

### Typical Applications

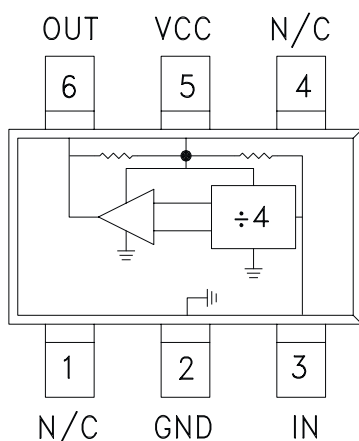
Prescaler for DC to C Band PLL Applications:

- UNII, Point-to-Point & VSAT Radios
- 802.11a & HiperLAN WLAN
- Fiber Optic
- Cellular / 3G Infrastructure

### Features

- Ultra Low SSB Phase Noise: -150 dBc/Hz
- Single-Ended I/O's
- Output Power: -2 to -3.5 dBm
- Single DC Supply: +3V @ 53 mA
- 9 mm<sup>2</sup> Ultra Small Package: SOT26

### Functional Diagram



### General Description

The HMC433(E) is a low noise Divide-by-4 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 -150 dBc/Hz at 100 kHz offset helps the user maintain good system noise performance.

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

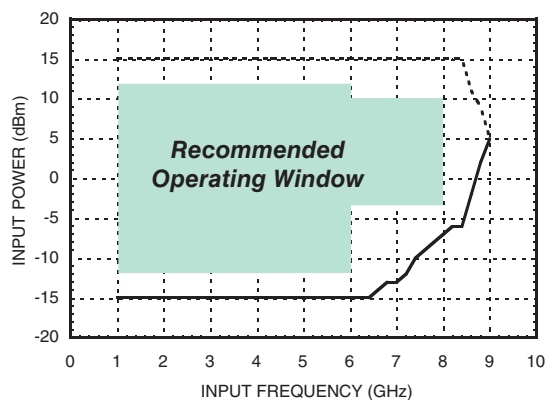
| Parameter                        | Conditions                                                                | Min. | Typ. | Max. | Units  |
|----------------------------------|---------------------------------------------------------------------------|------|------|------|--------|
| Maximum Input Frequency          |                                                                           | 8    | 8.5  |      | GHz    |
| Minimum Input Frequency          | Sine Wave Input. [1]                                                      |      | 0.2  |      | GHz    |
| Input Power Range                | $F_{in} = 1 \text{ to } 6 \text{ GHz}$                                    | -12  |      | +12  | dBm    |
|                                  | $F_{in} = 6 \text{ to } 8 \text{ GHz}$                                    | -3   |      | +10  | dBm    |
| Output Power                     | $F_{in} = 4 \text{ GHz}$                                                  | -5.0 | -2.0 |      | dBm    |
|                                  | $F_{in} = 8 \text{ GHz}$                                                  | -6.5 | -3.5 |      | dBm    |
| Reverse Leakage                  | RF Output Terminated, $F_{in} = 4 \text{ GHz}$ , $P_{in} = 0 \text{ dBm}$ |      | -25  |      | dBm    |
| SSB Phase Noise (100 kHz offset) | $P_{in} = 0 \text{ dBm}$ , $F_{in} = 4 \text{ GHz}$                       |      | -150 |      | dBc/Hz |
| Output Transition Time           | $P_{in} = 0 \text{ dBm}$ , $F_{out} = 882 \text{ MHz}$                    |      | 120  |      | ps     |
| Supply Current ( $I_{CC}$ )      | $V_{CC} = +3.0V$                                                          |      | 53   | 71   | mA     |

