



## FILTER - TUNABLE, BAND PASS 9 - 19 GHz

### Typical Applications

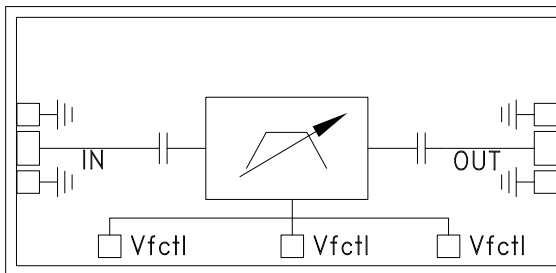
The HMC897 is ideal for:

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

### Features

- Fast Tuning Response
- Excellent Wideband Rejection
- Single Chip Replacement For Mechanically Tuned Designs
- Small Size: 2.48 x 1.16 x 0.10 mm

### Functional Diagram



### General Description

The HMC897 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 9 and 19 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 HMC897 has excellent microphonics due to the monolithic design, and provides a dynamically adjustable solution in advanced communications applications.

### Electrical Specifications, $T_A = +25\text{ }^\circ\text{C}$

Parameter	Min.	Typ.	Max.	Units
$F_{\text{center}}$ Tuning Range	9		19	GHz
3 dB Bandwidth		18		%
Low Side Rejection Frequency (Rejection >20 dB)		$0.81 * F_{\text{center}}$		GHz
High Side Rejection Frequency (Rejection >20 dB)		$1.17 * F_{\text{center}}$		GHz
Low Side Sub-Harmonic Rejection (Rejection >40 dB)		$0.58 * F_{\text{center}}$		GHz
High Side Sub-Harmonic Rejection (Rejection >40 dB)		$1.23 * F_{\text{center}}$		GHz
Re-entry Frequency (Rejection <30 dB)		>40		GHz
Insertion Loss		5.5		dB
Return Loss (2 dB Bandwidth)		9.5		dB
Input IP3 (Pin = 0 to +20 dBm)		30		dBm
Input Power @ 5° Shift In Insertion Phase ( $V_{\text{fctl}} = 0\text{V}$ )		10		dBm
Input Power @ 5° Shift In Insertion Phase ( $V_{\text{fctl}} \geq 1\text{V}$ )		15		dBm
Frequency Control Voltage ( $V_{\text{fctl}}$ )	0		14	V
Source/Sink Current ( $I_{\text{fctl}}$ )			$\pm 1$	mA
Residual Phase Noise [1] (100 kHz Offset)		-160		dBc/Hz
$F_{\text{center}}$ Drift Rate		-1.6		MHz/°C
Tuning Speed, Phase Settling to within $10^\circ$ [2]		< 200		ns

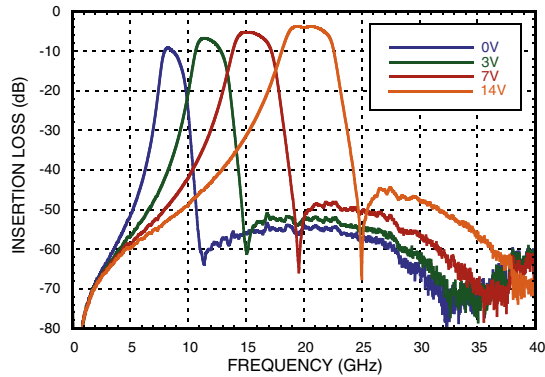
[1] Optimum residual phase noise performance requires the use of a low noise driver circuit.

[2] Tuning speed includes 40 ns tuning voltage ramp from driver.

