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FEATURES

Dual output

$f_{OUT} = 9.25 \text{ GHz to } 10.10 \text{ GHz}$

$f_{OUT}/2 = 4.625 \text{ GHz to } 5.050 \text{ GHz}$

Power output (P_{OUT}): 11 dBm (typical)

Single-sideband (SSB) phase noise: $-115 \text{ dBc/Hz at } 100 \text{ kHz}$

No external resonator needed

RoHS-compliant, 5 mm × 5 mm LFCSP: 25 mm²

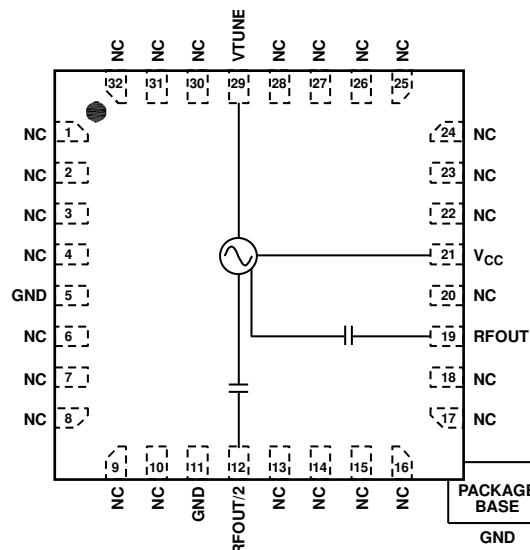
APPLICATIONS

Point to point and multipoint radios

Test equipment and industrial controls

Very small aperture terminals (VSATs)

FUNCTIONAL BLOCK DIAGRAM



NOTES
1. NC = NO CONNECT. THESE PINS ARE NOT INTERNALLY CONNECTED. HOWEVER, THESE PINS CAN BE CONNECTED TO RF/DC GROUND WITHOUT AFFECTING THE PERFORMANCE OF THE DEVICE.

13066-001

Figure 1.

GENERAL DESCRIPTION

The HMC1162 is a monolithic microwave integrated circuit (MMIC), voltage controlled oscillator (VCO) that integrates the resonator, a negative resistance device, and varactor diodes, and features a half frequency output.

Because of the monolithic construction of the oscillator, the output power and phase noise performance are excellent over temperature.

The power output is 11 dBm typical from a 5 V supply voltage. The VCO is housed in a RoHS-compliant, 32-lead LFCSP and requires no external matching components.

HMC1162* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

COMPARABLE PARTS

View a parametric search of comparable parts.

EVALUATION KITS

- Evaluation Board for HMC1162LP5

DOCUMENTATION

Data Sheet

- HMC1162: 9.25 GHz to 10.10 GHz MMIC VCO with Half Frequency Output Data Sheet

REFERENCE MATERIALS

Quality Documentation

- Package/Assembly Qualification Test Report: LP3, LP4, LP5 & LP5G (QTR: 2014-00145)

DESIGN RESOURCES

- HMC1162 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

DISCUSSIONS

View all HMC1162 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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REVISION HISTORY

9/15—v00.0914 to Rev. A

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

| | |
|--|-----------|
| Updated Format..... | Universal |
| Changes to Features Section and General Description Section..... | 1 |
| Deleted Frequency vs. Tuning Voltage, T = 25°C Graph; Renumbered Sequentially..... | 2 |
| Changes to Table 1 | 3 |
| Deleted Reliability Information Table; Renumbered Sequentially | 3 |

| | |
|--|----|
| Changes to Table 2..... | 4 |
| Added Interface Schematics Section..... | 6 |
| Reordered Figure Sequence, Typical Performance Characteristics Section | 7 |
| Added Applications Information Section | 9 |
| Added Figure 16; Renumbered Sequentially | 9 |
| Changes to Table 4..... | 10 |
| Updated Outline Dimensions..... | 11 |
| Changes to Ordering Guide | 11 |

SPECIFICATIONS

$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5\text{ V}$, unless otherwise noted.

