ANALOG DEVICES

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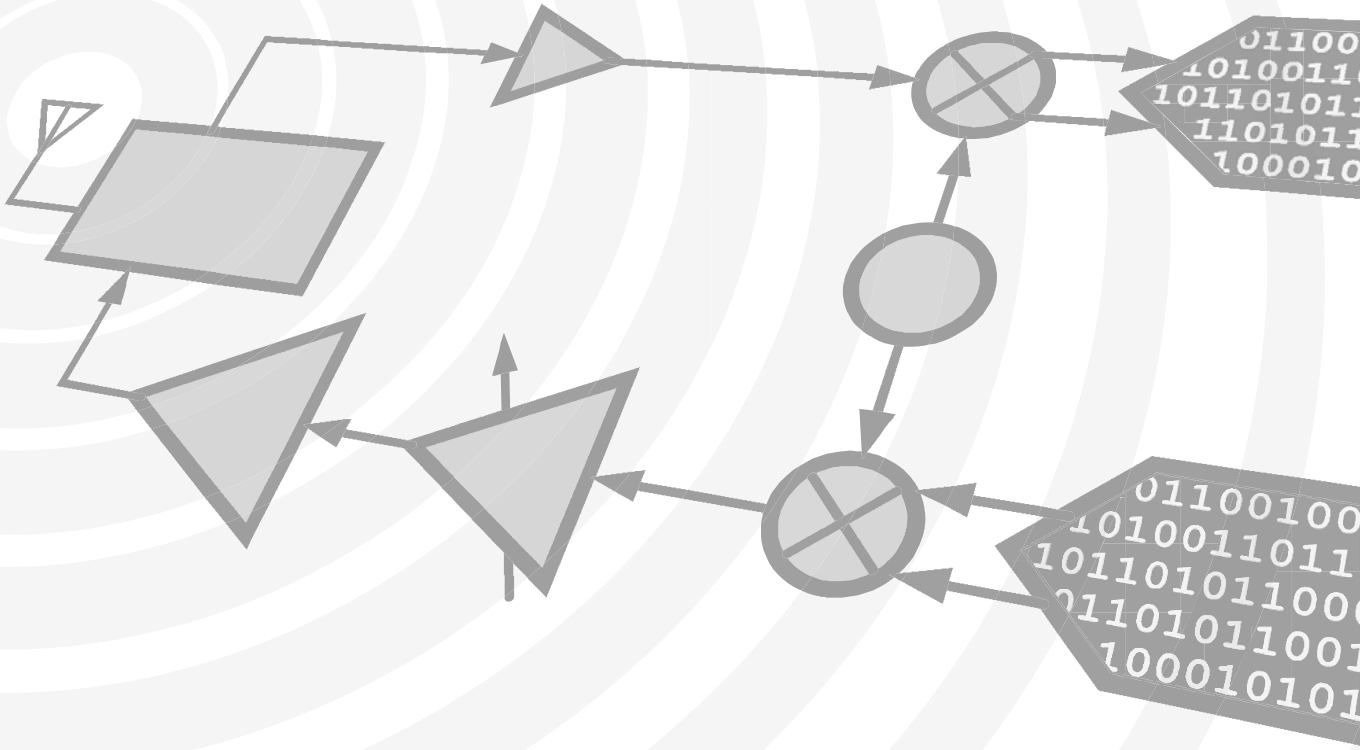
Analog Devices Welcomes Hittite Microwave Corporation



