8 GHz to 8.3 GHz, Dielectric Resonator Oscillator Module

Data Sheet **HMC-C200**

FEATURES

- **Frequency range: 8.0 GHz to 8.3 GHz**
- **Low SSB phase noise center frequency: −122 dBc/Hz at 10 kHz offset**
- **Voltage supply: 6 V to 15 V at a 116 mA supply current**
- **Internal voltage regulator**
- **Internal buffer amplifier**
- **High power output: 13.5 dBm**
- **−40°C to +85°C operating temperature range**

APPLICATIONS

- **Test and measurement equipment**
- **Lab instrumentation**
- **Industrial and medical equipment**
- **Military, electronic warfare (EW), electronic counter measures (ECM) communications**

FUNCTIONAL BLOCK DIAGRAM

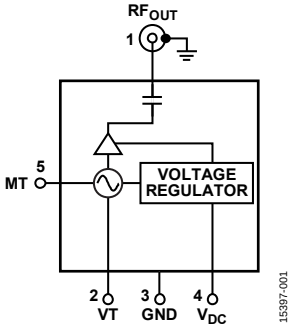

Figure 1.

GENERAL DESCRIPTION

The HMC-C200 is a high performance dielectric resonator oscillator (DRO) module that incorporates Analog Devices, Inc., ultralow phase noise technology and provides −122 dBc/Hz single sideband (SSB) phase noise at a 10 kHz offset. The output buffer also provides 13.5 dBm of power output. Internal temperature compensation allows this DRO to operate over a temperature range of −40°C to +85°C with a frequency drift rate of only 2 ppm/°C. The VT port accepts an analog tuning voltage from 2 V to 12 V and provides an electric tuning range of ±1 MHz from the center frequency.

The DRO is packaged in a small, moisture sealed 1.5 inch × 1.5 inch (36 mm × 36 mm) module with a field replaceable subminiature version A (SMA) connector. The HMC-C200 can be used as a drop in module if the SMA connector is not used. The HMC-C200 is available from 8.0 GHz to 8.3 GHz in 25 MHz frequency steps.

Rev. F **Document Feedback**

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REVISION HISTORY

This Hittite Microwave Products data sheet has been reformatted to meet the styles and standards of Analog Devices, Inc.

3/2017—v06.0612 to Rev. F

Updated Format ..... Universal
Changes to Features Section and General Description Section 1
Changes to Table 1 3
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Changed Application Notes Section to Theory of Operation Section 7
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SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

T_A = 25°C, frequency = 8.2 GHz, V_{DC} = 6.5 V, unless otherwise noted.

Table 1.

Parameter	Min	Typ	Max	Units	Test Conditions/Comments
FREQUENCY					
Range	8.0		8.3	GHz	See the Ordering Guide for available frequencies
Accuracy	−250		+250	kHz	
Pushing		5		kHz/V	
Pulling		5		kHz p-p	Into 2:1 voltage standing wave ratio (VSWR)
Drift Rate		2		ppm/°C	−40°C to +85°C
Drift vs. Time		1		ppm/Year	At 25°C
POWER OUTPUT	12	13.5		dBm	
SSB PHASE NOISE, CENTER FREQUENCY					
At 1 kHz Offset		−95		dBc/Hz	
At 10 kHz Offset	−117	−122		dBc/Hz	
At 100 kHz Offset		−140		dBc/Hz	
At 1 MHz Offset		−150		dBc/Hz	
TUNING VOLTAGE (VT)	2		12	V	
ELECTRIC TUNING RANGE	−1		+1	MHz	
HARMONIC DISTORTION					
Second, 2 f_{OUT}		−28		dBc	
Third, 3 f_{OUT}		−35		dBc	
OUTPUT RETURN LOSS		12		dB	
VOLTAGE SUPPLY (V_{DC})	6		15	V	
SUPPLY CURRENT		116		mA	V_{DC} = 6.5 V

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
V_{DC}	15 V
VT	0 V to 15 V
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	−40°C to +85°C[1]

[1] While the HMC-C200 operates over this temperature range, it is not guaranteed that the specific frequency is in the tuning range at all temperatures. For additional options, contact a local Analog Devices sales or distribution representative for information on additional screening to ensure any required operation over temperature.

