ANALOG DEVICES

HMC899

v00.0911

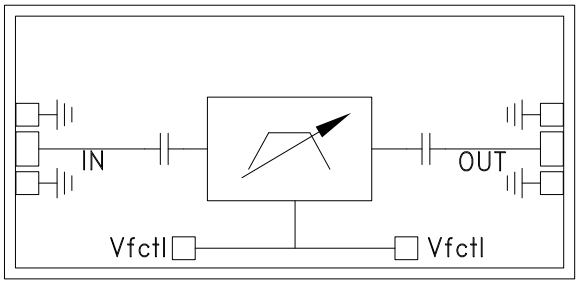
FILTER - TUNABLE, BAND PASS 19 - 38 GHz

Typical Applications

The HMC899 is ideal for:

- Test & Measurement Equipment
- Military RADAR & EW/ECM
- SATCOM & Space
- Industrial & Medical Equipment

Functional Diagram



Features

Fast Tuning Response

Excellent Wideband Rejection

Single Chip Replacement
for Mechanically Tuned Designs

Small Size: 2.5 x 1.2 x 0.10 mm

General Description

The HMC899 is a MMIC band pass filter which features a user selectable passband frequency. The 3 dB filter bandwidth is approximately 18%. The 20 dB filter bandwidth is approximately 35%. The center frequency can be varied between 19 and 38 GHz by applying an analog tune voltage between 0 and 14V. This tunable filter can be used as a much smaller alternative to physically large switched filter banks and cavity tuned filters. The HMC899 has excellent microphonics due to the monolithic design, and provides a dynamically adjustable solution in advanced communications applications.

Electrical Specifications, T_A = +25 °C

Parameter	Min.	Typ.	Max.	Units
F_{center} Tuning Range	19		38	GHz
3 dB Bandwidth		18		%
Low Side Rejection Frequency (Rejection >20 dB)		0.81 *F_{center}		GHz
High Side Rejection Frequency (Rejection >20 dB)		1.20 *F_{center}		GHz
Low Side Sub-Harmonic Rejection (Rejection >40 dB)		0.54 *F_{center}		GHz
High Side Sub-Harmonic Rejection (Rejection >40 dB)		1.32 *F_{center}		GHz
Re-entry Frequency (Rejection <30 dB)		>50		GHz
Insertion Loss		7		dB
Return Loss		10		dB
Input IP3 (Pin = 0 to +20 dBm)		25		dBm
Input Power @ 5° Shift In Insertion Phase (Vfctl = 0.5V)		14		dBm
Input Power @ 5° Shift In Insertion Phase (Vfctl > = 1V)		16		dBm
Frequency Control Voltage (V_{fctl})	0		14	V
Source/Sink Current (I_{fctl})			±1	mA
Residual Phase Noise [1] (100 kHz Offset)		-157		dBc/Hz
F_{center} Drift Rate		-3.2		MHz/°C
Tuning Speed, Phase Settling to within 10° [2]		< 100		ns

[1] Optimum residual phase noise performance requires the use of a low noise driver circuit.
[2] Tuning speed includes 40 ns tuning voltage ramp from driver.

