2.5 GHz to 8.5 GHz I/Q Mixer

Preliminary Technical Data

HMC8193

FEATURES

- Passive I/Q mixer
- RF and local oscillator (LO) range: 2.5 GHz to 8.5 GHz
- Wide IF of dc to 3.5 GHz
- Single-ended RF, LO, and IF
- Conversion loss: 8 dB (typical)
- Input third-order intercept (IIP3): 21 dBm (typical)
- High image rejection: 32 dBm (typical)
- High LO to RF isolation: 40 dB (typical)
- High LO to IF isolation: 40 dB (typical)
- Phase balance: ±5°
- Reduces need for IF filtering
- Exposed paddle, 4 mm × 4 mm, 24-lead LFCSP package

APPLICATIONS

- Test and measurement instrumentation
- Military, aerospace, and radar
- Direct conversion receivers

FUNCTIONAL BLOCK DIAGRAM

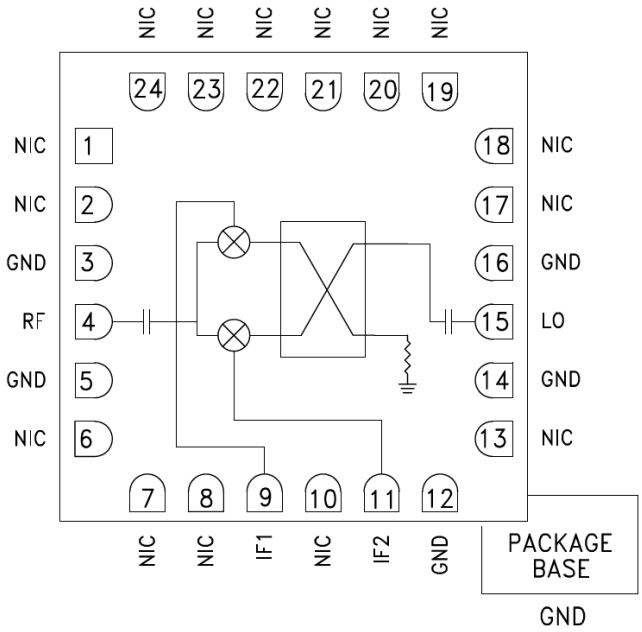

Figure 1.

GENERAL DESCRIPTION

HMC8193 is a passive in-phase/quadrature (I/Q) monolithic microwave integrated circuit (MMIC) mixer that can be used either as an image reject mixer for receiver operations or as single sideband upconverter for transmitter operations from 2.5 GHz to 8.5 GHz. The inherent I/Q architecture of the HMC8193 offers excellent image rejection and thereby eliminates the need for expensive filtering for unwanted sidebands. The mixer also provides excellent LO to RF and LO to IF isolation and reduces the effect of LO leakage to ensure signal integrity.

Being a passive mixer, the HMC8193 does not require any dc power sources. It offers a lower noise figure compared to an active mixer, ensuring superior dynamic range for high performance and precision applications.

The HMC8193 is fabricated on a GaAs MESFET process and uses Analog Devices, Inc., mixer cells and a 90-degree hybrid. It is available in a compact 4 mm × 4 mm, 24-lead LFCSP package and operates over a −40°C to +85°C temperature range. An evaluation board for this device is also available.

Rev. PrA Document Feedback

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Technical Support www.analog.com

HMC8193* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

COMPARABLE PARTS

View a parametric search of comparable parts.

EVALUATION KITS

- HMC8193 Evaluation Board

DOCUMENTATION

Data Sheet

- HMC8193: 2.5 GHz to 8.5 GHz I/Q Mixer Preliminary Data Sheet

REFERENCE MATERIALS

Technical Articles

- The Changing Landscape of Frequency Mixing Components

DESIGN RESOURCES

- HMC8193 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

DISCUSSIONS

View all HMC8193 EngineerZone Discussions.

SAMPLE AND BUY

Visit the product page to see pricing options.

TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

DOCUMENT FEEDBACK

Submit feedback for this data sheet.