Stresses at or above those 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

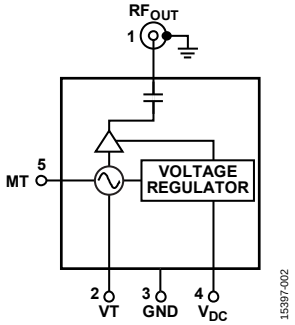

Figure 2. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	RF_{OUT}	Radio Frequency Output. RF_{OUT} is ac-coupled and uses a female SMA connector. See Figure 3 for the interface schematic.
2	VT	Tuning Voltage. Control voltage and modulation input. Modulation bandwidth is 5 kHz for an ideal 2 V to 12 V source. See Figure 4 for the interface schematic.
3	GND	Ground. Must be connected to power supply ground. See Figure 5 for the interface schematic.
4	V_{DC}	Positive Power Supply Voltage. V_{DC} = 6 V to 15 V. See Figure 6 for the interface schematic.
5	MT	Mechanical Tuning Screw. MT is set at the factory per the specified frequency of the customer. See Figure 7 for the interface schematic.

INTERFACE SCHEMATICS

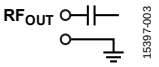

Figure 3. RF_{OUT} Interface Schematic

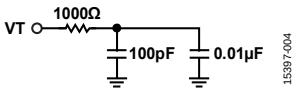

Figure 4. VT Interface Schematic

Figure 5. GND Interface Schematic

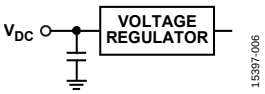

Figure 6. V_{DC} Interface Schematic

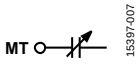

Figure 7. MT Interface Schematic

TYPICAL PERFORMANCE CHARACTERISTICS

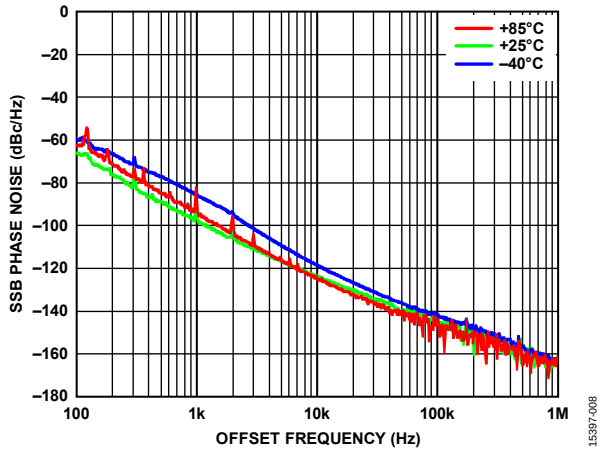

Figure 8. SSB Phase Noise vs. Offset Frequency for Various Temperatures at 8.2 GHz