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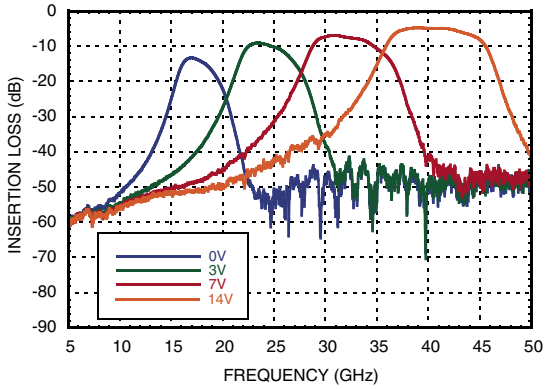
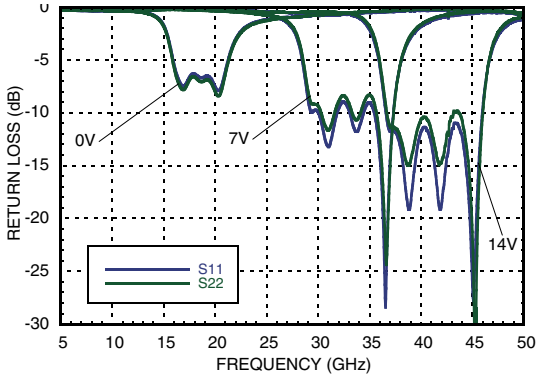
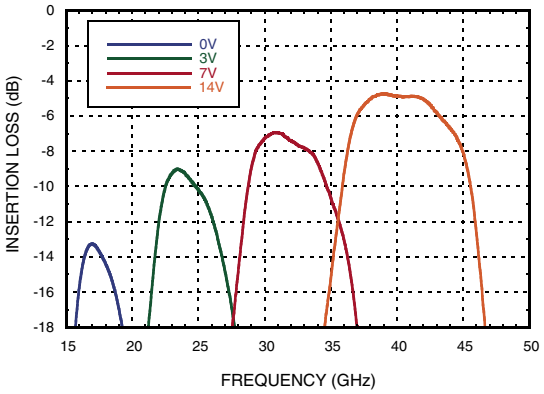
Broadband Insertion Loss vs. Vfctl