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SPECIFICATIONS

$f_{IF\ OUT} = f_{RF\ IN} - f_{LO}$ (downconverter, upper sideband), f_{IFOUT} = 100 MHz to 3500 MHz, $P_{RF\ IN}$ = −10 dBm, P_{LO} = 18 dBm, T_A = 25°C.

Table 1.

Parameter	Test Conditions	Min	Typ	Max	Unit
RF INPUT INTERFACE					
Return Loss		7	10		dB
Input Impedance			50		Ω
RF Input Frequency Range		2500		8500	MHz
IF INTERFACE					
Return Loss		7	10		dB
IF Impedance			50		Ω
IF Frequency Range		DC		3500	MHz
LO INTERFACE					
LO Power			18		dBm
Return Loss		9	10		dB
Input Impedance			50		Ω
LO Frequency Range		2500		8500	MHz
DOWNCONVERTER DYNAMIC PERFORMANCE at $f_{IF\ OUT}$ = 100 MHz					
Conversion Loss			8	10	dB
Input Third-Order Intercept (IIP3)		17	21		dBm
Image Rejection		23	32		dBc
Output Power for 1 dB Compression (P1dB)			14		dBm
LO to RF Isolation[1]		37	45		dB
LO to IF Isolation[1]		30	40		dB
RF to IF Isolation[1]		13	20		dB
Phase Balance			±5		Degrees
Amplitude Balance			±0.5		dB
DOWNCONVERTER DYNAMIC PERFORMANCE at $f_{IF\ OUT}$ = 1000 MHz					
Conversion Loss			8	10	dB
Input Third-Order Intercept		17	21		dBm
Image Rejection		23	32		dBc
Output Power for 1 dB Compression (P1dB)			14		dBm
LO to RF Isolation[1]		37	45		dB
LO to IF Isolation[1]		30	40		dB
RF to IF Isolation[1]		13	20		dB
Phase Balance			±5		Degrees
Amplitude Balance			±0.5		dB
DOWNCONVERTER DYNAMIC PERFORMANCE at f_{IFout} = 3500 MHz					
Conversion Loss			8	10	dB
Input Third-Order Intercept		17	21		dBm
Image Rejection		23	32		dBc
Output Power for 1 dB Compression (P1dB)			14		dBm
LO to RF Isolation[1]		37	45		dB
LO to IF Isolation[1]		30	40		dB
RF to IF Isolation[1]		13	20		dB
Balance			±5		Degrees
Amplitude Balance			±0.5		dB

[1] See the Typical Performance Characteristics section.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
RFIN Power	TBD
LO Drive	TBD
Channel Temperature	TBD
Continuous P_{DISS} (T = 85°C) (Derate 9.8 mW/°C above 85°C)	TBD
Thermal Resistance (R_{TH}) (Junction to Die Bottom)	TBD
Operating Temperature Range	–40°C to +85°C
Storage Temperature Range	–65°C to +150°C
ESD Sensitivity (HBM)	TBD

