



SMT GaAs HBT MMIC DIVIDE-BY-5, DC - 7 GHz

Typical Applications

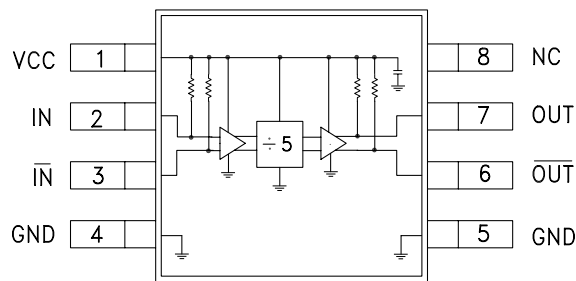
Prescaler for DC to C Band PLL Applications:

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

Features

SSB Phase Noise: -153 dBc/Hz @100 kHz
Wide Bandwidth
Output Power: -1 dBm
Single DC Supply: +5V @ 80 mA
MS8G SMT Package

Functional Diagram



General Description

The HMC438MS8G & HMC438MS8GE are low noise Divide-by-5 Static Dividers utilizing InGaP GaAs HBT technology in low cost 8 lead surface mount plastic packages. This device operates from DC (with a square wave input) to 7 GHz input frequency from a single +5V DC supply. The low additive SSB phase noise of -153 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, Vcc= 5V

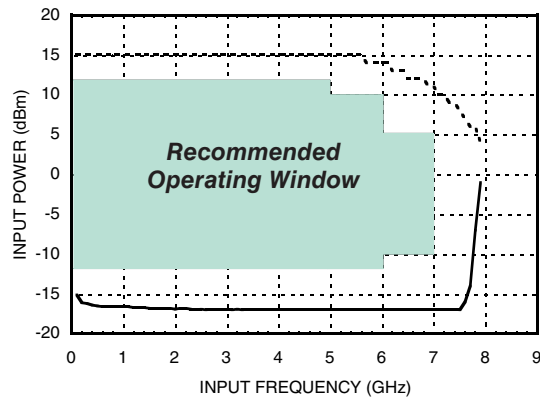
Parameter	Conditions	Min.	Typ.	Max.	Units
Maximum Input Frequency		7.0	7.5		GHz
Minimum Input Frequency	Sine Wave Input [1]		0.1		GHz
Input Power Range	$F_{in} = 1$ to 5 GHz	-15		+12	dBm
	$F_{in} = 5$ to 6 GHz	-15		+10	dBm
	$F_{in} = 6$ to 7 GHz	-15		+5	dBm
Output Power		-4	-1		dBm
Reverse Leakage	Both RF Outputs Terminated		-50		dBm
SSB Phase Noise (100 kHz offset)	$P_{in} = 0$ dBm, $F_{in} = 6$ GHz		-153		dBc/Hz
Output Transition Time	$P_{in} = 0$ dBm, $F_{out} = 882$ MHz		100		ps
Supply Current (I_{cc})			80		mA

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

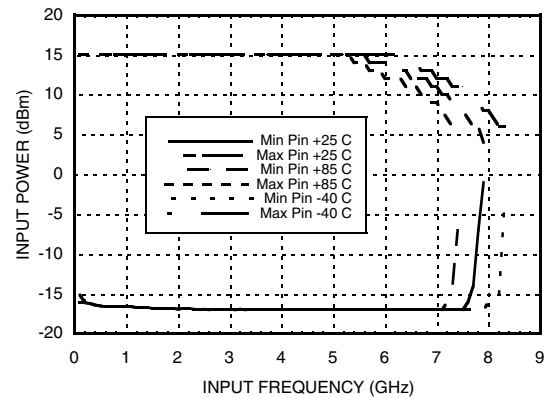
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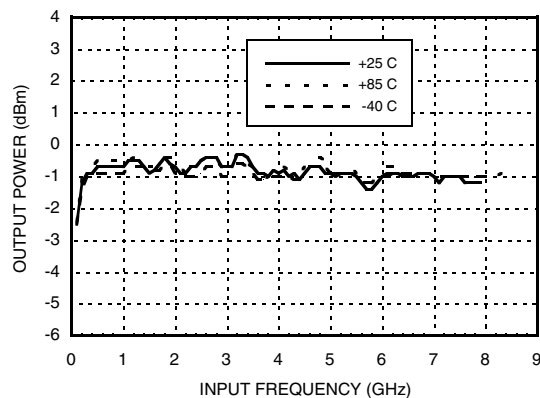
Input Sensitivity Window, $T = 25^\circ\text{C}$