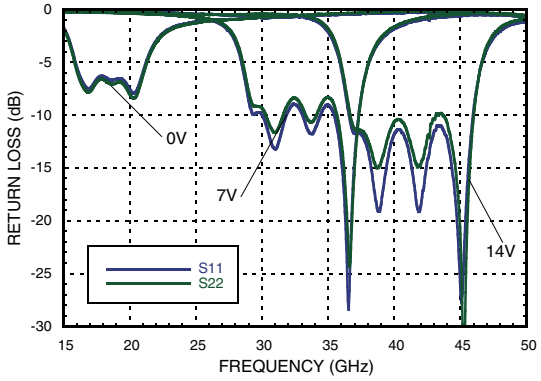
Broadband Return Loss vs. Vfctl



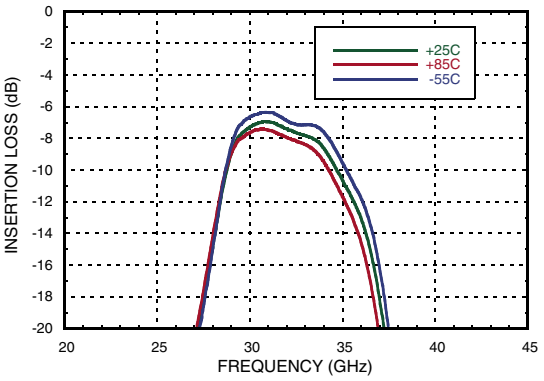
Insertion Loss vs. Vfctl



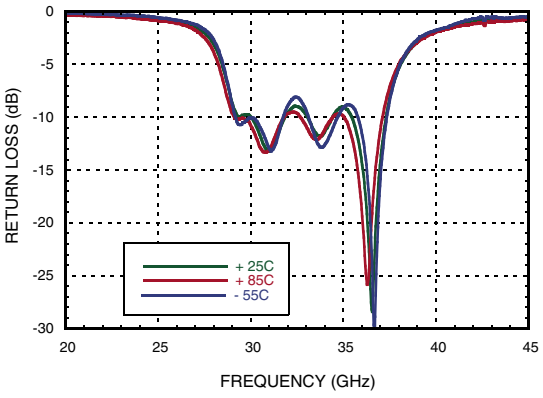
Return Loss vs. Vfctl



Insertion Loss vs. Temperature, Vfctl = 7V



Return Loss vs. Temperature, Vfctl = 7V



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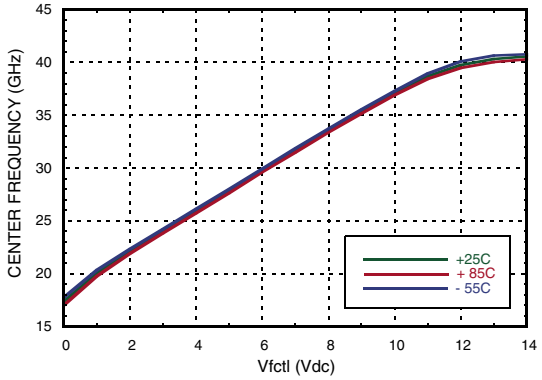
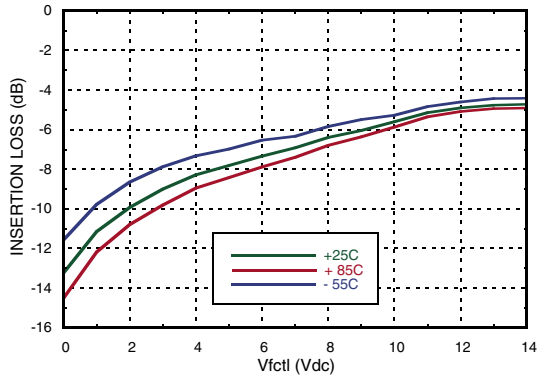
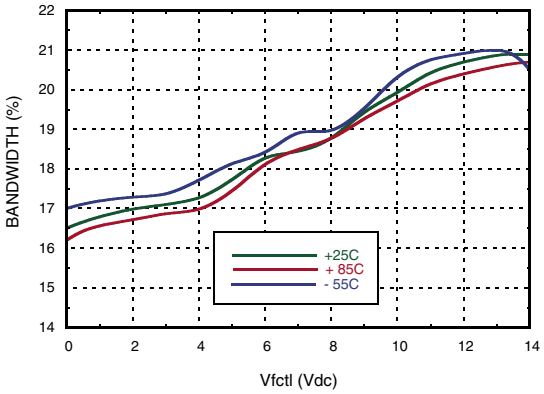
Center Frequency vs. Temperature



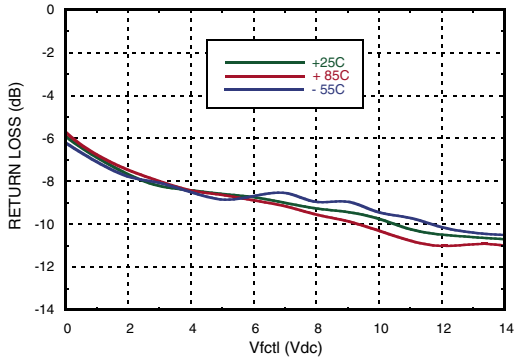
Insertion Loss vs. Temperature



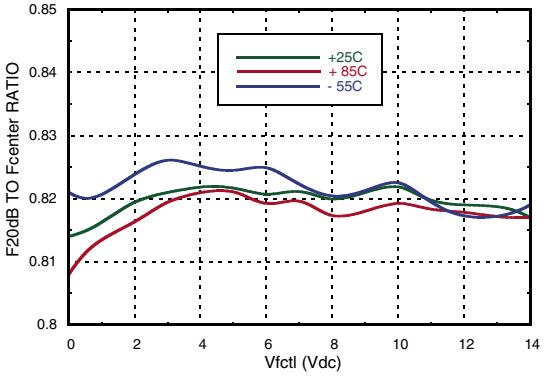
3 dB Bandwidth vs. Temperature



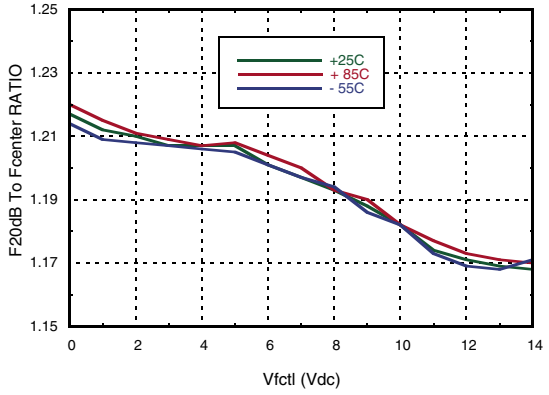
Maximum Return Loss in a 2 dB Bandwidth vs Temperature



Low Side Rejection Ratio vs. Temperature [1]



High Side Rejection Ratio vs. Temperature [1]



[1] Rejection ratio is defined as the ratio of the frequency at which the relative insertion loss is 20 dB to the insertion loss at *f*center.