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

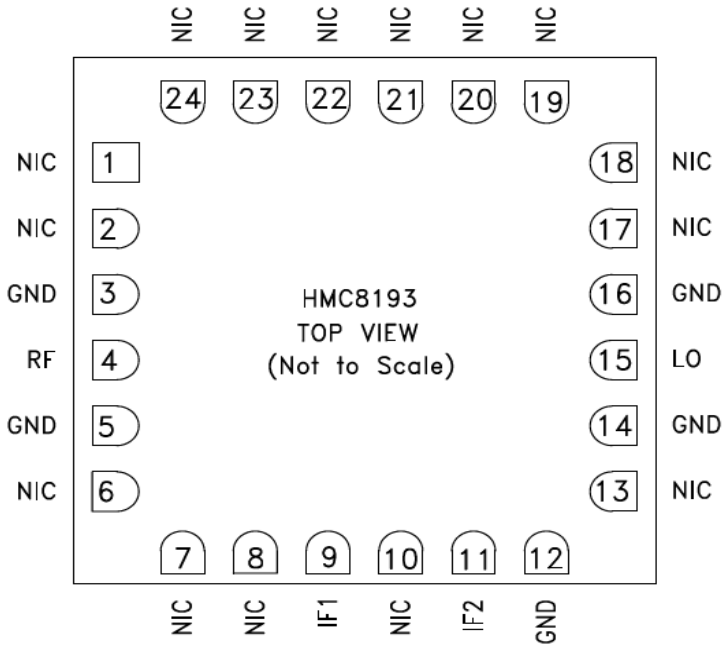

Figure 2. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1, 2, 6 to 8, 10, 13, 17 to 24	NIC	Not Internal Connection. No connection is required. These pins may be connected to RF/dc ground without affecting performance.
3, 5, 12, 14, 16,	GND	Ground Connect. These pins and package bottom must be connected to RF/dc ground.
9, 11	IF1, IF2	First and Second Quadrature Intermediate Frequency. These pins are dc-coupled. For applications not requiring operations to dc, this port should be dc blocked externally using a series capacitor whose value is selected to pass the necessary IF frequency range. For operations to dc, this pin must not source/sink more than 3 mA of current; otherwise, the device does not function and may fail.
4	RF	Radio Frequency. This pin is dc-coupled and matched to 50 Ω.
15	LO	Local Oscillator. This pin is dc-coupled and matched to 50 Ω.

TYPICAL PERFORMANCE CHARACTERISTICS

F_{IFOUT} at 100 MHz

$f_{IF\,OUT} = f_{LO} - f_{RF\,IN}$ (downconverter, lower sideband), $f_{IF\,OUT}$ = 100 MHz, $P_{RF\,IN}$ = −10 dBm, P_{LO} = 18 dBm, T_A = 25°C.

