



**Hittite**  
MICROWAVE PRODUCTS  
FROM ANALOG DEVICES

# Analog Devices Welcomes Hittite Microwave Corporation



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### Typical Applications

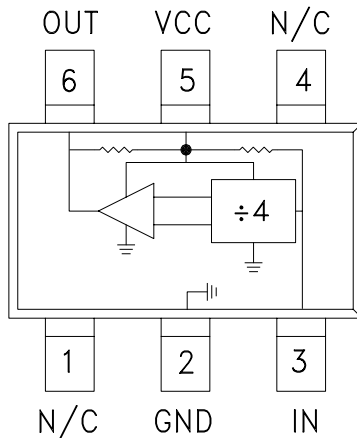
Prescaler for DC to C band PLL applications:

- UNII, point-to-point & 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

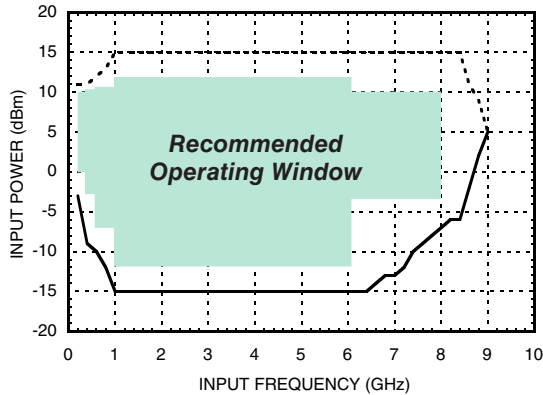
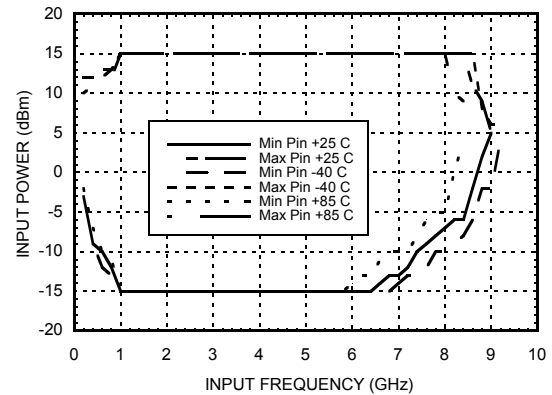
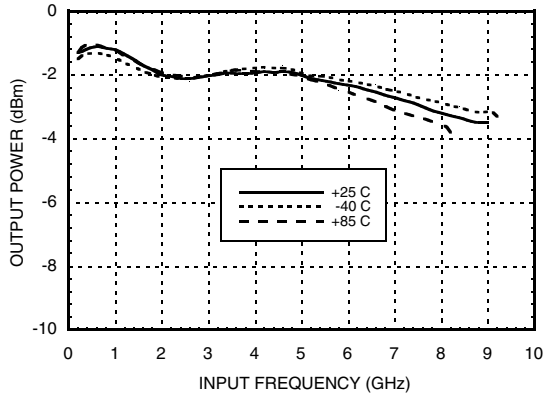
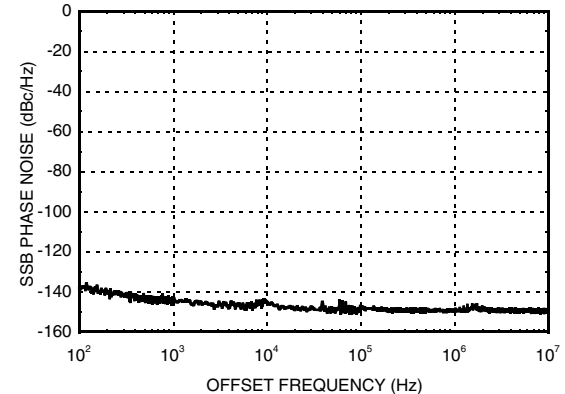
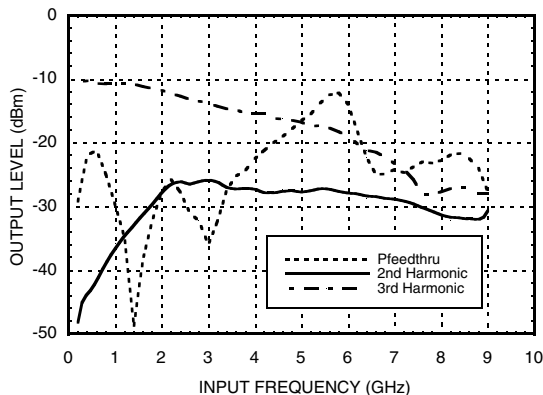
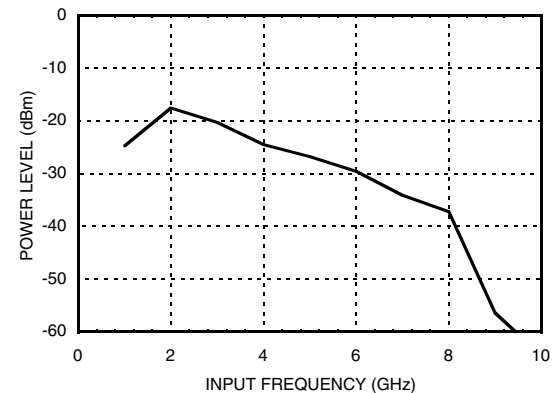
The HMC433(E) is a low noise divide-by-4 static divider utilizing InGaP GaAs HBT technology in ultra small surface mount SOT26 plastic packages. This device operates from near DC (with a square wave input) to 8 GHz input frequency with a single +3V DC supply. Single-ended inputs and outputs reduce component 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
Input frequency	Sine Wave Input. [1] [2]			8	GHz
Input power range	$F_{in} = 0.2$ to $0.4$ GHz	0		+10	dBm
	$F_{in} = 0.4$ to $0.6$ GHz	-5		+10	
	$F_{in} = 0.6$ to $1.0$ GHz	-7		+10	
	$F_{in} = 1.0$ to $6.0$ GHz	-12		+12	
	$F_{in} = 6.0$ to $8.0$ GHz	-3		+10	
Output power	$F_{in} = 4.0$ GHz	-5.0	-2.0		dBm
	$F_{in} = 8.0$ GHz	-6.5	-3.5		
Reverse leakage	RF Output Terminated, $F_{in} = 4$ GHz, $P_{in} = 0$ dBm		-25		dBm
SSB phase noise (100 kHz offset)	$P_{in} = 0$ dBm, $F_{in} = 4$ GHz		-150		dBc/Hz
Output transition time	$P_{in} = 0$ dBm, $F_{out} = 882$ MHz		120		ps
Supply current ( $I_{CC}$ )	$V_{CC} = +3.0V$		53	71	mA

