



**Hittite**  
MICROWAVE PRODUCTS  
FROM ANALOG DEVICES

# Analog Devices Welcomes Hittite Microwave Corporation



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### Typical Applications

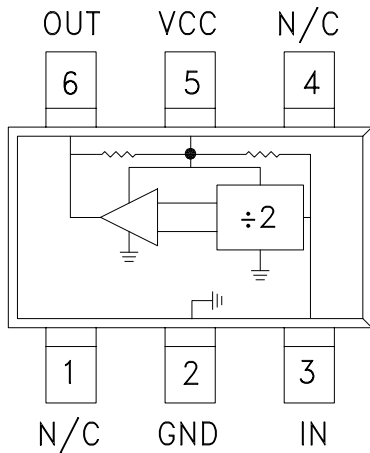
Prescaler for DC to C band PLL applications:

- UNII, point-to-point, and VSAT radios
- 802.11a and HiperLAN WLAN
- Fiber optic
- Cellular / 3G infrastructure

### Features

- Ultra low SSB phase noise: -148 dBc/Hz
- Single-ended I/O's
- Output power: -3 dBm to -9 dBm
- Single DC supply: +3V @ 42 mA
- 9 mm<sup>2</sup> ultra small package: SOT26

### Functional Diagram



### General Description

The HMC432(E) is a low noise divide-by-2 static divider utilizing InGaP GaAs HBT technology in ultra small surface mount SOT26 plastic packages. This device operates from DC (with a square wave input) to 8 GHz input frequency with a single +3V DC supply. Single-ended inputs and outputs reduce component count and cost. The low additive SSB phase noise of -148 dBc/Hz at 100 kHz offset helps the user maintain good system noise performance.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , 50 $\Omega$ System, $V_{CC} = +3\text{V}$

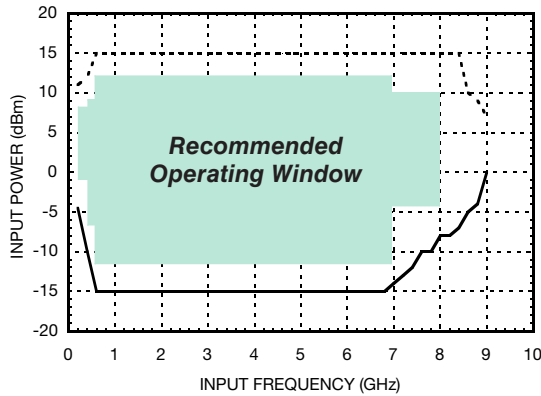
| Parameter                        | Conditions  | Min. | Typ. | Max. | Units  |
|----------------------------------|---|------|------|------|--------|
| Input frequency                  | Sine wave input [1] [2]   |      |      | 8    | GHz    |
| Input power range                | $F_{in} = 0.2 \text{ GHz to } 0.4 \text{ GHz}$                            | -4   |      | +11  | dBm    |
|                                  | $F_{in} = 0.4 \text{ GHz to } 0.6 \text{ GHz}$                            | -10  |      | +12  |        |
|                                  | $F_{in} = 0.6 \text{ GHz to } 1.0 \text{ GHz}$                            | -15  |      | +15  |        |
|                                  | $F_{in} = 1 \text{ GHz to } 7 \text{ GHz}$                                | -12  |      | +12  |        |
|                                  | $F_{in} = 7 \text{ GHz to } 8 \text{ GHz}$                                | -4   |      | +10  |        |
| Output power                     | $F_{in} = 4 \text{ GHz}$  | -6   | -3   |      | dBm    |
|                                  | $F_{in} = 8 \text{ GHz}$  | -12  | -9   |      | dBm    |
| Reverse leakage                  | RF output terminated, $F_{in} = 4 \text{ GHz}$ , $P_{in} = 0 \text{ dBm}$ |      | -30  |      | dBm    |
| SSB phase noise (100 kHz offset) | $P_{in} = 0 \text{ dBm}$ , $F_{in} = 4 \text{ GHz}$                       |      | -148 |      | dBc/Hz |
| Output transition time           | $P_{in} = 0 \text{ dBm}$ , $F_{out} = 882 \text{ MHz}$                    |      | 145  |      | ps     |
| Supply current ( $I_{CC}$ )      | $V_{CC} = 3.0 \text{ V}$  |      | 42   | 56   | mA     |