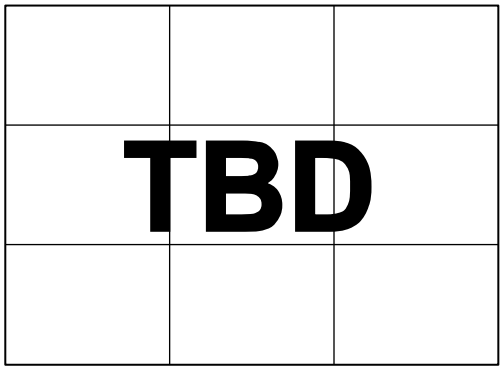

Figure 3. Image Rejection, Downconverter

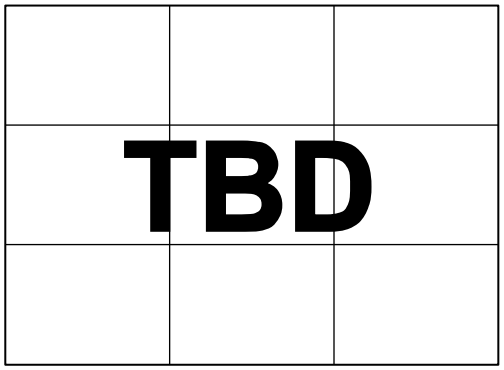

Figure 5. Input IP3, Downconverter

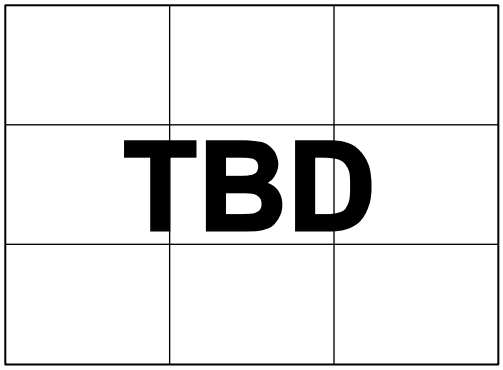

Figure 4. RF to IF Isolation, Downconverter

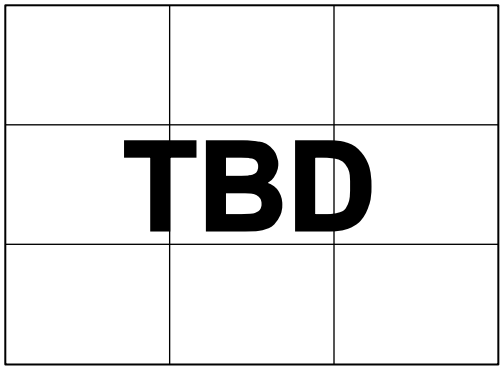

Figure 6. LO to IF Isolation, Downconverter

F_{IFOUT} at 1000 MHz

$f_{IF\,OUT} = f_{LO} - f_{RF\,IN}$ (downconverter, lower sideband), $f_{IF\,OUT}$ = 1000 MHz, $P_{RF\,IN}$ = −10dBm, P_{LO} = 14 dBm, 16 dBm, 18 dBm, 20 dBm, T_A = 25°C.