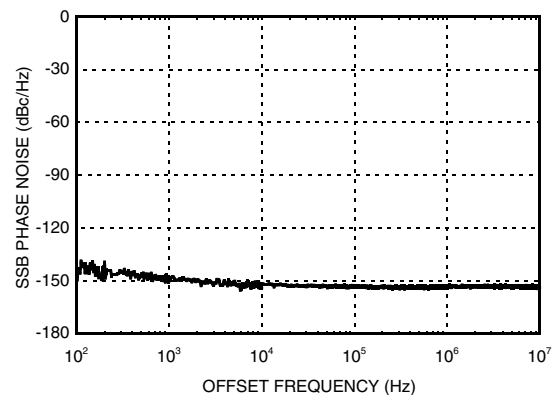
Input Sensitivity Window vs. Temperature



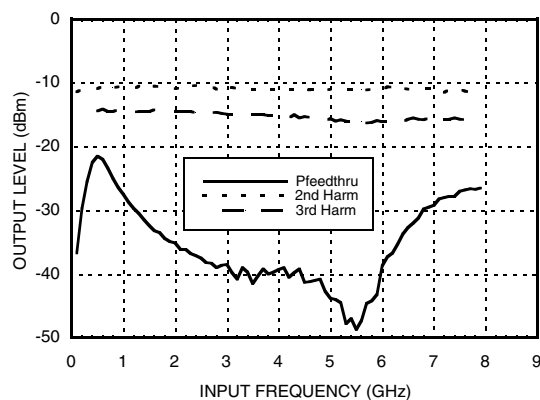
Output Power vs. Temperature



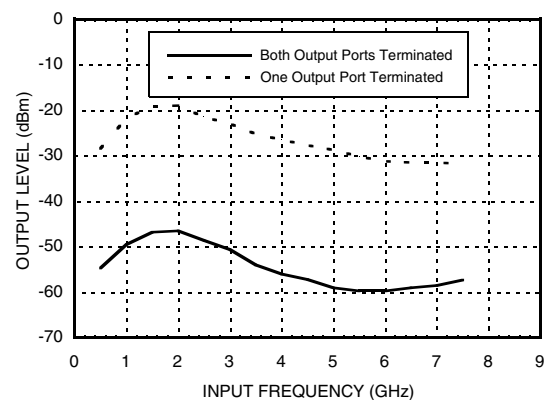
**SSB Phase Noise Performance,
 $P_{in} = 0\text{ dBm}$, $F_{in} = 6\text{ GHz}$, $T = 25^\circ\text{C}$**



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



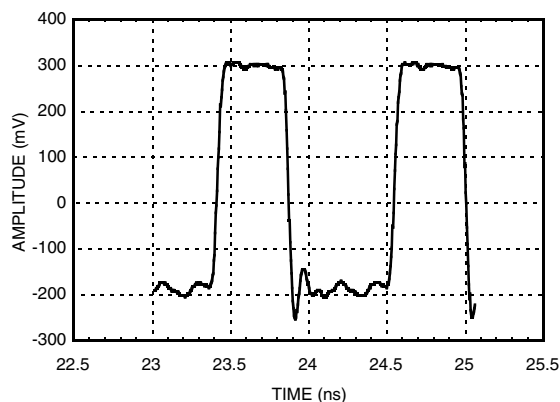
Reverse Leakage, $P_{in} = 0\text{ dBm}$, $T = 25^\circ\text{C}$





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Output Voltage Waveform,
 $P_{in} = 0\text{ dBm}$, $F_{out} = 882\text{ MHz}$, $T = 25\text{ }^{\circ}\text{C}$



Absolute Maximum Ratings

RF Input Power ($V_{CC} = +5\text{V}$)	13 dBm
Nominal +5V Supply to GND	-0.3V to +5.5V
Max Peak Flow Temperature	260 $^{\circ}\text{C}$
Storage Temperature	-65 to +125 $^{\circ}\text{C}$
ESD Sensitivity (HBM)	Class 1A