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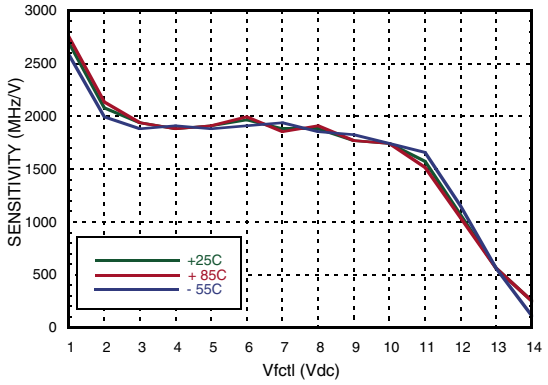
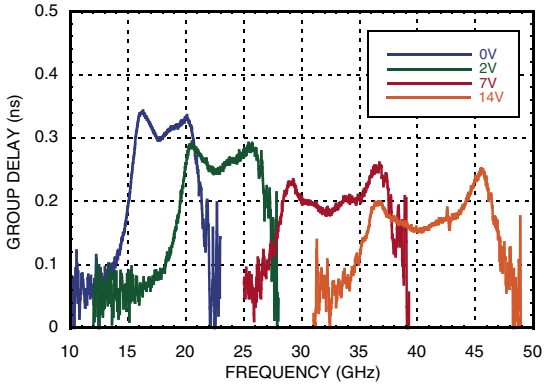
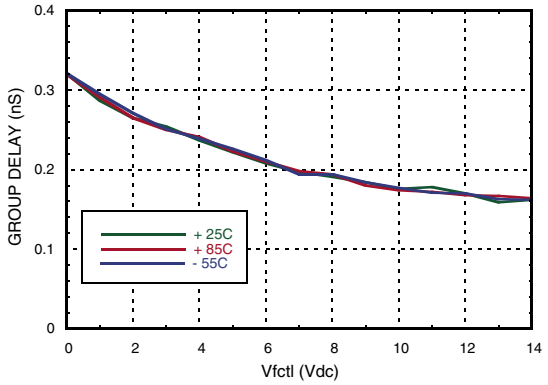
Tuning Sensitivity vs. Vfctl