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HMC433 / 433E

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

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

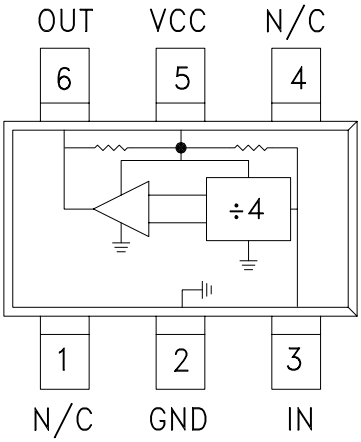
Single-ended I/O's

Output Power: -2 to -3.5 dBm

Single DC supply: +3V @ 53 mA

9 mm^2 ultra small package: SOT26

Functional Diagram



General Description

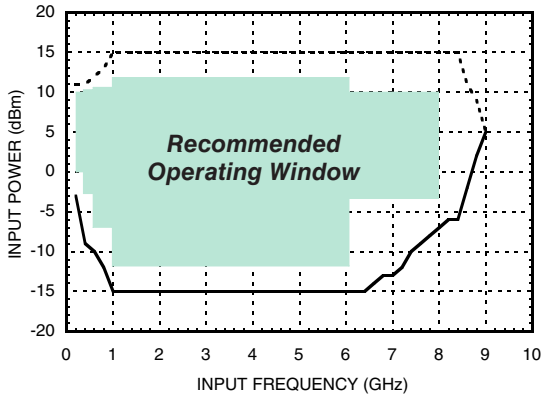
The HMC433(E) is a low noise divide-by-4 static divider utilizing InGaP GaAs HBT technology in ultra small surface mount SOT26 plastic packages. This device operates from near DC (with a square wave input) to 8 GHz input frequency with a single +3V DC supply. Single-ended inputs and outputs reduce component 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° C, 50 Ohm System, Vcc= +3V

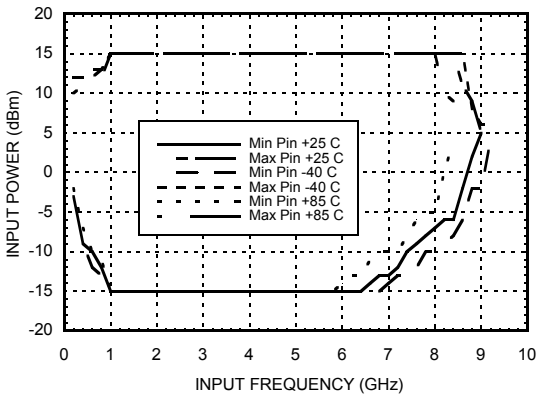
Parameter	Conditions	Min.	Typ.	Max.	Units
Input frequency	Sine Wave Input. [1] [2]			8	GHz
Input power range	Fin = 0.2 to 0.4 GHz Fin = 0.4 to 0.6 GHz Fin = 0.6 to 1.0 GHz Fin = 1.0 to 6.0 GHz Fin = 6.0 to 8.0 GHz	0 -5 -7 -12 -3		+10 +10 +10 +12 +10	dBm
Output power	Fin = 4.0 GHz Fin = 8.0 GHz	-5.0 -6.5	-2.0 -3.5		dBm
Reverse leakage	RF Output Terminated, Fin = 4 GHz, Pin = 0 dBm		-25		dBm
SSB phase noise (100 kHz offset)	Pin = 0 dBm, Fin = 4 GHz		-150		dBc/Hz
Output transition time	Pin = 0 dBm, Fout = 882 MHz		120		ps
Supply current (Icc)	Vcc = +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."

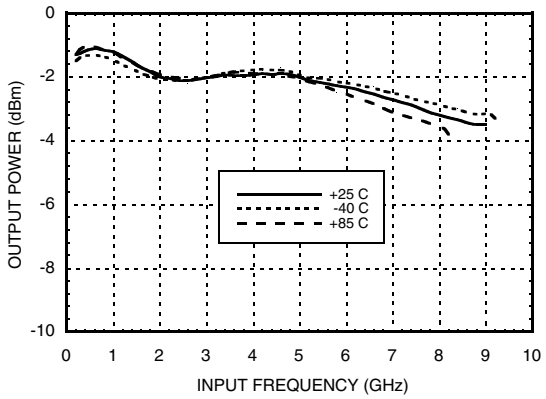
Input Sensitivity Window, T = 25 °C



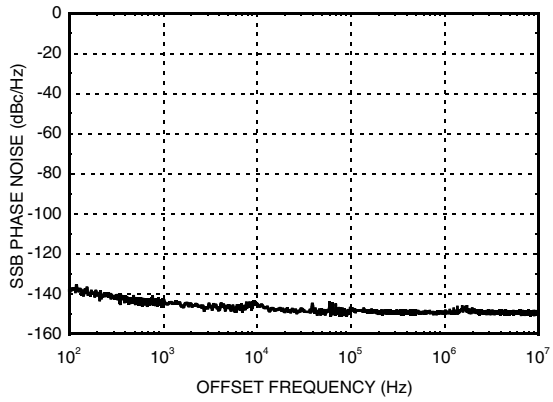
Input Sensitivity Window vs. Temperature