Reliability Information

Junction Temperature to Maintain 1 Million Hour MTTF	135 $^{\circ}\text{C}$
Nominal Junction Temperature ($T = 85\text{ }^{\circ}\text{C}$)	122 $^{\circ}\text{C}$
Thermal Resistance (Junction to GND Paddle, 5V Supply)	88.5 $^{\circ}\text{C/W}$
Operating Temperature	-40 to +85 $^{\circ}\text{C}$

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



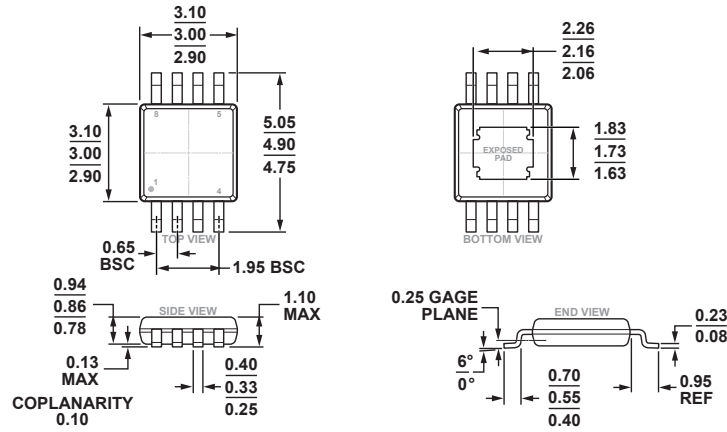
ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Typical Supply Current vs. V_{CC}

V_{CC} (V)	I_{CC} (mA)
4.75	75
5.0	80
5.25	87

Note: Divider will operate over full voltage range shown above

Outline Drawing



COMPLIANT TO JEDEC STANDARDS MO-187-AA-T

8-Lead Mini Small Outline Package with Exposed Pad [MINI_SO_EP]
(RH-8-1)

Dimensions shown in millimeters

Package Information

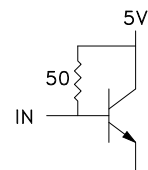
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking ^[3]
HMC438MS8G	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 ^[1]	H438 XXXX
HMC438MS8GTR	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 ^[1]	H438 XXXX
HMC438MS8GE	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 ^[2]	H438 XXXX
HMC438MS8GETR	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 ^[2]	H438 XXXX
105786- HMC438MS8G	Eval Board			

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

Pin Description

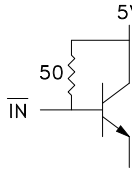
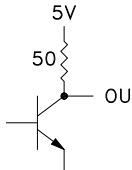
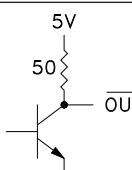
Pin Number	Function	Description	Interface Schematic
1	Vcc	Supply voltage 5V ± 0.25V.	
2	IN	RF input must be DC blocked.	

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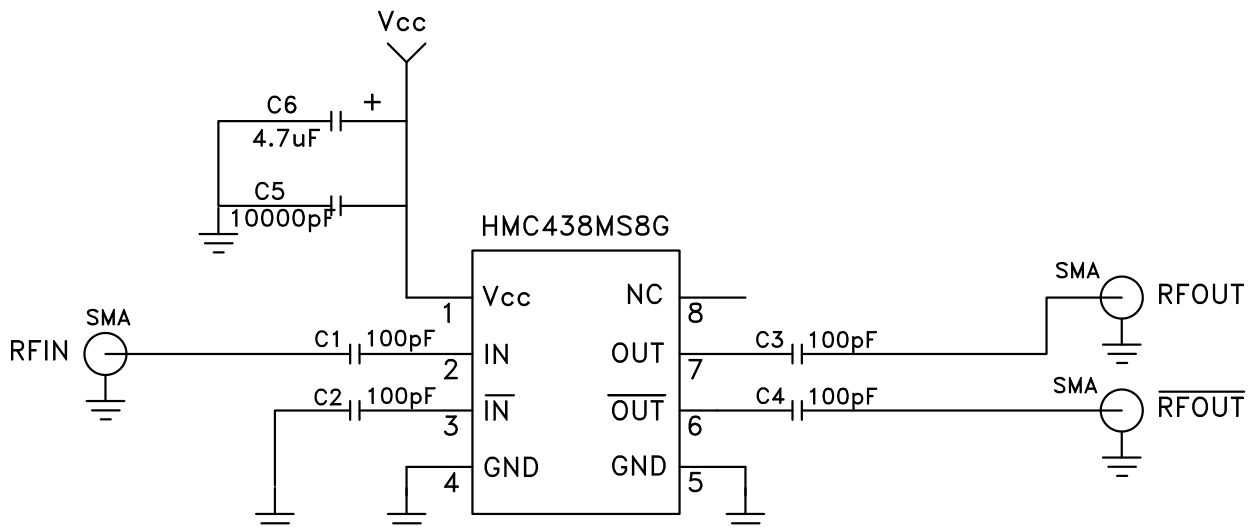