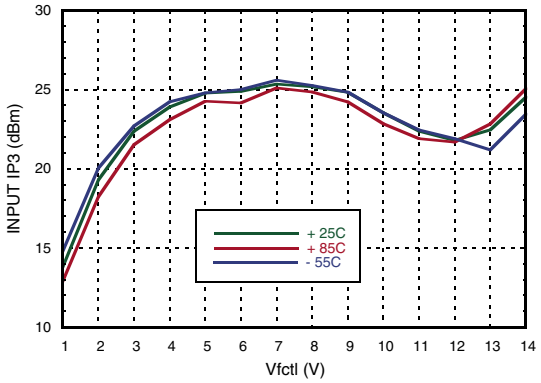
Group Delay vs. Frequency



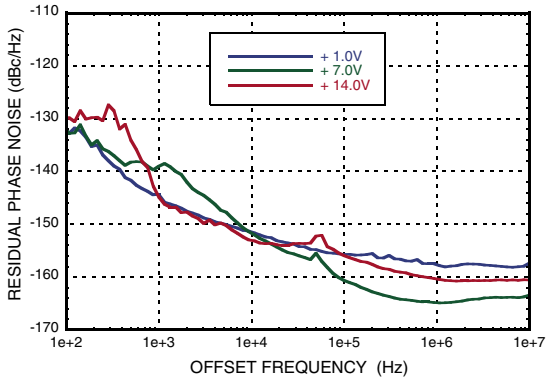
Group Delay vs. Fcenter



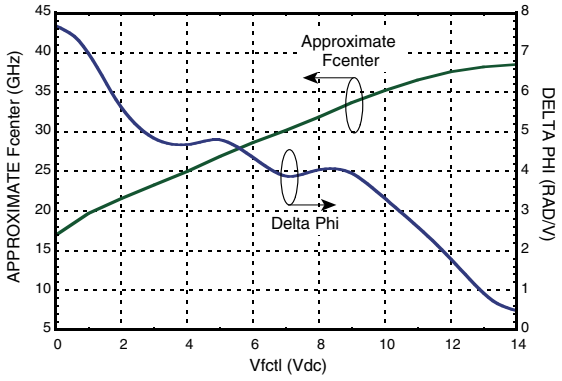
Input IP3 vs. Temperature



Residual Phase Noise



Phase Sensitivity vs. Vfctl



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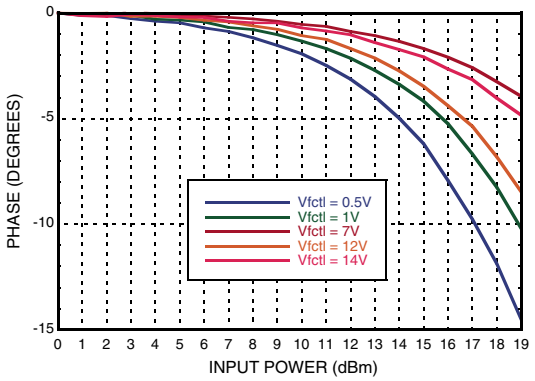
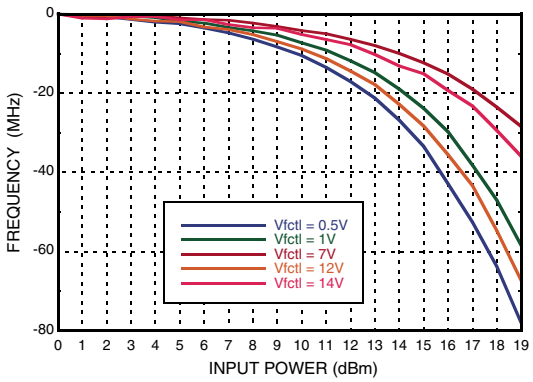
Phase Shift vs. Pin



Frequency Shift vs. Pin



Absolute Maximum Ratings

Frequency Control Voltage (Vfctl)	-0.5 to +15V
RF Power Input	27 dBm
Storage Temperature	-65 to +150 °C
ESD Sensitivity (HBM)	Class 1 A

Reliability Information

Junction Temperature to Maintain 1 Million Hour MTTF	150 °C
Nominal Junction Temperature (T= 85 °C and Pin = 27 dBm)	103 °C
Operating Temperature	-55 to +85 °C

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

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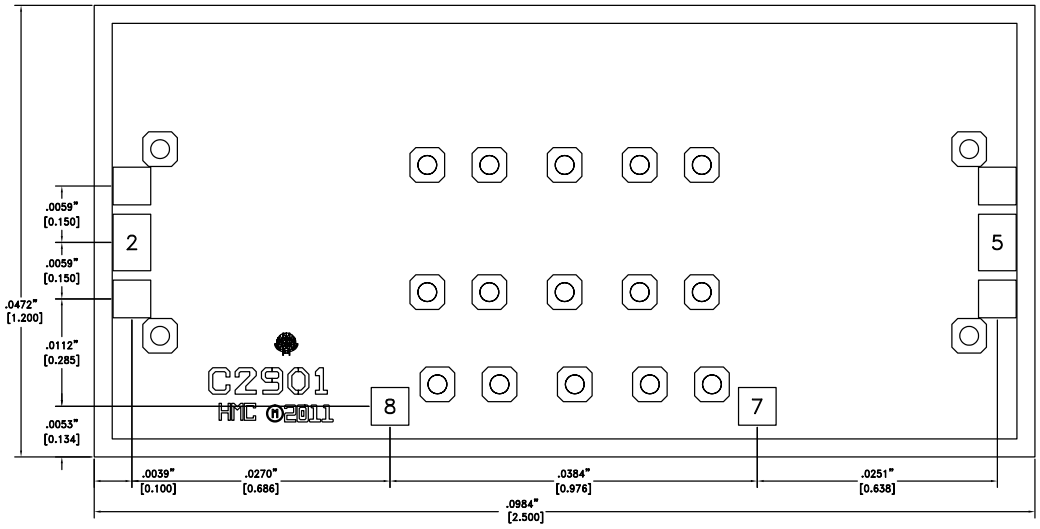
Outline Drawing