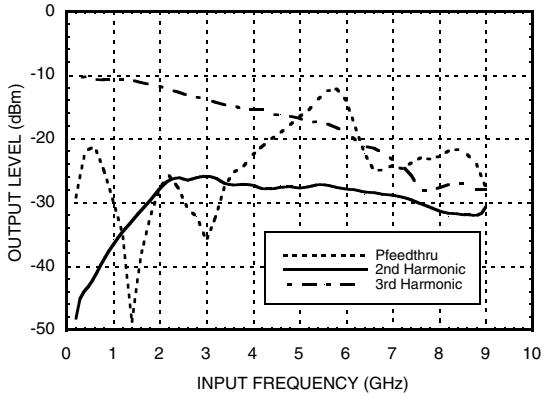
Output Power vs. Temperature



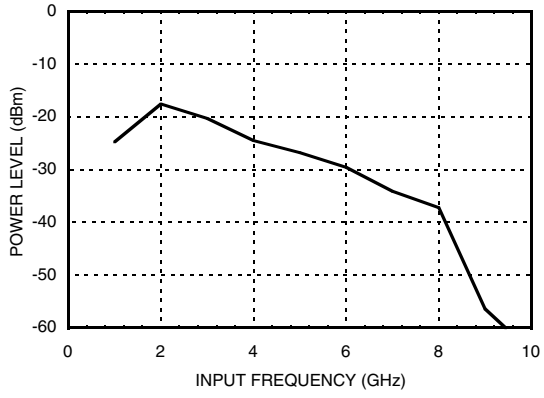
SSB Phase Noise Performance, Pin = 0 dBm, T = 25 °C



Output Harmonic Content, Pin = 0 dBm, T = 25 °C

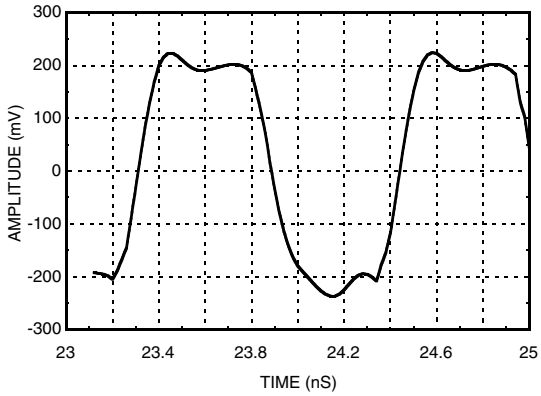


Reverse Leakage, Pin = 0 dBm, T = 25 °C



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

Typical Supply Current vs. Vcc

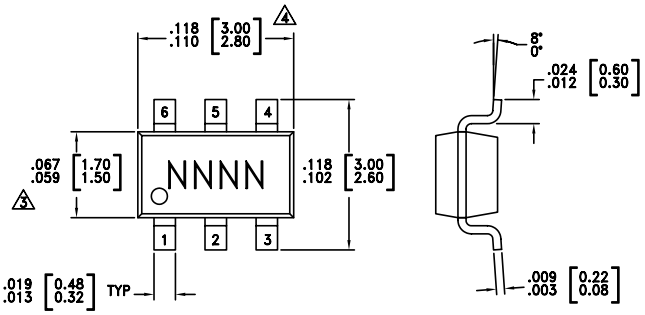
Vcc (V)	Icc (mA)
2.70	42
3.0	53
3.30	63

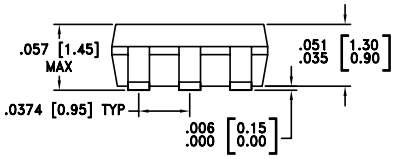
Note: Divider will operate over full voltage range shown above

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

Outline Drawing





NOTES:

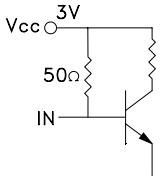
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. PAD BURR LENGTH SHALL BE 0.15 mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05 mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05 mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED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

Package Information

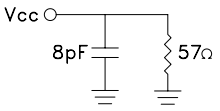
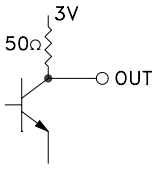
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC433	Low stress injection molded plastic	Sn/Pb solder	MSL1 [1]	H433 XXXX
HMC433E	RoHS-compliant low stress injection molded plastic	100% matte Sn	MSL1 [2]	433E XXXX