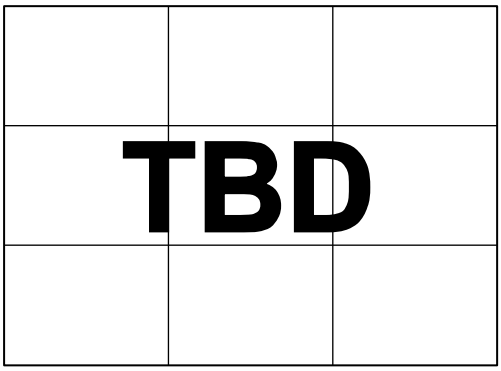

Figure 7. Conversion Loss, Downconverter

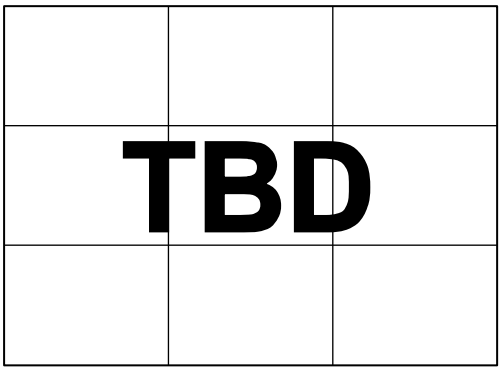

Figure 10. Input IP3, Downconverter

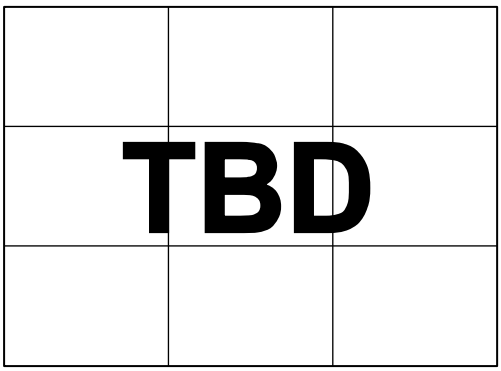

Figure 8. Image Rejection, Downconverter

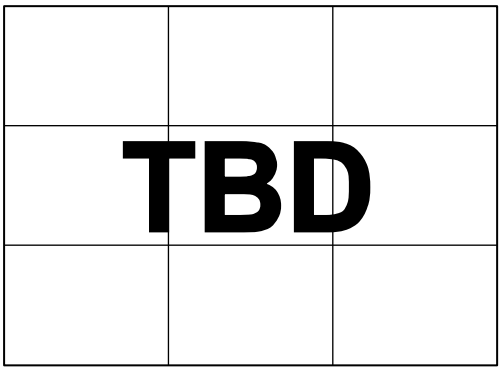

Figure 11. LO to RF Isolation, Downconverter

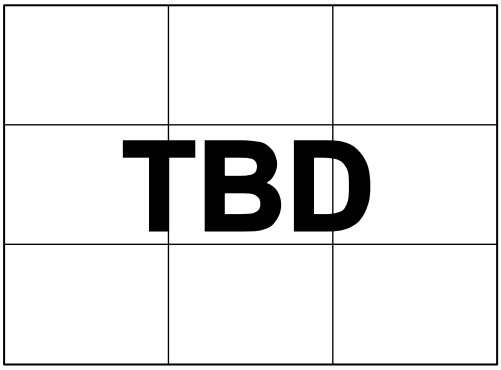

Figure 9. Amplitude Balance, Downconverter

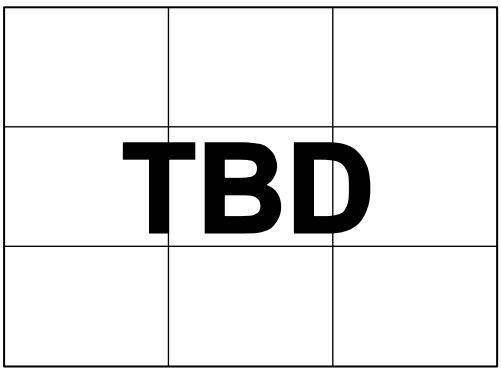

Figure 12. Phase Balance, Downconverter

F_{IFOUT} at 3500 MHz

$f_{IF\,OUT} = f_{LO} - f_{RF\,IN}$ (downconverter, lower sideband), f_{IFOUT} = 3500 MHz, $P_{RF\,IN}$ = −10dBm, P_{LO} = 14 dBm, 16 dBm, 18 dBm, 20 dBm, T_A = 25°C.

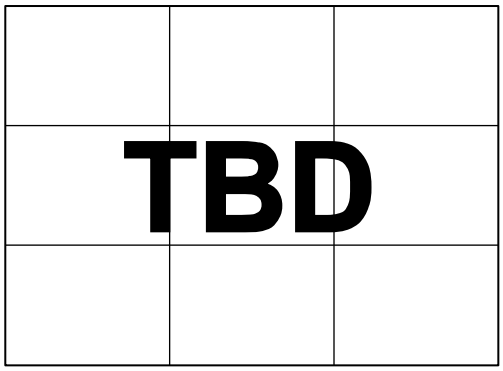

Figure 13. Conversion Loss, Downconverter

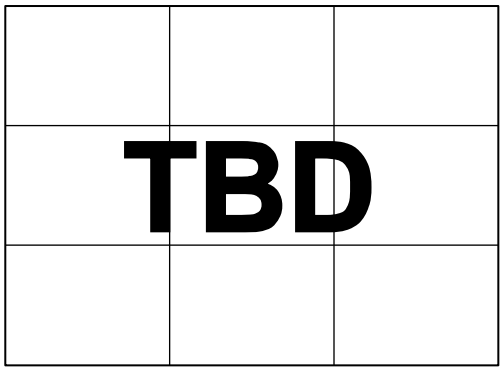

Figure 15. Input IP3, Downconverter

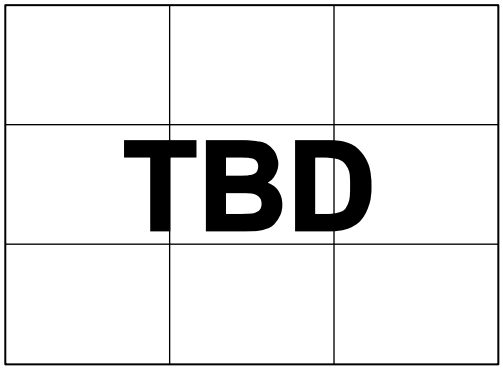

Figure 14. Image Rejection, Downconverter

EVALUATION BOARD

An evaluation board is available for the HMC8193. The standard evaluation board is fabricated using Rogers® RO4003C material. The schematic for the evaluation board is shown in Figure 16.