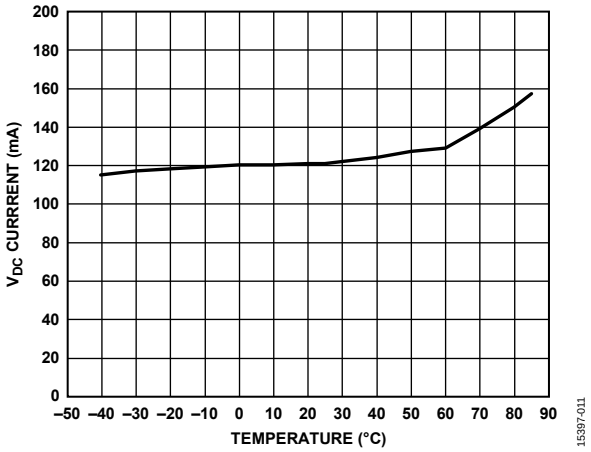

Figure 11. V_{DC} Current vs. Temperature at 8.2 GHz

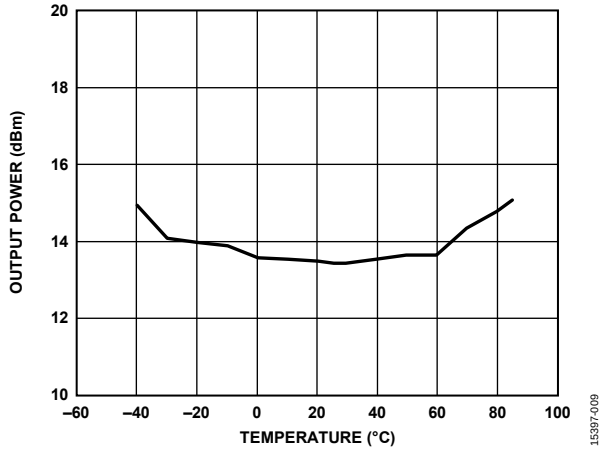

Figure 9. Output Power vs. Temperature at 8.2 GHz

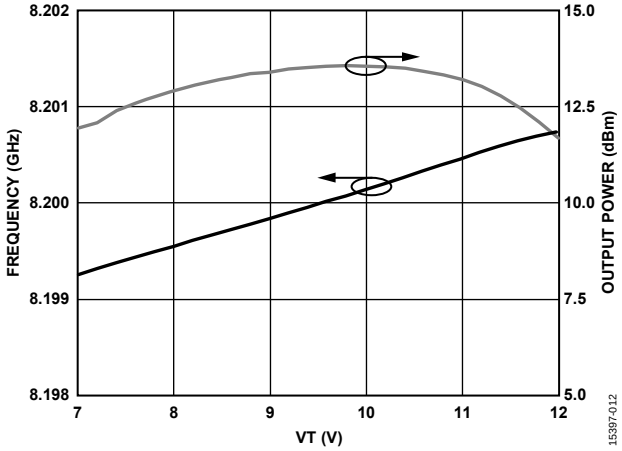

Figure 12. Frequency and Output Power vs. Tuning Voltage(VT)

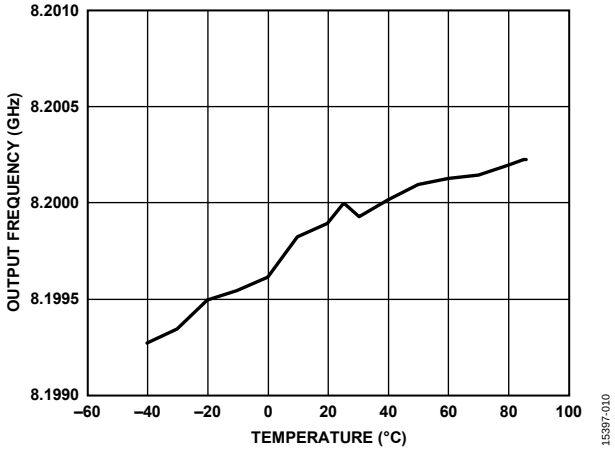

Figure 10. Output Frequency vs. Temperature

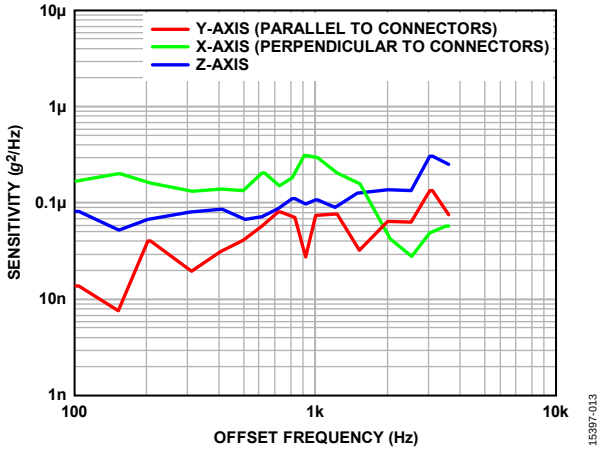

Figure 13. Vibration Sensitivity vs. Offset Frequency

THEORY OF OPERATION

DRO TUNING PROCEDURE

The DRO turning procedure is as follows:

1. A mechanical tuning (MT) screw is provided on the HMC-C200, which can adjust the center frequency by approximately ±20 MHz from the factory setting. This screw is set at the factory per the specified frequency of the customer, as outlined in the Ordering Guide section. Adjusting the screw clockwise increases the frequency, while turning the screw counterclockwise decreases the frequency. The MT screw has stops at either end of its approximately 8 turn range. Do not attempt to force the screw past the stops.
2. Connect the RF output to a spectrum analyzer and adjust the MT screw to set the output frequency within 1 MHz of the desired value.
3. Set the spectrum analyzer settings for a 10 MHz span centered on the desired output frequency. Change the reference value of the spectrum analyzer approximately 15 dBm and change the vertical scale to 1 dB per division so the peak oscillation frequency is visible on the screen.
4. Use the tuning voltage (VT) on Pin 2 to maximize the DRO output power and note the frequency. The tuning voltage must not be adjusted higher than 15 V.
5. If the frequency is meeting the new requirement and the output power is greater than 12 dBm, the tuning procedure is complete. If the frequency is not meeting the requirement, carefully readjust the MT screw and VT until the output frequency is within the required range.