Table 1.

| Parameter | Min | Typ | Max | Unit | Test Conditions/Comments |
|-----------------------------|-------|------|-------|-------------------------|---|
| FREQUENCY | | | | | |
| Range | | | | | |
| f_{OUT} | 9.25 | | 10.10 | GHz | |
| $f_{OUT}/2$ | 4.625 | | 5.050 | GHz | |
| Drift Rate | | 1.0 | | MHz/ $^{\circ}\text{C}$ | |
| Pulling | | 0.5 | | MHz p-p | Pulling into a 2.0:1 voltage standing wave ratio (VSWR) |
| Pushing | | 6 | | MHz/V | At VTUNE = 5 V |
| POWER OUTPUT (P_{OUT}) | | | | | |
| RFOUT | 7 | 11 | 15 | dBm | |
| RFOUT/2 | 3 | 7.5 | 12 | dBm | |
| Supply Current (I_{CC}) | | 205 | | mA | $V_{CC} = 4.75\text{ V}$ |
| | 160 | 230 | 310 | mA | $V_{CC} = 5.00\text{ V}$ |
| | | 250 | | mA | $V_{CC} = 5.25\text{ V}$ |
| HARMONICS, SUBHARMONICS | | | | | |
| 1/2 | | 39 | | dBc | |
| 3/2 | | 23 | | dBc | |
| Second | | 14 | | dBc | |
| Third | | 22 | | dBc | |
| TUNING | | | | | |
| Voltage (VTUNE) | 2 | | 13 | V | |
| Sensitivity | 50 | | 350 | MHz/V | |
| Tune Port Leakage Current | | | 10 | μA | VTUNE = 13 V |
| OUTPUT RETURN LOSS | | 7 | | dB | |
| SSB PHASE NOISE | | | | | |
| 10 kHz Offset | | -86 | -83 | dBc/Hz | |
| 100 kHz Offset | | -115 | -110 | dBc/Hz | |

ABSOLUTE MAXIMUM RATINGS

Table 2.

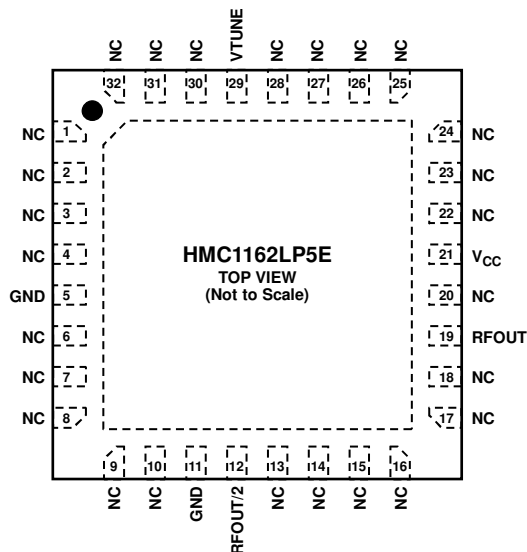
| Parameter | Rating |
|--|-----------------|
| V_{CC} | 5.5 V dc |
| VTUNE | 0 V to 15 V |
| Temperature | |
| Operating | –40°C to +85°C |
| Storage | –65°C to +150°C |
| Nominal Junction (To Maintain 1 Million Hours Mean Time to Failure (MTTF)) | 135°C |
| Nominal Junction ($T_A = 85^\circ\text{C}$) | 116.3°C |
| Maximum Reflow Temperature (MSL3 Rating) | 260°C |
| Thermal Resistance (Junction to Exposed Pad) | 24.3°C/W |
| ESD Sensitivity (Human Body Model) | Class 1A |

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



NOTES

1. NC = NO CONNECT. THESE PINS ARE NOT INTERNALLY CONNECTED. HOWEVER, THESE PINS CAN BE CONNECTED TO RF/DC GROUND WITHOUT AFFECTING THE PERFORMANCE OF THE DEVICE.
2. THE PACKAGE BOTTOM HAS AN EXPOSED METAL PAD THAT MUST BE CONNECTED TO RF/DC GROUND.