1. Divider will operate down to DC for square-wave input signal.

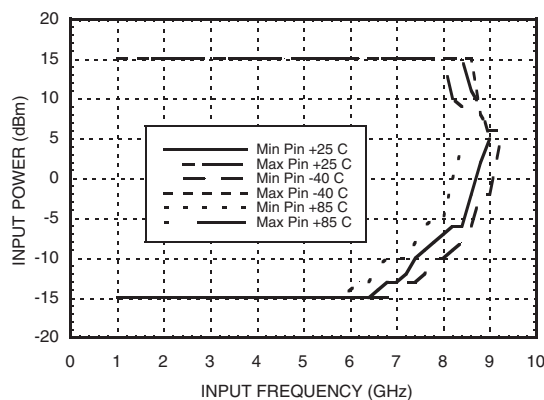


**SMT GaAs HBT MMIC  
DIVIDE-BY-4, DC - 8 GHz**

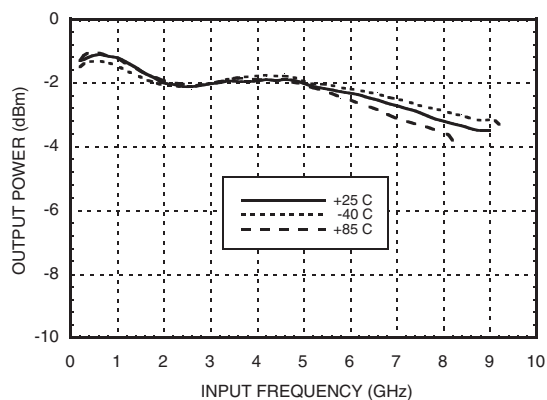
**Input Sensitivity Window,  $T = 25^\circ\text{C}$**