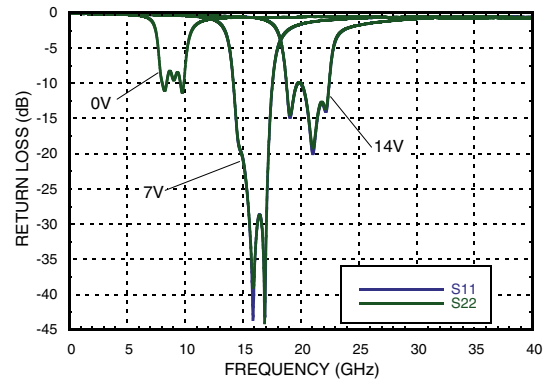


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9 - 19 GHz**

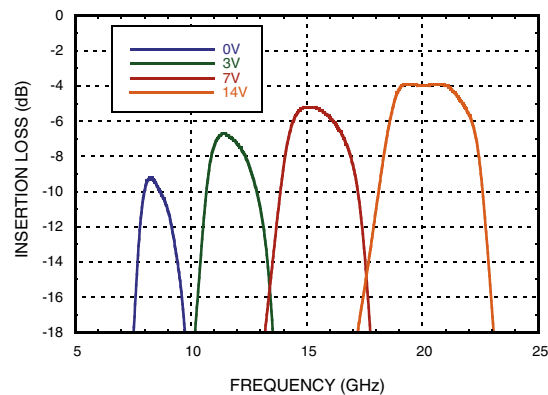
**Broadband Insertion Loss vs. Vfctl**



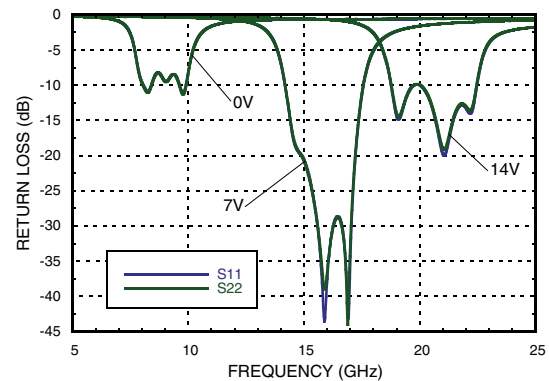
**Broadband Return Loss vs. Vfctl**



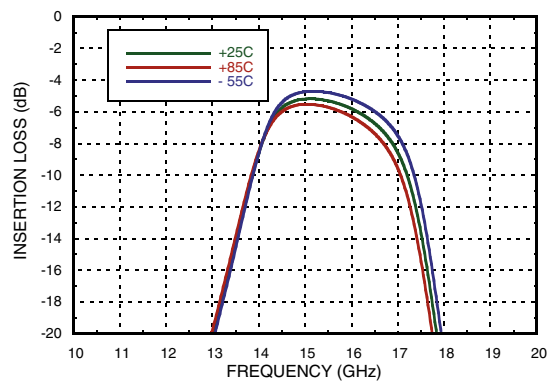
**Insertion Loss vs. Vfctl**



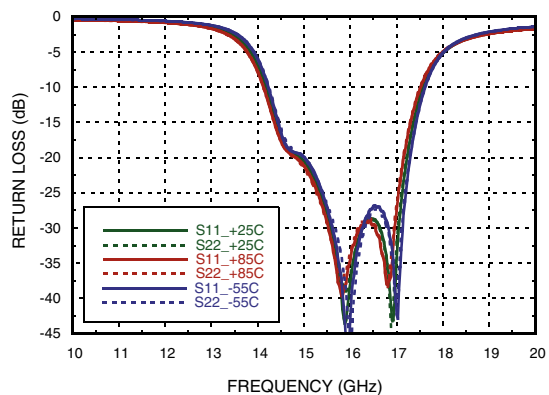
**Return Loss vs. Vfctl**



**Insertion Loss vs. Temperature, Vfctl = 7V**



**Return Loss vs. Temperature, Vfctl = 7V**



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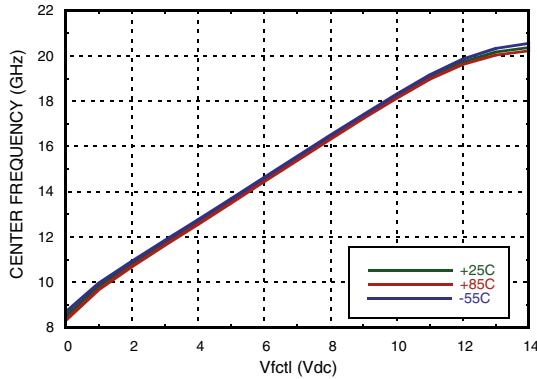
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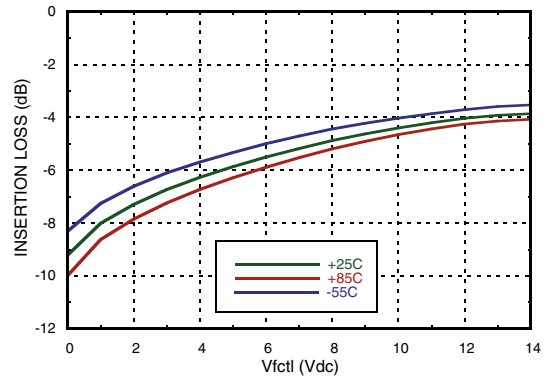
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FILTERS - TUNABLE - CHIP