13066-002

Figure 2. Pin Configuration

Table 3. Pin Function Descriptions

| Pin No. | Mnemonic | Description |
|---|-----------------|--|
| 1 to 4, 6 to 10, 13 to 18, 20, 22 to 28, 30 to 32 | NC | No Connect. These pins are not internally connected. However, these pins can be connected to RF/dc ground without affecting the performance of the device. |
| 5, 11 | GND | Ground. These pins must be connected to RF/dc ground. |
| 12 | RFOUT/2 | Half Frequency Output. This pin is ac-coupled. |
| 19 | RFOUT | RF Output. This pin is ac-coupled. |
| 21 | V _{CC} | Supply Voltage (5 V). |
| 29 | VTUNE | Control Voltage and Modulation Input. The modulation bandwidth is dependent on the drive source impedance. |
| | EP | Exposed Pad. The package bottom has an exposed metal pad that must be connected to RF/dc ground. |

INTERFACE SCHEMATICS

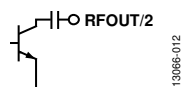


Figure 3. RFOUT/2 Interface

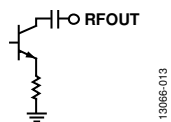


Figure 4. RFOUT Interface

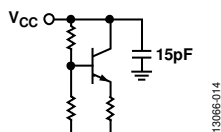
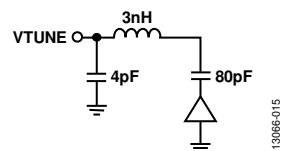
Figure 5. V_{CC} Interface