1. Divider will operate down to near DC.

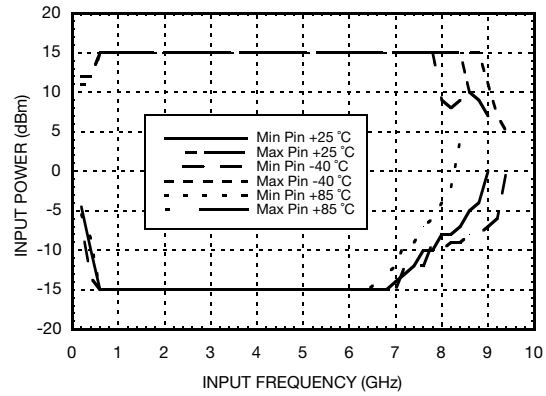
2. For stable operation without an input signal, refer to Analog Devices Application Note, "Frequency Divider Operation & Compensation with No Input Signal."



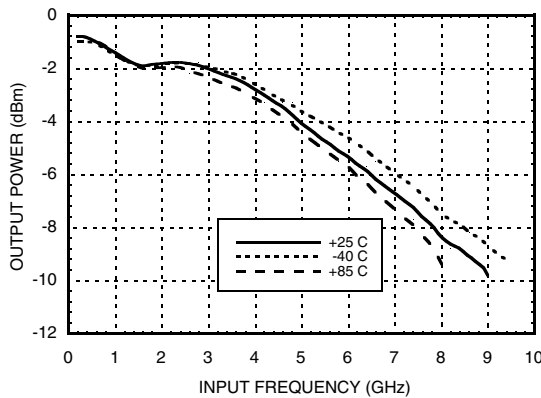
**Input Sensitivity Window,  $T = 25\text{ }^{\circ}\text{C}$**



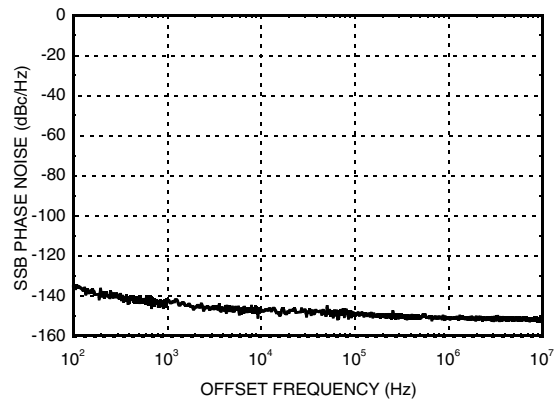
**Input Sensitivity Window vs. Temperature**