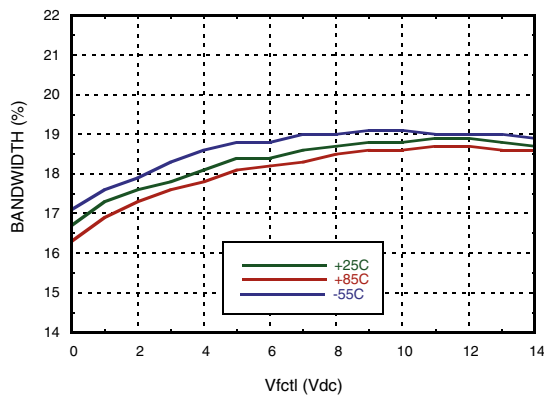
**Center Frequency vs. Temperature**



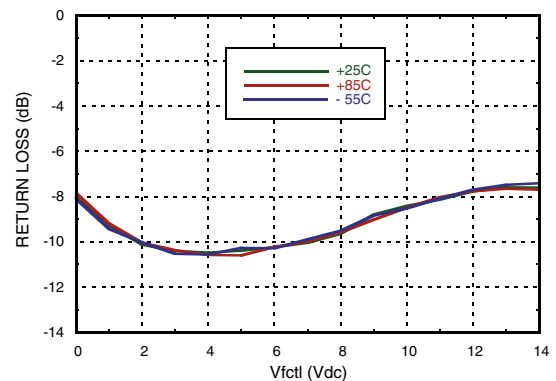
**Insertion Loss vs. Temperature**



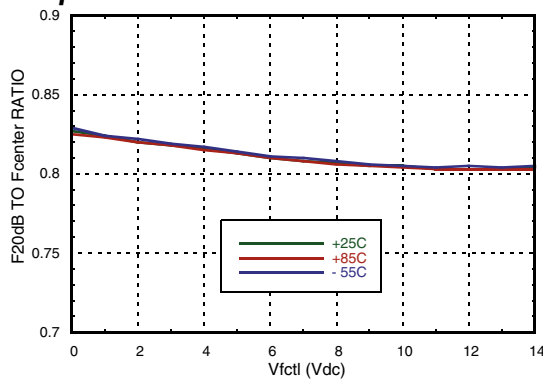
**3 dB Bandwidth vs. Temperature**



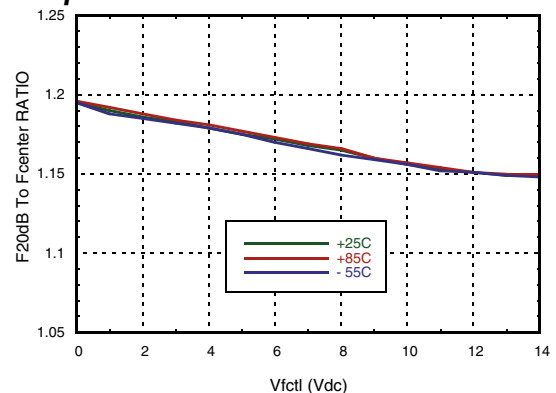
**Maximum Return Loss in a 2 dB Bandwidth vs Temperature**



**Low Side Rejection Ratio vs. Temperature [1]**



**High Side Rejection Ratio vs. Temperature [1]**

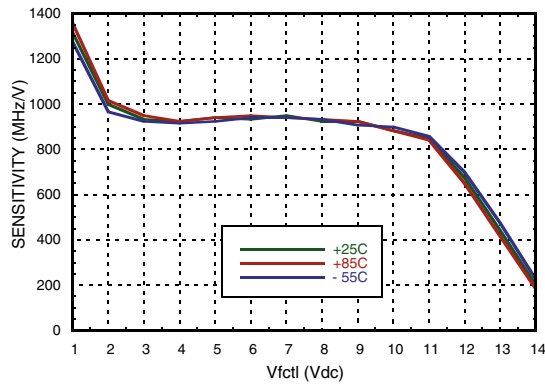


[1] Rejection ratio is defined as the ratio of the frequency at which the relative insertion loss is 20 dB to the insertion loss at  $f_{center}$ .