Figure 6. VTUNE Interface



Figure 7. GND Interface

TYPICAL PERFORMANCE CHARACTERISTICS

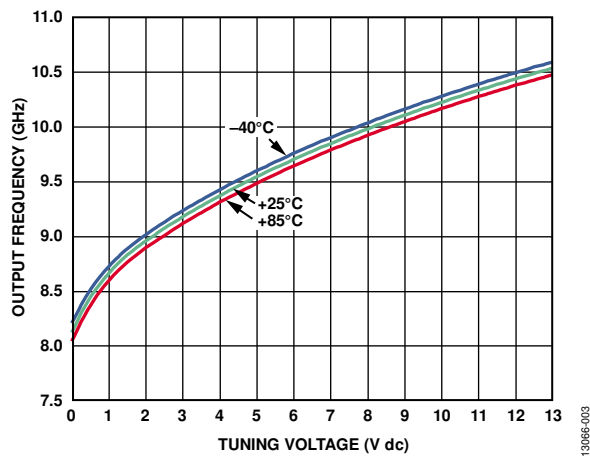


Figure 8. Output Frequency vs. Tuning Voltage

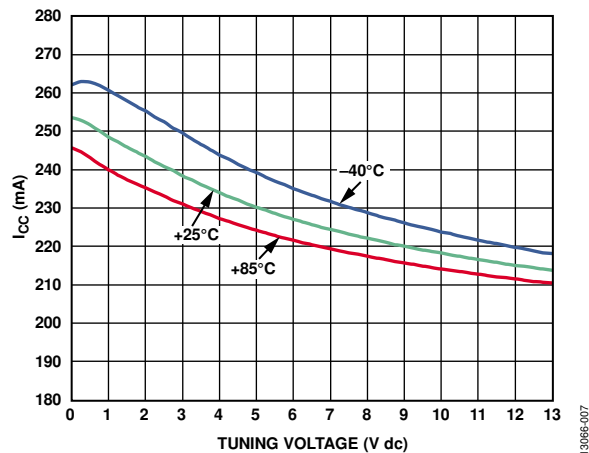


Figure 11. Supply Current vs. Tuning Voltage

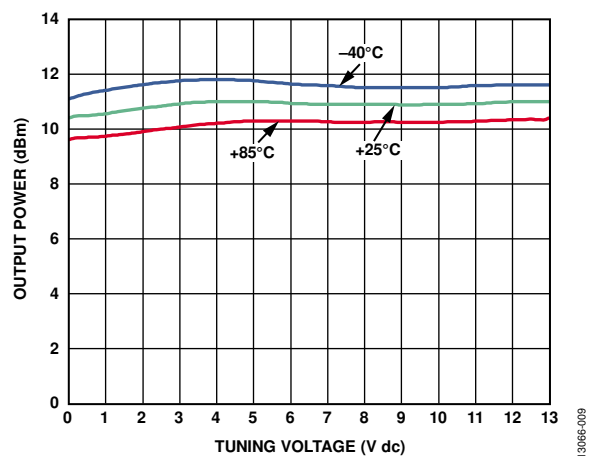


Figure 9. Output Power vs. Tuning Voltage

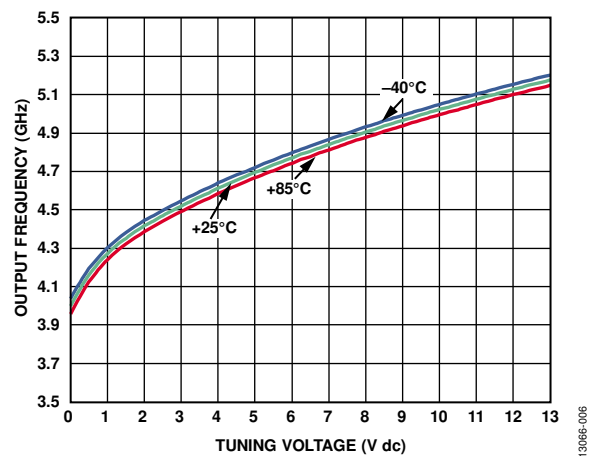


Figure 12. RFOUT/2 Output Frequency vs. Tuning Voltage

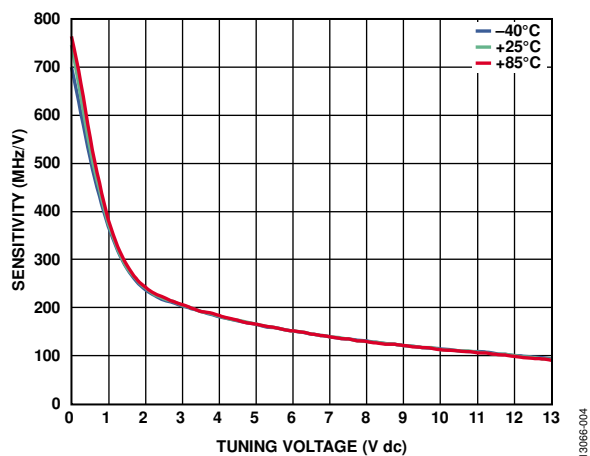


Figure 10. Sensitivity vs. Tuning Voltage

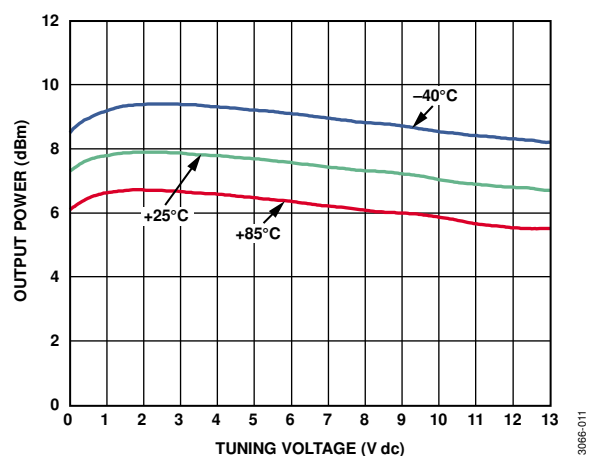


Figure 13. RFOUT/2 Output Power vs. Tuning Voltage

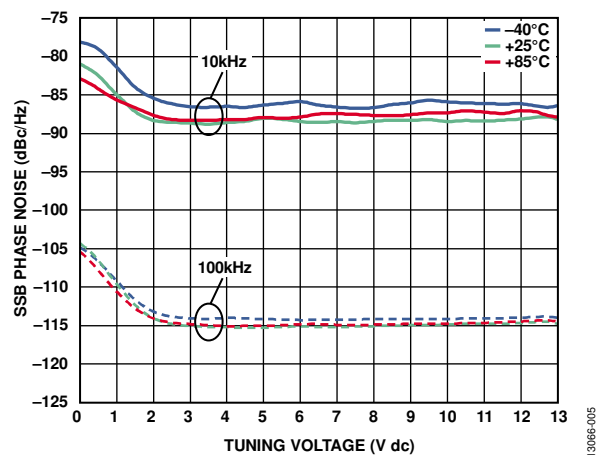


Figure 14. SSB Phase Noise vs. Tuning Voltage

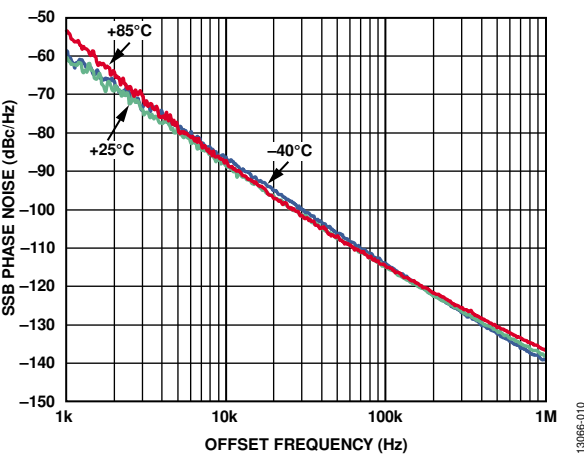


Figure 15. SSB Phase Noise vs. Offset Frequency at VTUNE = 5 V

APPLICATIONS INFORMATION