Die Packaging Information [1]

Standard	Alternate
WP-9	[2]

[1] Refer to "Waffle-Pak & Gel-Pak" section for die packaging dimensions.
[2] For alternate packaging information contact Hittite Microwave Corporation.

NOTES:

1. ALL DIMENSIONS ARE IN INCHES [MILLIMETERS]
2. DIE THICKNESS IS .004".
3. TYPICAL BOND PAD IS .004" SQUARE..
5. BOND PAD METALIZATION: GOLD
6. BACKSIDE METALIZATION: GOLD
7. BACKSIDE METAL IS GROUND
7. CONNECTION NOT REQUIRED FOR UNLABELED PADS.

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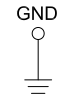
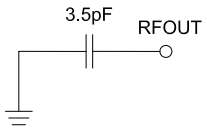
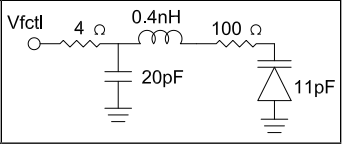
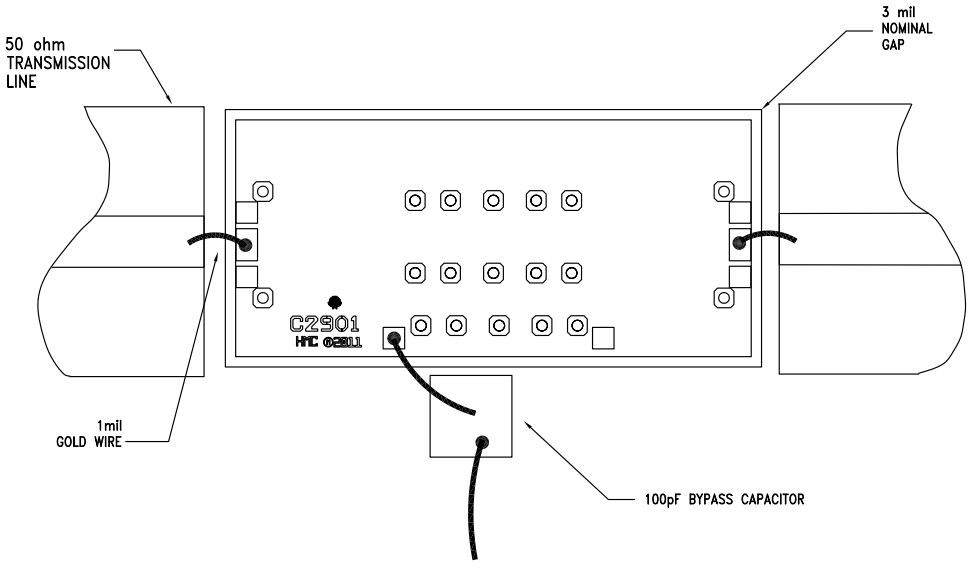
Pin Descriptions

Pin Number	Function	Description	Interface Schematic
Die Bottom	GND	Die bottom must be connected to RF/DC ground.	
2	RFIN	This pad is AC coupled and matched to 50 Ohms.	
5	RFOUT	This pad is AC coupled and matched to 50 Ohms.	
7, 8	Vctl	Center frequency control voltage. Pads are connected together internally.	

Assembly Diagram



NOTES:

1. The HMC899 I/O's are inherently capacitive in order to accommodate bond wire connections.
2. 1 mil diameter bond wires can be used.
3. Ideally, double bond wires 20 mils long, or a single bond wire 12 mils long should be used (approx.140 pH).
4. It is recommended that on the opposite side of the bond wires, an additional 20–50 fF fringe capacitance be present.

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