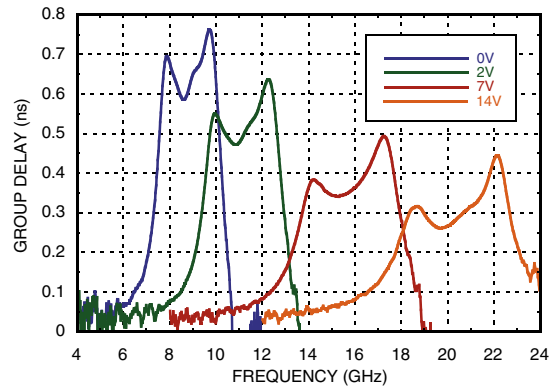


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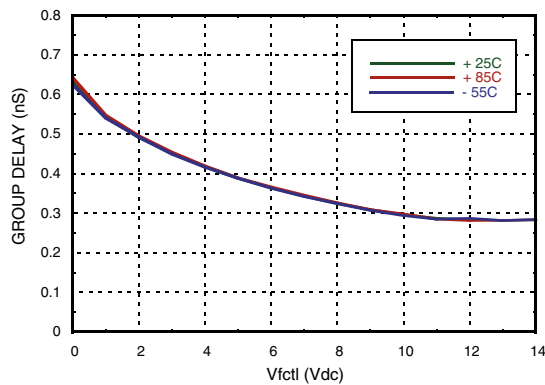
**Tuning Sensitivity vs. Vfctl**



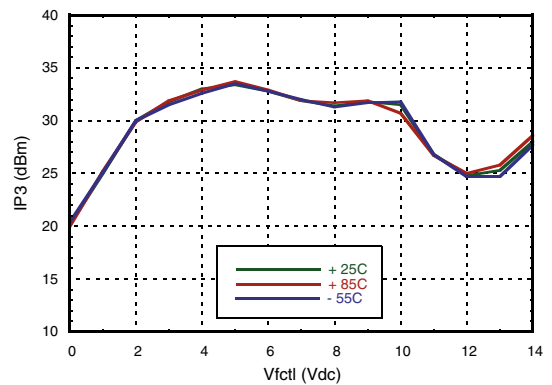
**Group Delay vs. Frequency**



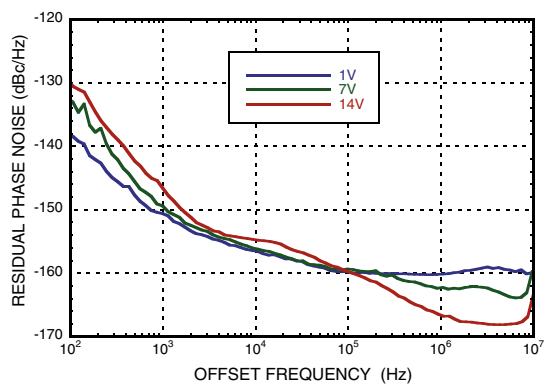
**Group Delay vs. Fcenter**



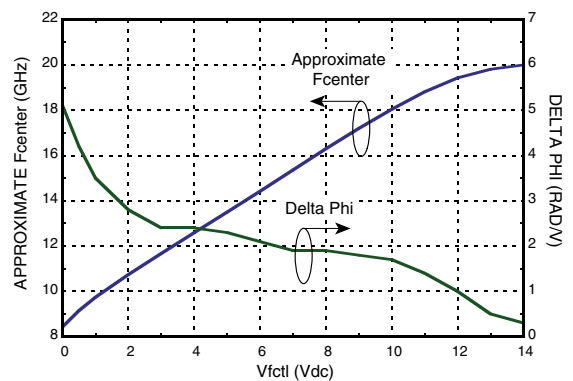
**Input IP3 vs. Temperature**



**Residual Phase Noise**



**Phase Sensitivity vs. Vfctl**



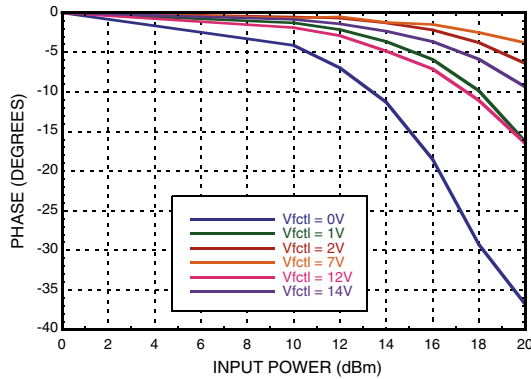
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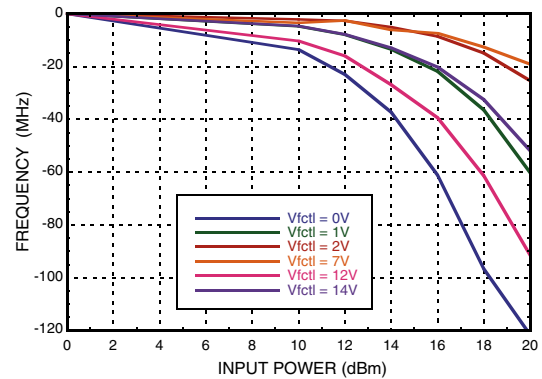