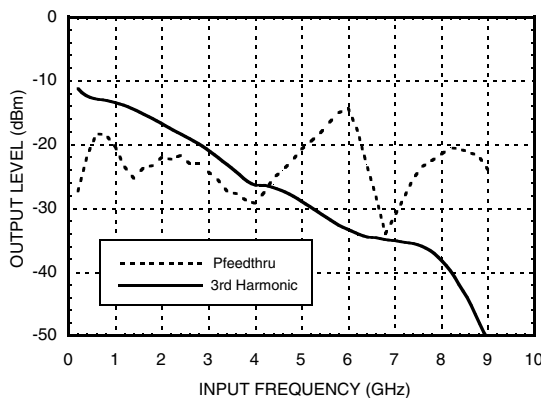
**Output Power vs. Temperature**



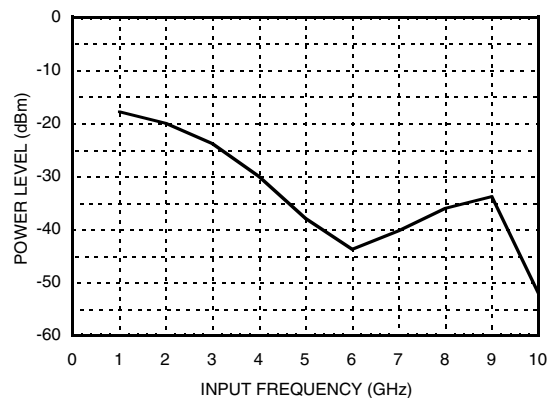
**SSB Phase Noise Performance,  
 $P_{in} = 0\text{ dBm}, T = 25\text{ }^{\circ}\text{C}$**



**Output Harmonic Content,  
 $P_{in} = 0\text{ dBm}, T = 25\text{ }^{\circ}\text{C}$**

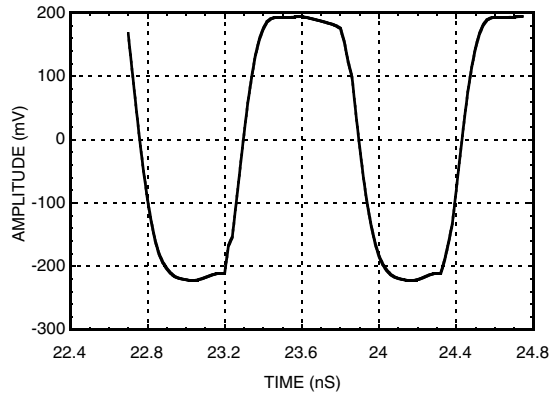


**Reverse Leakage,  $P_{in} = 0\text{ dBm}, T = 25\text{ }^{\circ}\text{C}$**





**Output Voltage Waveform,**  
*Pin = 0 dBm, Fout = 882 MHz, T = 25 °C*



**Absolute Maximum Ratings**

|                            |                   |
|----------------------------|-------------------|
| RF input power (Vcc = +3V) | 15 dBm            |
| Nominal +3V supply to GND  | -0.3V to 3.5V     |
| Max peak flow temperature  | 260 °C            |
| Storage temperature        | -65 °C to +125 °C |
| ESD sensitivity (HBM)      | 150 V             |

**Reliability Information**

|  |               |
|--|---------------|
| Junction temperature to maintain 1 million hour MTTF   | 135 °C        |
| Nominal junction temperature (T = 85 °C)               | 99 °C         |
| Thermal resistance (Junction to GND paddle, 3V supply) | 108 °C/W      |
| Operating temperature                                  | -40 to +85 °C |

DC blocking capacitors are required at RF input and RF output ports. Choose value for lowest frequency of operation.

**Typical Supply Current vs. Vcc**

| Vcc (V) | Icc (mA) |
|---------|----------|
| 2.70    | 34       |
| 3.00    | 42       |
| 3.30    | 50       |

