **34 dB typical for 22 GHz to 29 GHz**
  - **38 dB typical for 29 GHz to 38 GHz**
- **LO to IF isolation**
  - **29 dB typical for 22 GHz to 29 GHz**
  - **31 dB typical for 29 GHz to 38 GHz**
- **RF to IF isolation**
  - **24 dB typical for 22 GHz to 29 GHz**
  - **39 dB typical for 29 GHz to 38 GHz**
- **Input IP3**
  - **20 dBm typical for 22 GHz to 29 GHz**
  - **19.5 dBm typical for 29 GHz to 38 GHz**

IF bandwidth: dc to 18 GHz
Passive, no dc bias required

APPLICATIONS

Point to point radios
Point to multipoint radios and very small aperture terminal (VSAT) radios
Test equipment and sensors
Military end use

FUNCTIONAL BLOCK DIAGRAM

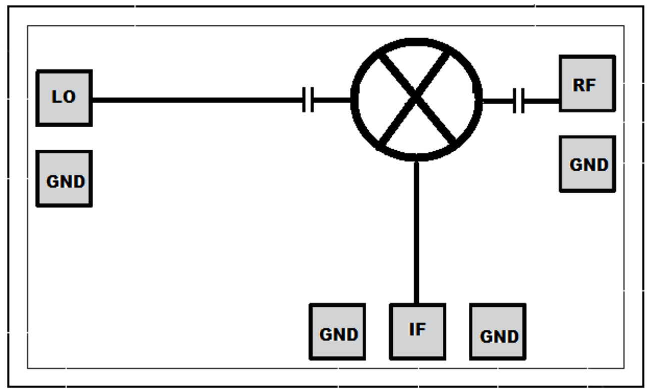

Figure 1.

GENERAL DESCRIPTION

The HMC560A chip is a general-purpose, double balanced mixer that can be used as an upconverter or downconverter from 22 GHz to 38 GHz in a small chip area. This mixer requires no external component or matching circuitry.

The HMC560A provides excellent local oscillator (LO) to radio frequency (RF) and LO to intermediate frequency (IF) suppression due to optimized balun structures. The mixer operates with LO drive levels above 9 dBm.

Rev. PrA Document Feedback

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TABLE OF CONTENTS

SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

T_A = 25°C, IF = 1 GHz, LO drive level = 13 dBm, RF frequency range = 22 GHz to 29 GHz, all measurements performed as a downconverter with the upper sideband selected, unless otherwise noted.

Table 1.

Parameter	Symbol	Min	Typ	Max	Unit
FREQUENCY RANGE					
Radio Frequency	RF	22		29	GHz
Local Oscillator	LO	22		29	GHz
Intermediate Frequency	IF	dc		18	GHz
CONVERSION LOSS			10	TBD	dB
NOISE FIGURE			10.5		dB
ISOLATION					
LO to RF			34		dB
LO to IF		TBD	29		dB
RF to IF		TBD	24		dB
INPUT THIRD-ORDER INTERCEPT	IP3	TBD	20		dBm
INPUT SECOND-ORDER INTERCEPT	IP2		38		dBm
INPUT POWER					
1 dB Compression	P1dB		9		dBm
UPCONVERTER PERFORMANCE					
Conversion Loss			10		dB
IP3			13.5		dBm
RETURN LOSS					
RF			7		dB
LO			8		dB

T_A = 25°C, IF = 1 GHz, LO drive level = 13 dBm, RF frequency range = 29 GHz to 38 GHz, all measurements performed as a downconverter with the upper sideband selected, unless otherwise noted.

Table 2.

Parameter	Symbol	Min	Typ	Max	Unit
FREQUENCY RANGE					
Radio Frequency	RF	29		38	GHz
Local Oscillator	LO	29		38	GHz
Intermediate Frequency	IF	Dc		18	GHz
CONVERSION LOSS			11	TBD	dB
NOISE FIGURE			11.5		dB
ISOLATION					
LO to RF			38		dB
LO to IF		TBD	31		dB
RF to IF		TBD	39		dB
INPUT THIRD-ORDER INTERCEPT	IP3	TBD	19.5		dBm
INPUT SECOND-ORDER INTERCEPT	IP2		38		dBm
INPUT POWER					
1 dB Compression	P1dB		11.5		dBm
UPCONVERTER PERFORMANCE					
Conversion Loss			9		dB
IP3			16.5		dBm
RETURN LOSS					
RF			14		dB
LO			7		dB