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**Phase Shift vs. Pin**



**Frequency Shift vs. Pin**



**Absolute Maximum Ratings**

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

**Reliability Information**

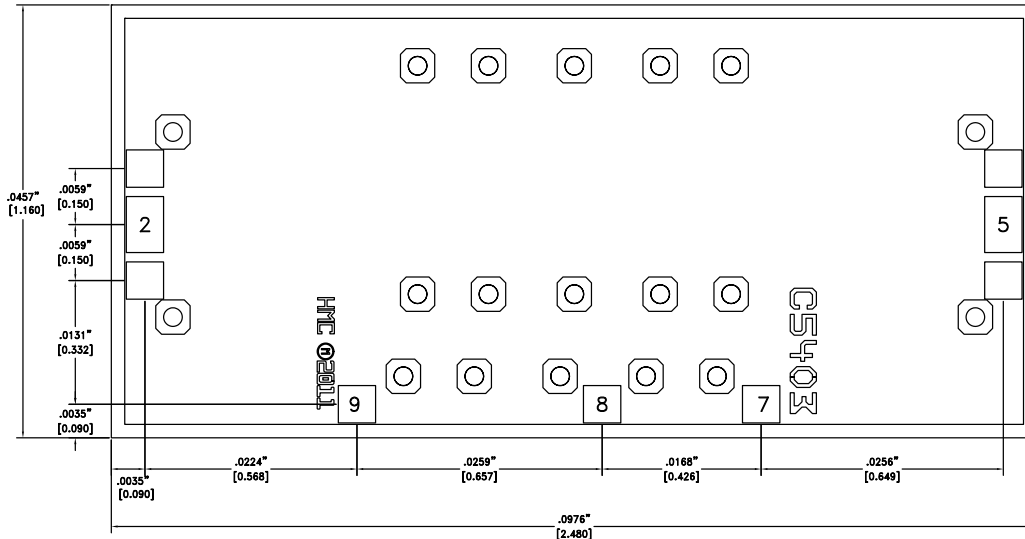
Junction Temperature to Maintain 1 Million Hour MTTF	150 °C
Nominal Junction Temperature (T= 85 °C and Pin = 27 dBm)	108 °C
Operating Temperature	-55 to +85 °C



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**



**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.

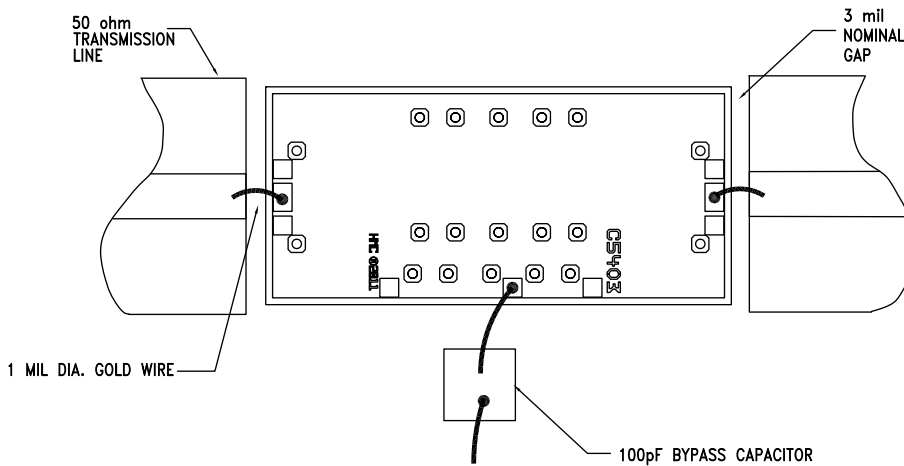


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**Pin Descriptions**

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, 9	Vfctl	Center frequency control voltage. All pads are interconnected on the die. Only one bond on any of these pads is required for center frequency control.	

**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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