The HMC1162 serves as the local oscillator (LO) in microwave synthesizer applications. Point to point microwave radios, military, radars, test and measurement, as well as industrial and medical equipment are the primary applications. The low phase noise allows higher orders of modulation and offers improved bit error rates in communication systems, and the linear,

monotonic tuning sensitivity allows a stable loop filter design. The higher output power minimizes the gain required to drive subsequent stages. The half frequency output reduces the input frequency to the prescaler without the addition of residual phase noise to the input of the phase-locked loop synthesizer.

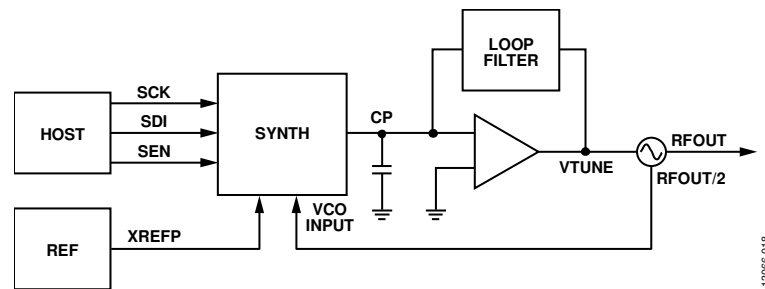


Figure 16. Typical Application Diagram

EVALUATION PRINTED CIRCUIT BOARD (PCB)

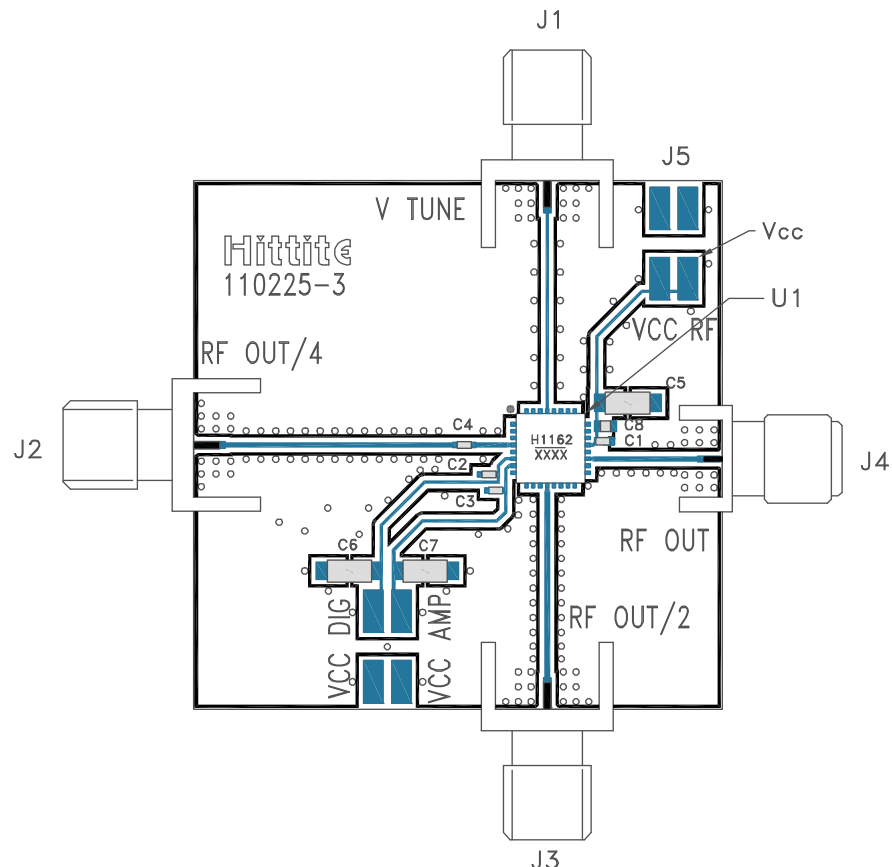


Figure 17. Evaluation Board

The circuit board used in an application uses RF circuit design techniques. Ensure that the signal lines have 50 Ω impedance and that the package ground leads and backside ground paddle are connected directly to the ground plane.