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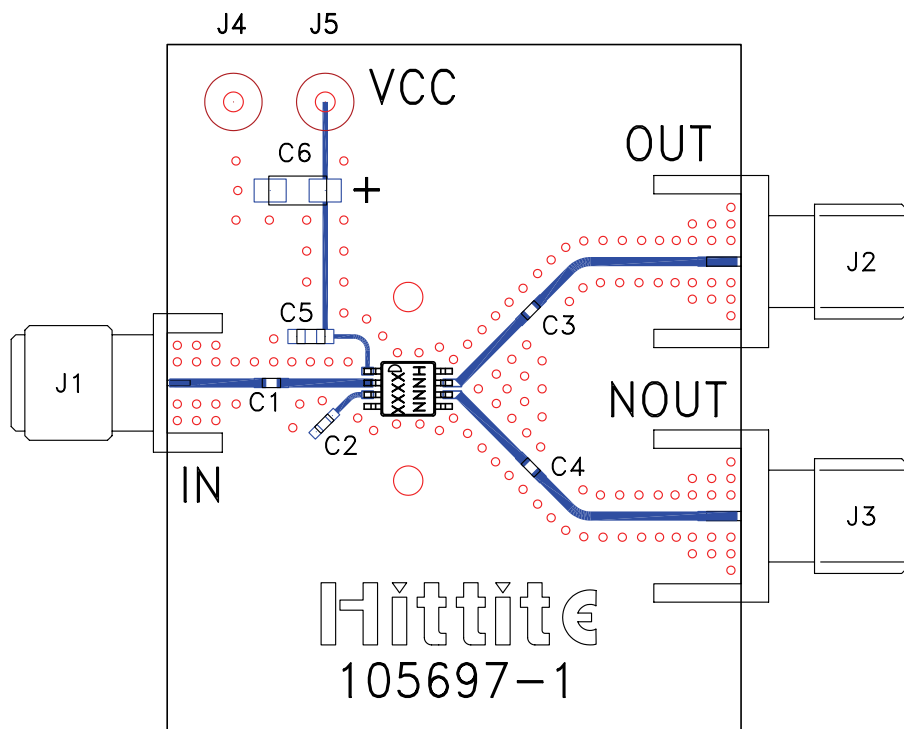
Pin Description (Continued)

Pin Number	Function	Description	Interface Schematic
3	$\overline{\text{IN}}$	RF input 180° out of phase with pin 2 for differential operation. AC ground for single ended operation.	
4, 5	GND	All ground leads and ground paddle must be soldered to PCB RF/DC ground.	
6	$\overline{\text{OUT}}$	Divided output 180° out of phase with pin 7.	
7	OUT	Divided Output.	
8	N/C	The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally.	

Application Circuit



Evaluation PCB



List of Materials for Evaluation PCB 105786 [1]

Item	Description
J1 - J3	PCB Mount SMA RF Connector
J4, J5	DC Pin
C1 - C4	100 pF Capacitor, 0402 Pkg.
C5	10,000 pF Capacitor, 0603 Pkg.
C6	4.7 μ F Tantalum Capacitor
U1	HMC438MS8G / HMC438MS8GE Divide-by-5
PCB [2]	105697 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 and backside ground slug 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 Analog Devices, upon request. This evaluation board is designed for single ended input testing. J2 and J3 provide differential output signals.