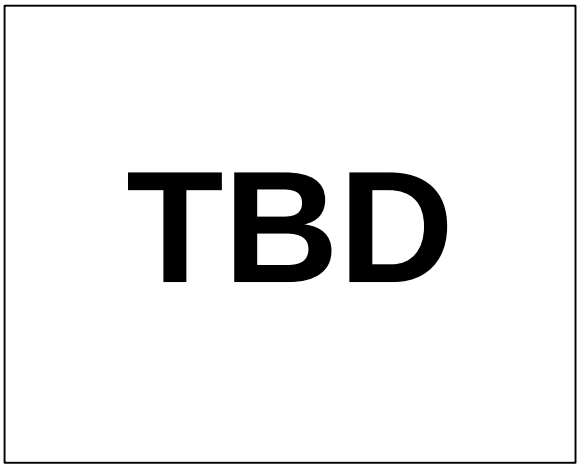

Figure 16. Evaluation Board Schematic

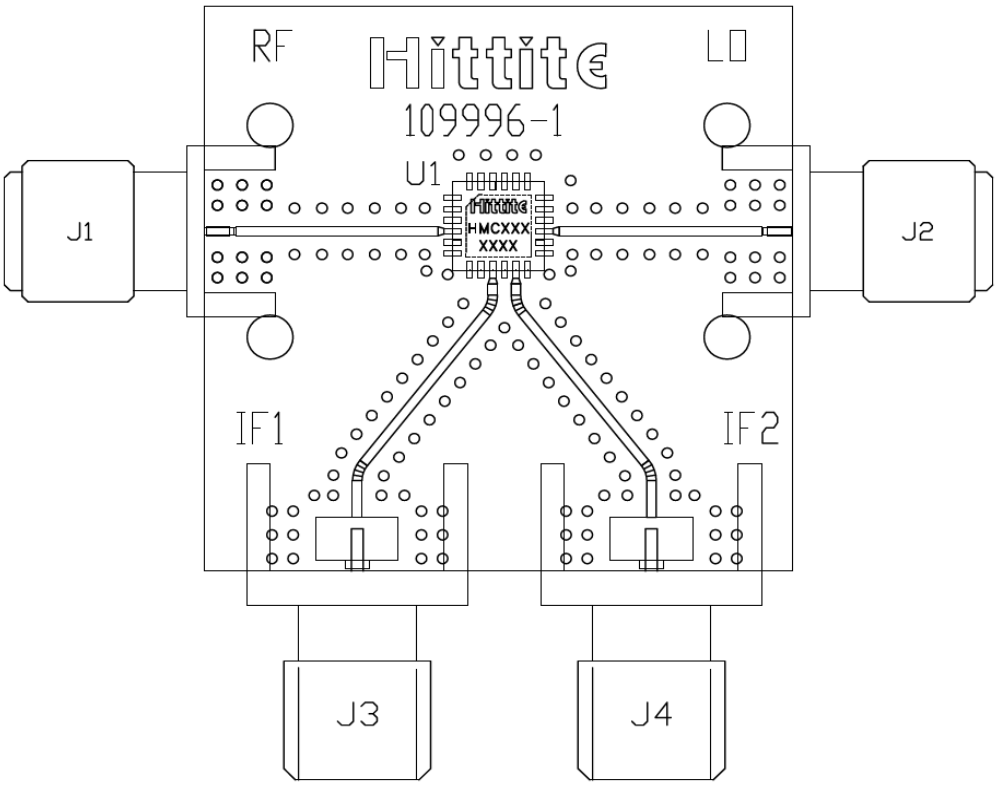

Figure 17. Evaluation Board, Top Layer

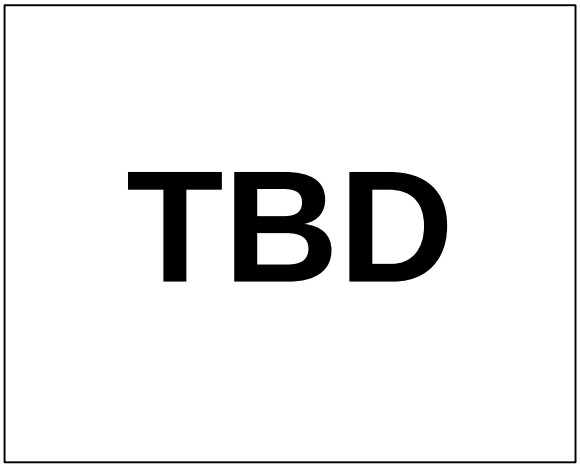

Figure 18. Evaluation Board, Bottom Layer

Table 4 describes the various configuration options for the evaluation board. Layouts for the board are shown in Figure 17 and Figure 18.