**Input Sensitivity Window vs. Temperature**

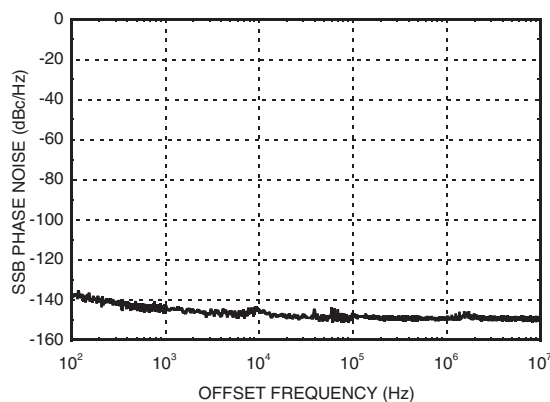


**Output Power vs. Temperature**



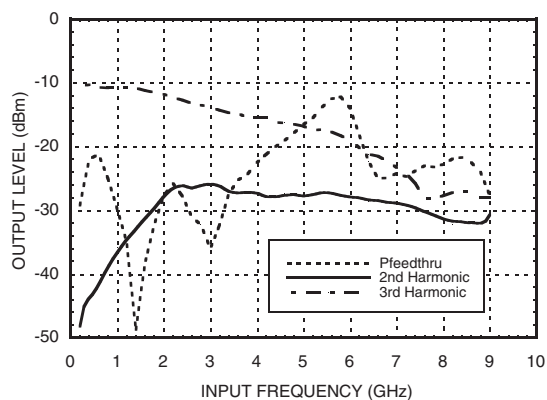
**SSB Phase Noise**

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

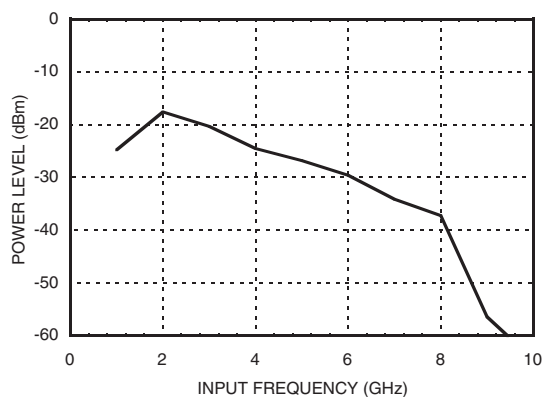


**Output Harmonic**

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

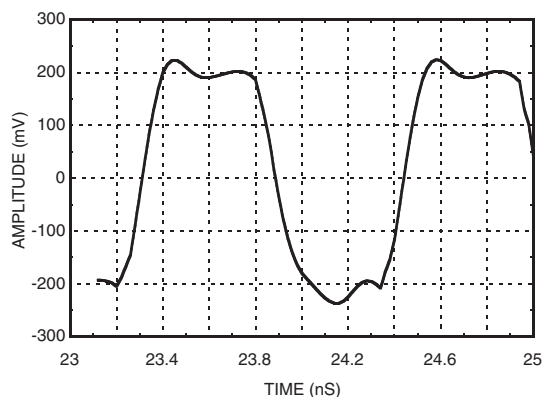


**Reverse Leakage,  $P_{in} = 0\text{ dBm}$ ,  $T = 25^\circ\text{C}$**




**SMT GaAs HBT MMIC  
DIVIDE-BY-4, DC - 8 GHz**

**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 to +125 °C |

**Reliability Information**

|                                                           |               |
|-----------------------------------------------------------|---------------|
| Junction Temperature to Maintain<br>1 Million Hour MTTF   | 135 °C        |
| Nominal Junction Temperature<br>(T = 85 °C)               | 99 °C         |
| Thermal Resistance<br>(Junction to GND Paddle, 3V Supply) | 83 °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.



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

**Typical Supply Current vs. Vcc**

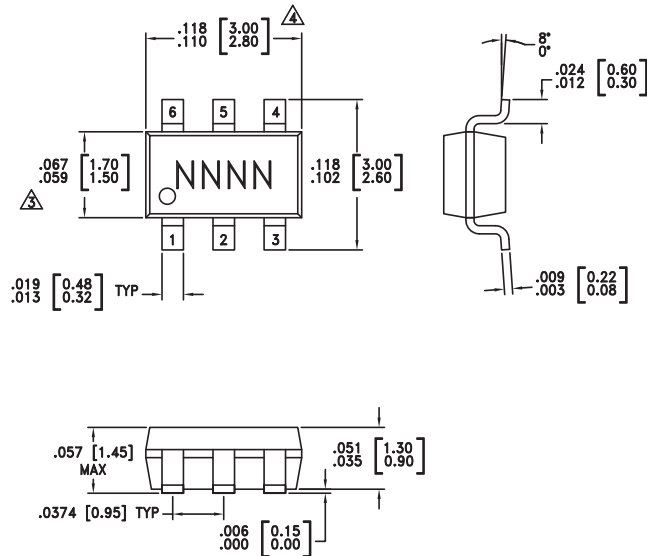
| Vcc (V) | Icc (mA) |
|---------|----------|
| 2.70    | 42       |
| 3.0     | 53       |
| 3.30    | 63       |

Note: Divider will operate over full voltage range shown above



## SMT GaAs HBT MMIC DIVIDE-BY-4, DC - 8 GHz

### Outline Drawing



#### NOTES:

- LEADFRAME MATERIAL: COPPER ALLOY
- DIMENSIONS ARE IN INCHES [MILLIMETERS]
- LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
- PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.  
PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
- PACKAGE WARP SHALL NOT EXCEED 0.05mm.
- ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
- REFER TO HITTITE APPLICATION NOT FOR SUGGESTED LAND PATTERN.

### Package Information

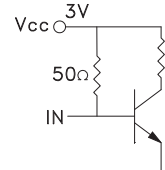
| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC433      | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H433<br>XXXX                   |
| HMC433E     | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 433E<br>XXXX                   |

[1] Max peak reflow temperature of 235 °C

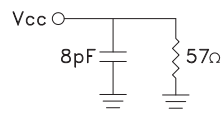
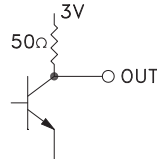
[2] Max peak reflow temperature of 260 °C