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
RF Input Power	25 dBm
LO Input Power	23 dBm
IF Input Power	25 dBm
IF Source and Sink Current	2 mA
Channel Temperature	150°C/W
Continuous Power Dissipation, P_{DISS} (T_A = 85°C, Derate 5.3 mW/°C Above 85°C)	344 mW
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	−40°C to +85°C
Electrostatic Discharge (ESD) Sensitivity	
Human Body Model (HBM)	500 V
Field Induced Charged Device Model (FICDM)	1250 V

Stresses at or above listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

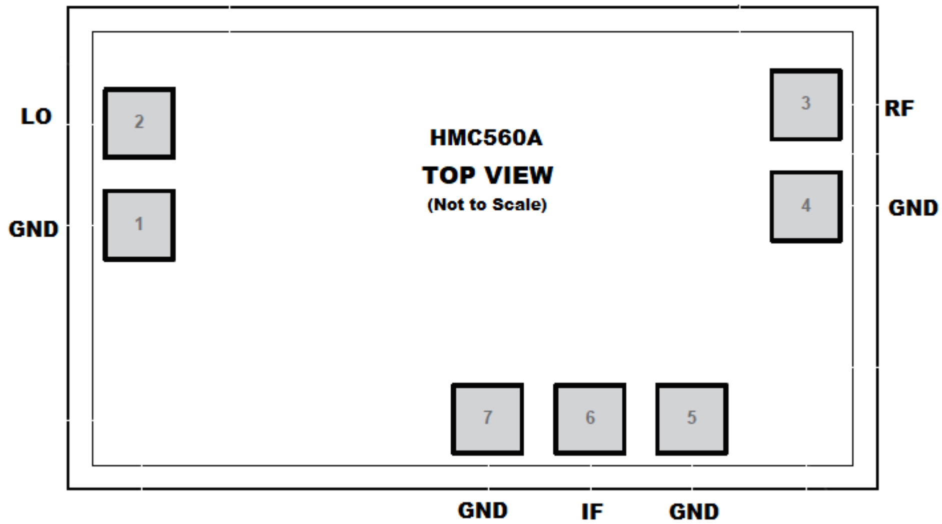

Figure 2. Pad Configuration

Table 4. Pad Function Descriptions

Pad No.	Mnemonic	Description
1, 4, 5, 7	GND	Not Internally Connected. No connection is required. These pads can be connected to RF/dc ground without affecting performance.
2	LO	Local Oscillator Port. This pad is ac-coupled and matched to 50 Ω. See Figure 4 for the LO interface schematic.
3	RF	Radio Frequency Port. This pad is ac-coupled and matched to 50 Ω. See Figure 6 for the RF interface schematic.
6	IF	Intermediate Frequency Port. This pad is dc-coupled. For applications not requiring operation to dc, dc block this port externally using a series capacitor of a value chosen to pass the necessary IF frequency range. For operation to dc, this pad must not source or sink more than 2 mA of current or die malfunction and possible die failure may result. See Figure 5 for the IF interface schematic.
Die bottom	GND	Ground. The die bottom must be attached directly to the ground plane eutectically or with conductive epoxy.

INTERFACE SCHEMATICS

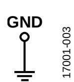

Figure 3. GND Interface Schematic

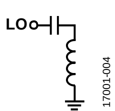

Figure 4. LO Interface Schematic

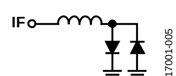

Figure 5. IF Interface Schematic

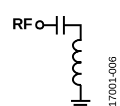

Figure 6. RF Interface Schematic

TYPICAL PERFORMANCE CHARACTERISTICS

DOWNCONVERTER PERFORMANCE

Downconverter Performance at IF = 1 GHz, Upper Sideband

TBD

Figure 7. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 13 dBm

TBD

Figure 8. Input IP3 vs. RF Frequency at Various Temperatures, LO = 13 dBm

TBD

Figure 9. Input p1dB vs. RF Frequency at Various Temperatures, LO = 13 dBm

TBD

Figure 10. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TBD

Figure 11. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TBD

Figure 12. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

THEORY OF OPERATION

The HMC560A is a general-purpose, double balanced mixer that can be used as an upconverter or a downconverter from 22 GHz to 38 GHz.

When used as a downconverter, the HMC560A downconverts RF between 22 GHz and 38 GHz to IF values between dc and 18 GHz.

When used as an upconverter, the mixer upconverts IF values between dc and 18 GHz to RF values between 22 GHz and 38 GHz.