Note: Divider will operate over full voltage range shown above

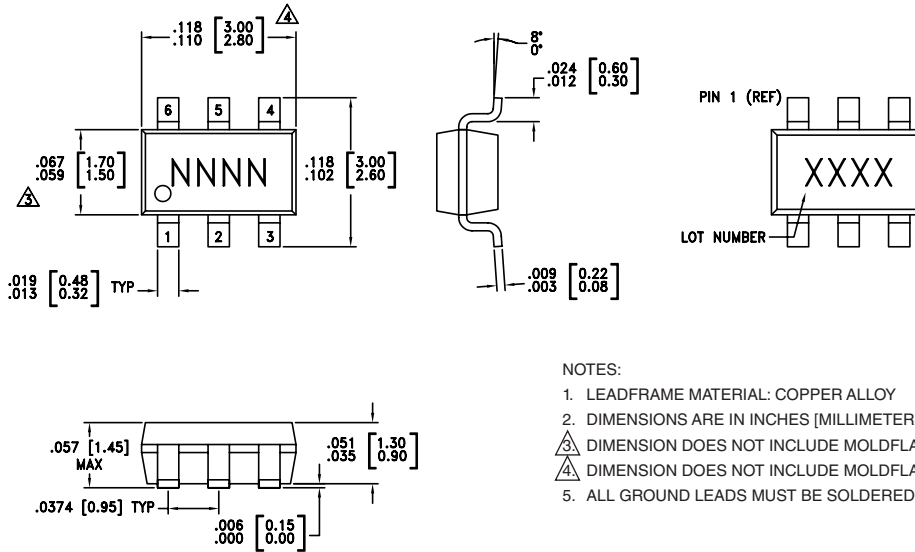


**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**



## SMT GaAs HBT MMIC DIVIDE-BY-2, DC - 8 GHz

### Outline Drawing



NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS].
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15 mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25 mm PER SIDE.
5. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC432      | Low stress injection molded plastic                | Sn/Pb solder  | MSL1 <sup>[1]</sup> | H432<br>XXXX                   |
| HMC432E     | RoHS-compliant low stress injection molded plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 432E<br>XXXX                   |

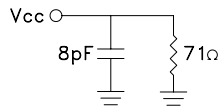
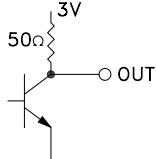
- [1] Max peak reflow temperature of 235 °C  
 [2] Max peak reflow temperature of 260 °C  
 [3] 4-digit lot number XXXX

### Pin Description

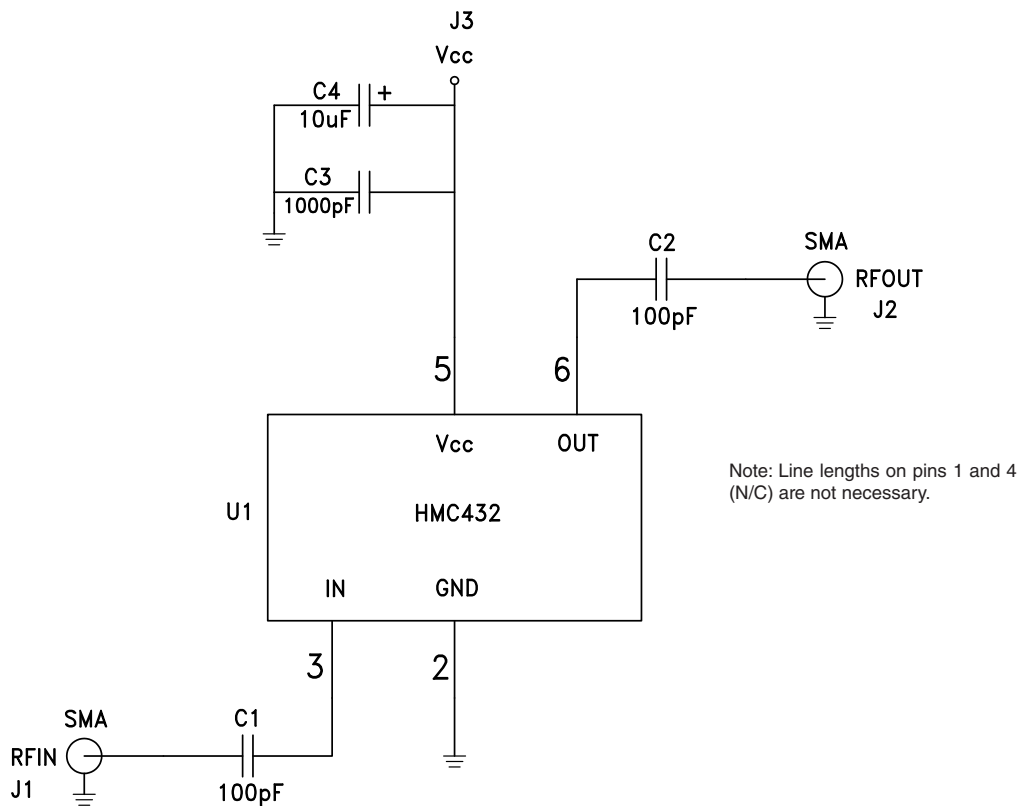
| Pin Number | Function | Description  | Interface Schematic |
|------------|----------|--|---------------------|
| 1, 4       | N/C      | The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. |                     |
| 2          | GND      | Pin must connect to RF/DC ground.  |                     |
| 3          | IN       | RF input must be DC blocked.   |                     |