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

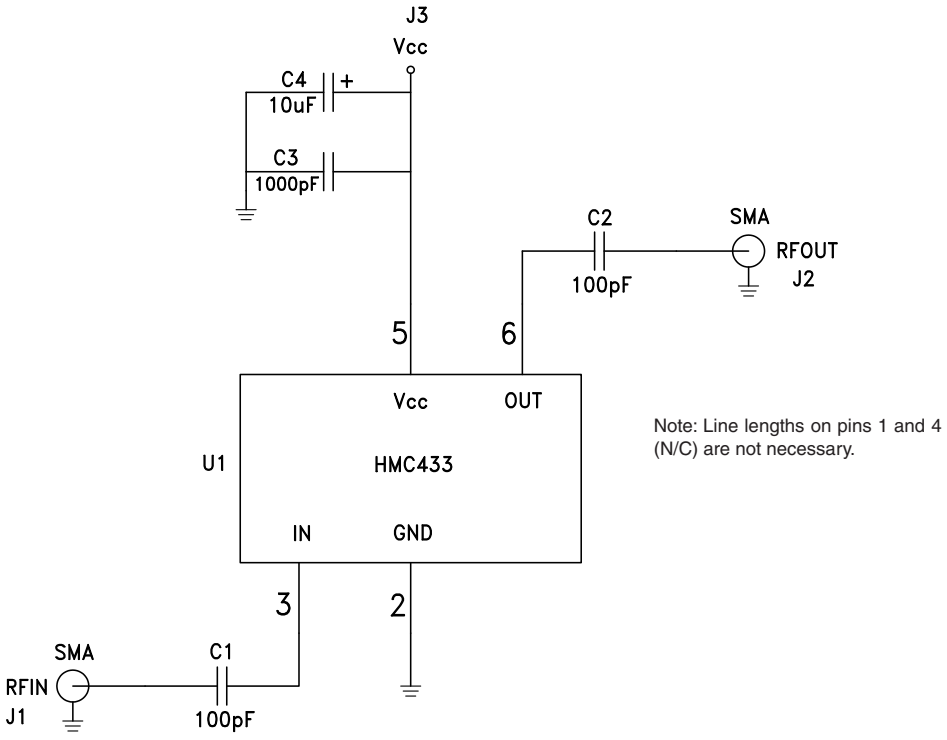
Pin Description

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

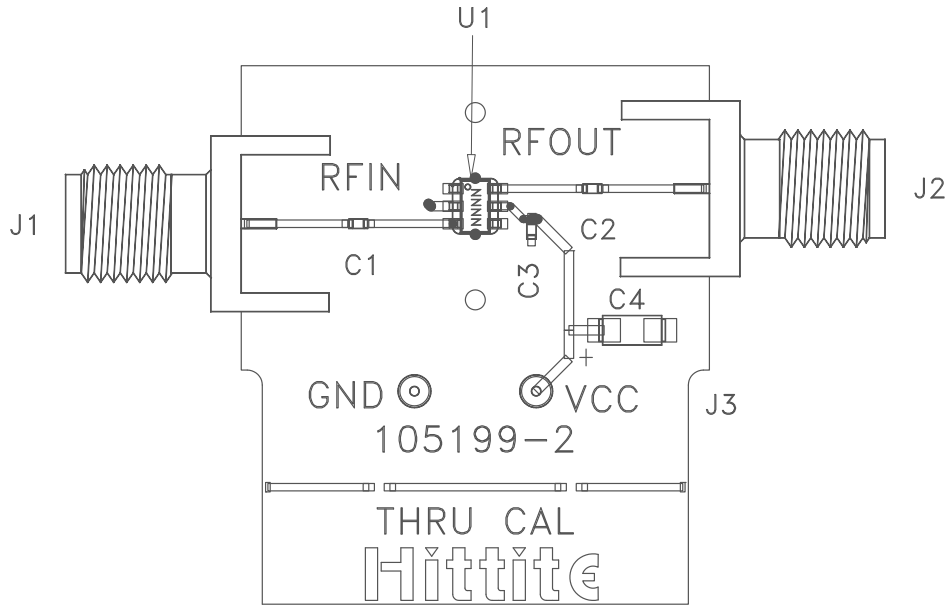


Note: Line lengths on pins 1 and 4 (N/C) are not necessary.

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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