The VT sustains oscillation over a fairly narrow range (approximately 1 MHz) before output power, temperature stability, and phase noise performance starts to degrade. In some cases, it is possible for the VT to be adjusted to the point where oscillation stops. Therefore, use the MT screw as a coarse tune, and use the VT effectively as a fine tune. In phase-locked loop (PLL) applications where the VT is used within the loop, this limited voltage range must be considered during the design of the loop. Use limiting circuit must be used to keep the VT voltage within the optimal range.

If the output power is less than 12 dBm, the DRO may be at the correct frequency; however, the phase noise performance and stability over temperature may degrade. It is recommended that the customer verify phase noise and stability after custom tuning.

APPLICATION CIRCUITS

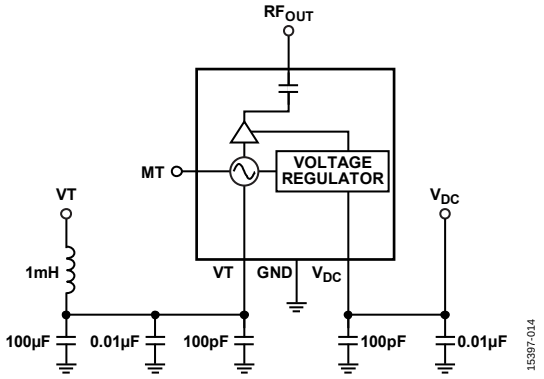

Figure 14. Fixed Output Frequency Application

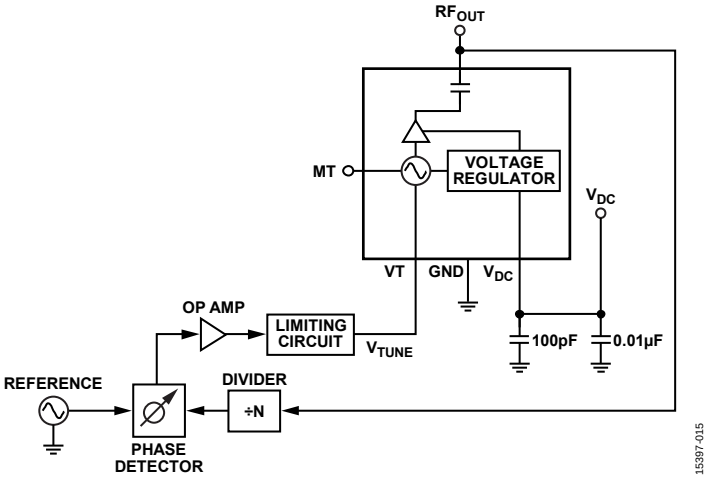

Figure 15. Phase Locked Application

OUTLINE DIMENSIONS

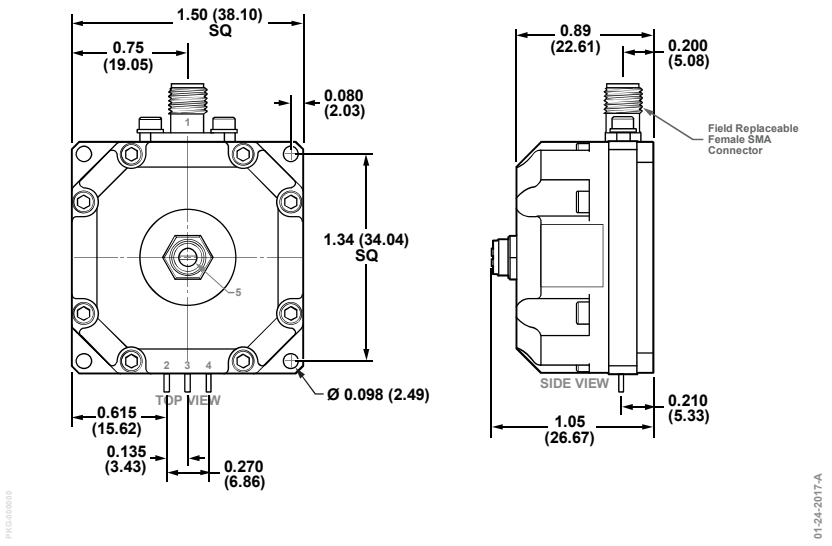

Figure 16. 5-Lead Connectorized Hermetic Module [MODULE]
(ML-5-3)
Dimensions shown in inches and (millimeters)

ORDERING GUIDE

Model	Temperature Range	Module Description	Package Option
HMC-C200-8000	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8025	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8050	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8075	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8100	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8125	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8150	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8175	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8200	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8225	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8250	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8275	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3
HMC-C200-8300	−40°C to +85°C	5-Lead Connectorized Hermetic Module [MODULE]	ML-5-3