### Pin Description (Continued)

| Pin Number | Function | Description                        | Interface Schematic   |
|------------|----------|------------------------------------|---|
| 5          | Vcc      | Supply voltage 3V ±0.3V.           |  |
| 6          | OUT      | Divided output must be DC blocked. |  |

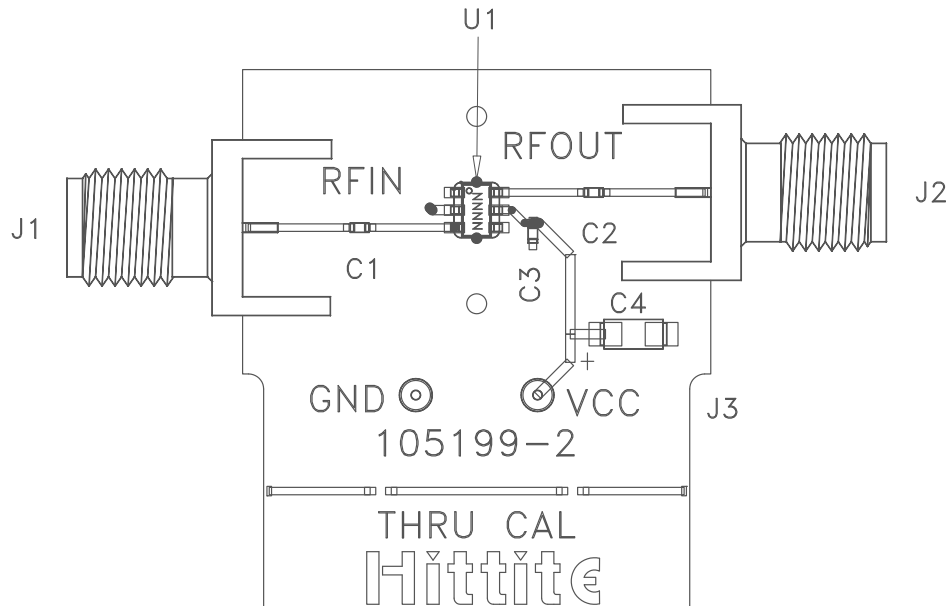
### Application Circuit



Note:

DC blocking capacitor values (C1, C2) and DC decoupling capacitor values (C3, C4) are chosen for lowest frequency of operation.

**Evaluation PCB**



**List of Materials for Evaluation PCB 105675 [1]**

| Item    | Description                         |
|---------|-------------------------------------|
| J1 - J2 | PCB mount SMA RF connector          |
| J3 - J4 | DC pin                              |
| C1 - C2 | 100 pF capacitor, 0402 pkg.         |
| C3      | 1000 pF capacitor, 0402 pkg.        |
| C4      | 10 μF tantalum capacitor, 1206 pkg. |
| U1      | HMC432/HMC432E divide-by-2          |
| PCB [2] | 105199 eval board                   |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit board material: Rogers 4350

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ω impedance while the package ground leads should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.



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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9