The mixer performs well with LO drive values of 13 dBm or greater and provides excellent LO to RF and LO to IF suppression due to optimized balun structures.

APPLICATIONS INFORMATION

TYPICAL APPLICATION CIRCUIT

Figure 13 shows the typical application circuit for the HMC560A. The HMC560A is a passive device and does not require any external components. The LO and RF pads are internally ac-coupled. When IF operation is not required until dc, it is recommended to use an ac-coupled capacitor at the IF port.

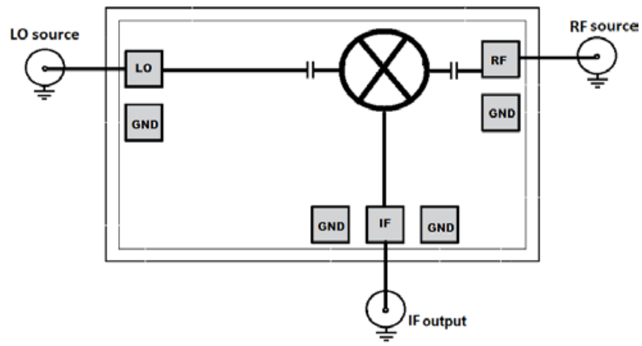

Figure 13. Typical Application Circuit

OUTLINE DIMENSIONS

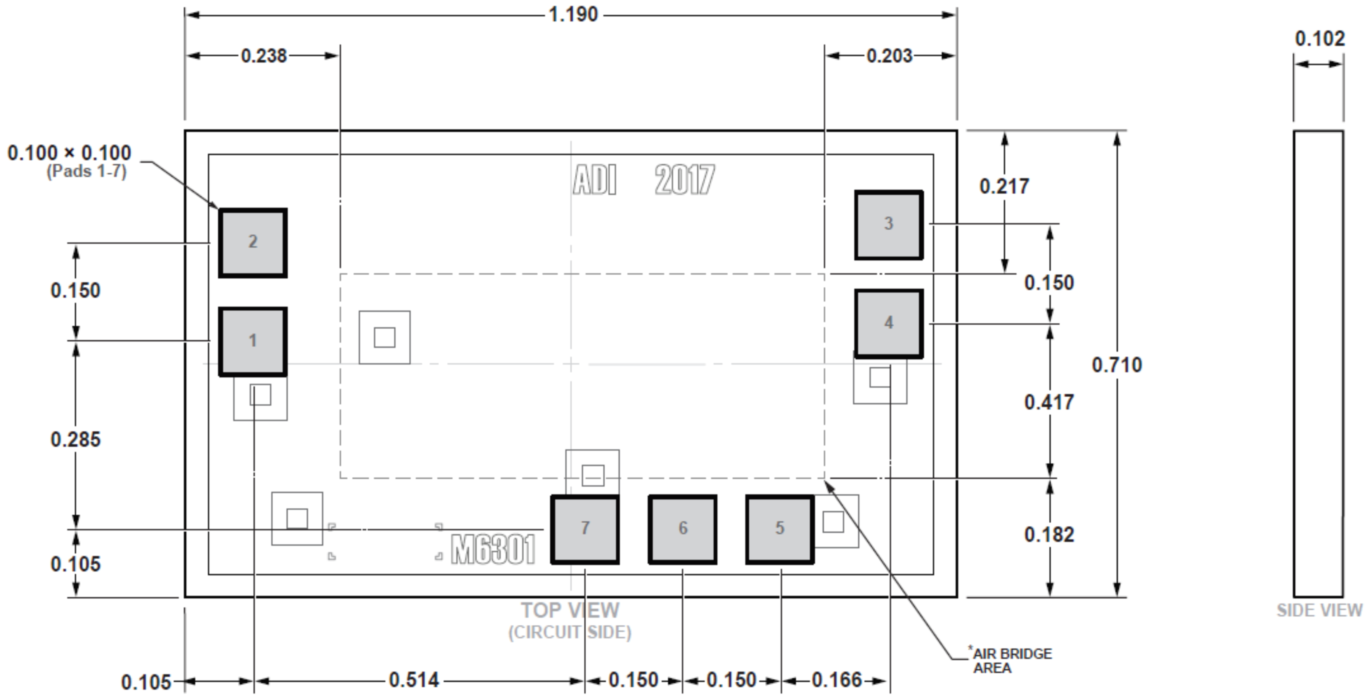

Figure 14. 7-Pad Bare Die [CHIP]
(C-7-10)
Dimensions shown in millimeters