Table 4. Evaluation Board Configuration

Components	Function	Default Conditions
TBD		

OUTLINE DIMENSIONS

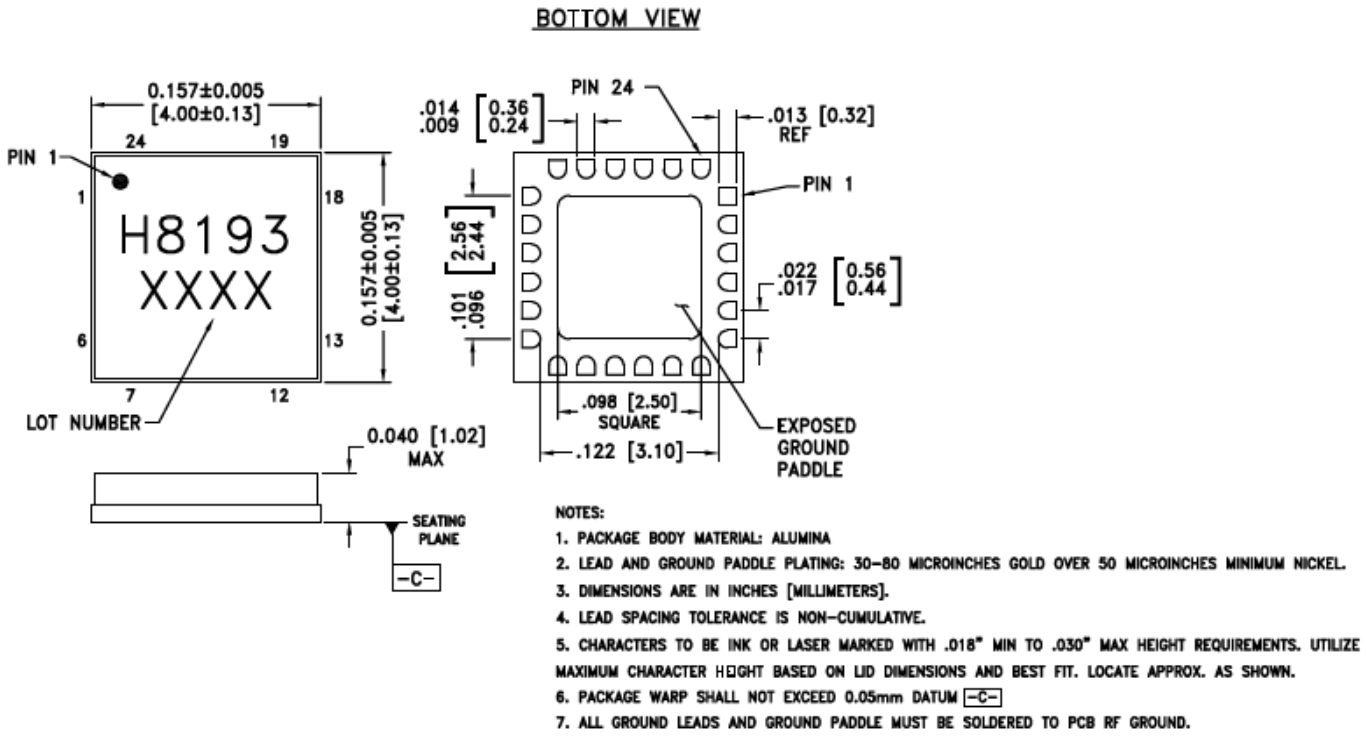

Figure 19. Outline Drawing and Dimensions

D14353-0-3/16(PrA)