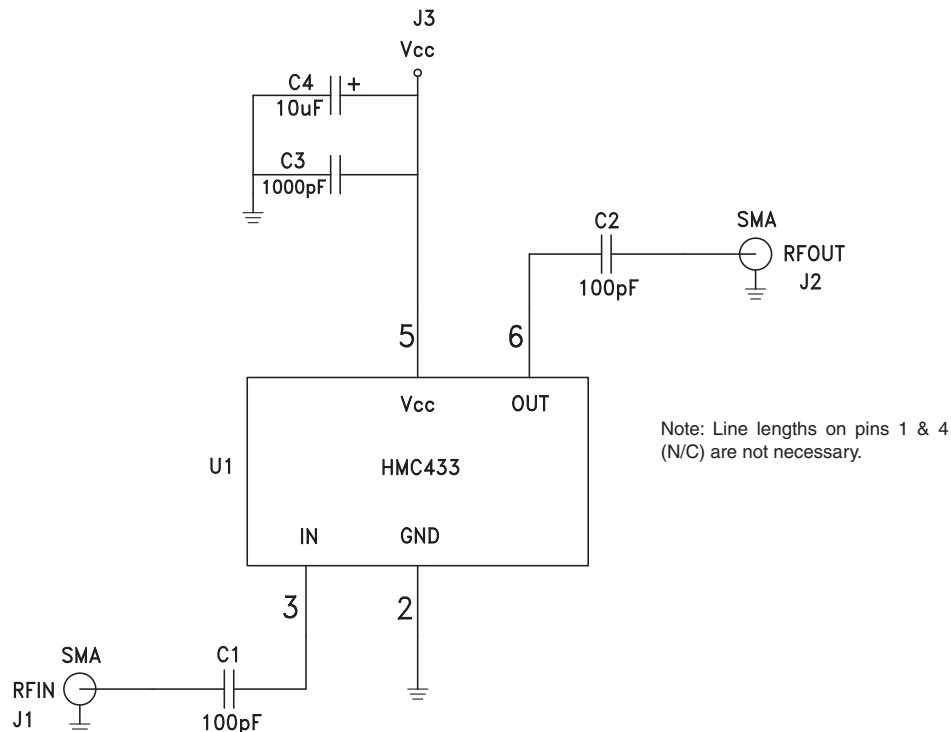
[3] 4-Digit lot number XXXX

### 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.                                                                                                             |  |


**SMT GaAs HBT MMIC  
DIVIDE-BY-4, DC - 8 GHz**
**Pin Description (Continued)**

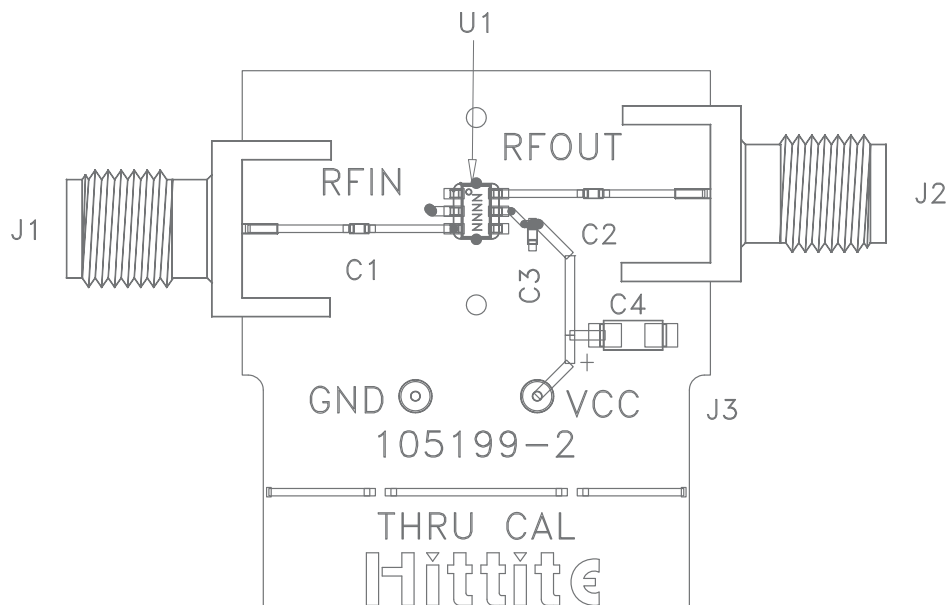
| Pin Number | Function | Description                        | Interface Schematic                                                                 |
|------------|----------|------------------------------------|-------------------------------------------------------------------------------------|
| 5          | Vcc      | Supply voltage $3V \pm 0.3V$ .     |  |
| 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 $\mu$ F Tantalum Capacitor, 1206 Pkg. |
| U1      | HMC433 / HMC433E Divide-by-4             |
| 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 Ohm 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.