Use a sufficient number of via holes to connect the top and bottom ground planes. The evaluation circuit board shown in Figure 17 is available from Analog Devices, Inc., upon request.

BILL OF MATERIALS

Table 4. Bill of Materials [EV1HMC1162LP5](#)

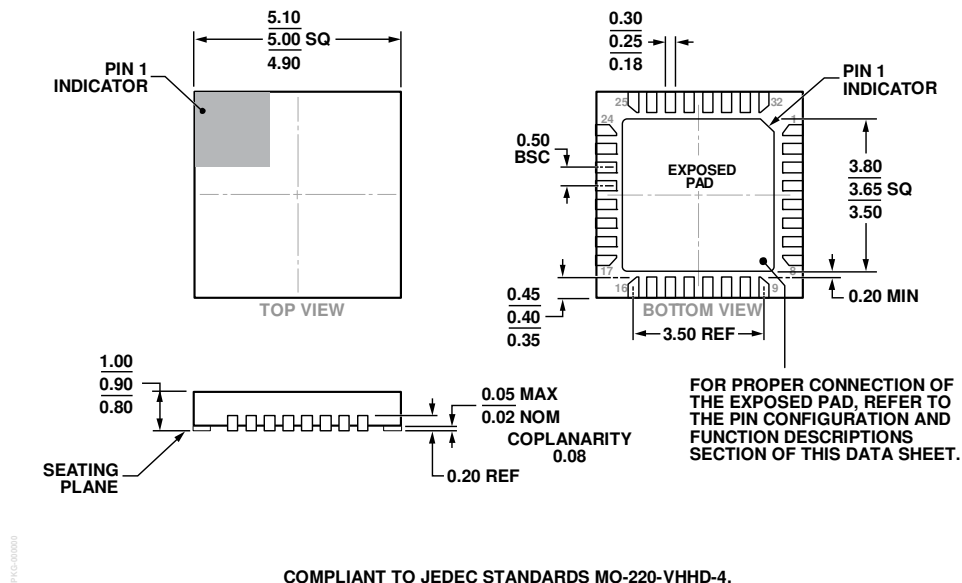
| Item | Description |
|------------------|---|
| J1 to J4 | PCB mount SMA RF connectors |
| J5, J6 | 2 mm dc headers |
| C1 to C3 | 100 pF capacitors, 0402 package |
| C4 | 1000 pF capacitor, 0402 package |
| C5 to C7 | 2.2 μ F tantalum capacitors |
| C8 | 0.01 μ F capacitor, 0603 package |
| U1 | HMC1162 VCO |
| PCB ¹ | EV1HMC1162LP5 evaluation board ² |

¹ Circuit board material is Rogers 4350.

² Reference this number when ordering the complete evaluation PCB.

PACKAGING AND ORDERING INFORMATION

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-220-VHHD-4.

Figure 18. 32-Lead Lead Frame Chip Scale Package [LFCSP_VQ]
 5 mm x 5 mm Body, Very Thin Quad
 (HCP-32-1)
 Dimensions shown in millimeters

ORDERING GUIDE

| Model ¹ | Temperature Range | MSL Rating ² | Package Description | Package Option | Qty. | Brand ³ |
|--------------------|-------------------|-------------------------|------------------------------------|----------------|------|--------------------|
| HMC1162LP5E | –40°C to +85°C | MSL3 | 32-Lead LFCSP_VQ | HCP-32-1 | | H1162 XXXX |
| HMC1162LP5ETR | –40°C to +85°C | MSL3 | 32-Lead LFCSP_VQ, 7" Tape and Reel | HCP-32-1 | 500 | H1162 XXXX |
| EV1HMC1162LP5 | | | Evaluation Board | | | |

¹ The HMC1162LP5E and HMC1162LP5ETR are RoHS compliant parts.

² See the Absolute Maximum Ratings section, Table 2.

³ XXXX is a placeholder for the 4-digit lot number.