1. Divider will operate down to near DC levels. Square-wave input required below 200 MHz

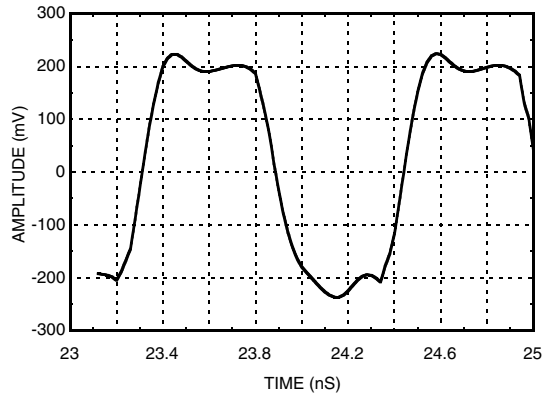
2. For stable operation without an input signal, refer to Analog Devices Application Note, "Frequency Divider Operation & Compensation with No Input Signal."

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


3. Sine-wave used for all plots.



**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)	150V

### 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)	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

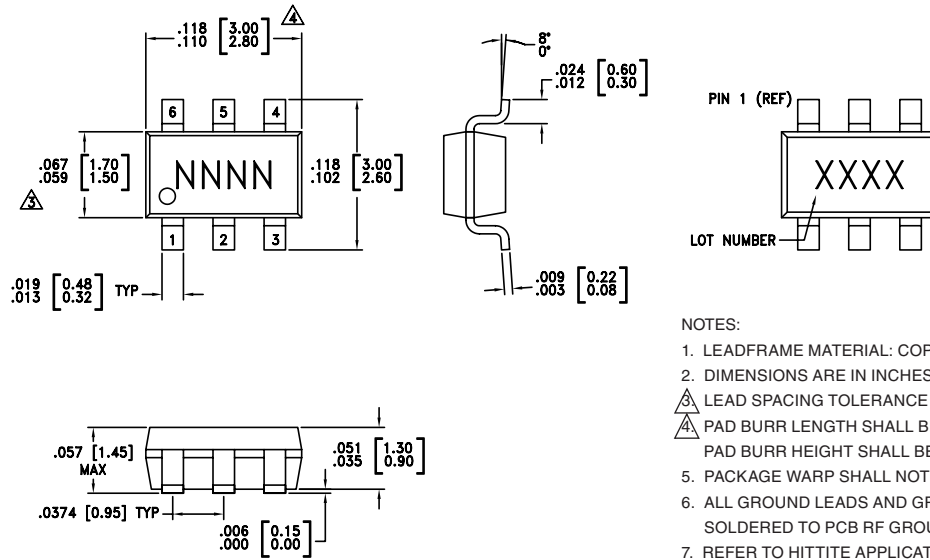
Vcc (V)	Icc (mA)
2.70	42
3.0	53
3.30	63

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 0.15 mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05 mm MAXIMUM.
  - PACKAGE WARP SHALL NOT EXCEED 0.05 mm.
  - ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
  - REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

### Package Information

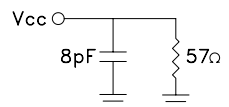
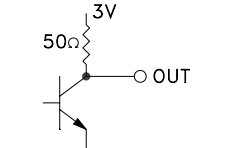
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[3]</sup>
HMC433	Low stress injection molded plastic	Sn/Pb solder	MSL1 <sup>[1]</sup>	H433 XXXX
HMC433E	RoHS-compliant low stress injection molded plastic	100% matte Sn	MSL1 <sup>[2]</sup>	433E XXXX

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

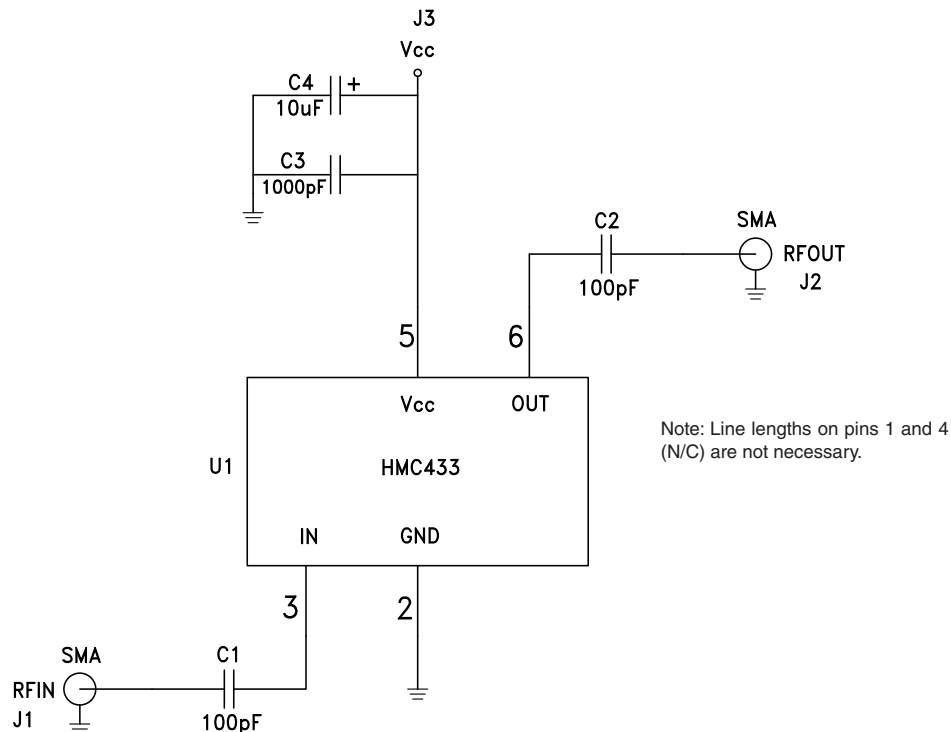
### Pin Description

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.	

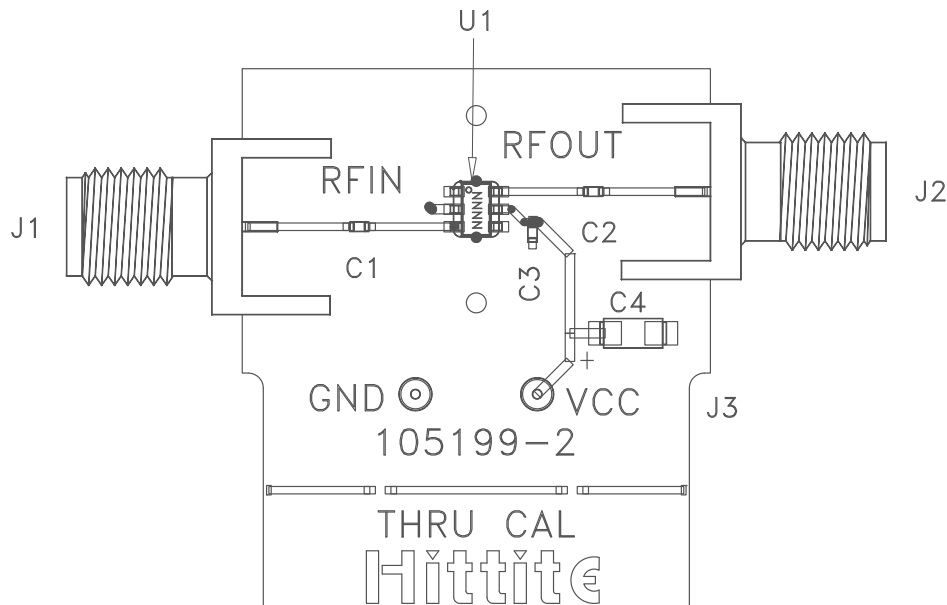
### Application Circuit



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 -HMC433 [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	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 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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