

## HMC893LP5E FILTER - TUNABLE, BAND PASS SMT

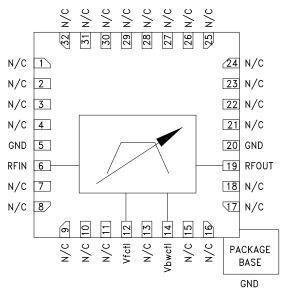
4.8 - 9.5 GHz

### Typical Applications

The HMC892LP5E is ideal for:

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

#### **Functional Diagram**



#### Features

Fast Tuning Response; 200 ns Excellent Wideband Rejection; >30 dB Single Chip Replacement for Mechanically Tuned Designs 32 Lead 5x5 mm SMT Package

### **General Description**

The HMC893LP5E is a MMIC band pass filter which features a user selectable passband frequency. The 3 dB filter bandwidth is approximately 6.5%. The 20 dB filter bandwidth is approximately 18%. The center frequency can be varied between 4.8 and 9.5 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 HMC893LP5E has excellent microphonics due to the monolithic design, and provides a dynamically adjustable solution in advanced communications applications.

### Electrical Specifications, $T_A = +25^{\circ}C$ , $V_{fctl} = V_{bwctl}$ Unless Otherwise Stated

| Parameter   | Min. | Тур.                    | Max. | Units  |
|---|------|-------------------------|------|--------|
| F <sub>center</sub> Tuning Range  | 4.8  |                         | 9.5  | GHz    |
| 3 dB Bandwidth  |      | 6.5                     |      | %      |
| Low Side Rejection Frequency (Rejection >20 dB)                         |      | 0.9*F <sub>center</sub> |      | GHz    |
| High Side Rejection Frequency (Rejection >20 dB)                        |      | 1.1*F <sub>center</sub> |      | GHz    |
| Re-entry Frequency (Rejection <30 dB)                                   |      | 2.7*F <sub>center</sub> |      | GHz    |
| 3 dB Bandwidth Control (V <sub>bwctl</sub> )                            |      | ±3                      |      | %      |
| Insertion Loss  |      | 10                      |      | dB     |
| Return Loss (2 dB Bandwidth)  |      | 7                       |      | dB     |
| Maximum Input Power for Linear Operation                                |      |                         | 10   | dBm    |
| Frequency Control Voltage (V <sub>fctl</sub> )                          | 0    |                         | 14   | V      |
| Source/Sink Current (I <sub>fctl</sub> )                                |      |                         | ±1   | mA     |
| Bandwidth Control Voltage (V <sub>bwctl</sub> )                         | 0    |                         | 14   | V      |
| Source/Sink Current (I <sub>bwctl</sub> )                               |      |                         | ±1   | mA     |
| Residual Phase Noise [1] (1 MHz Offset)                                 |      | -163                    |      | dBc/Hz |
| F <sub>center</sub> Drift Rate  |      | -0.75                   |      | MHz/°C |
| Tuning Characteristics <sup>[2]</sup><br>tFULLBAND (0% Vfctl to 90% RF) |      | 200                     |      | ns     |

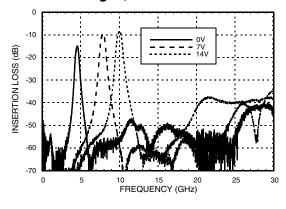
[1] Optimum residual phase noise performance requires the use of a low noise driver circuit.

[2] Tuning speed is dependent on driver circuit. Data measured with a high speed op-amp driver and includes driver slew rate delay.

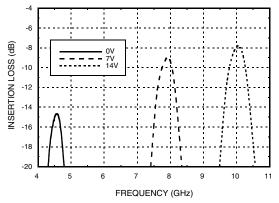




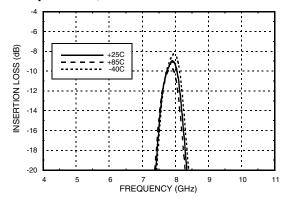
Broadband Insertion Loss vs. Control Voltages, Vfctl = Vbwctl



Insertion Loss vs. Control Voltages, Vfctl = Vbwctl

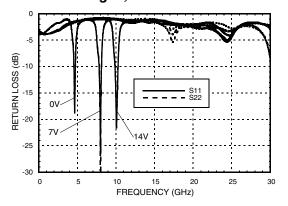


Insertion Loss vs. Temperature, Vfctl = Vbwctl = 7V

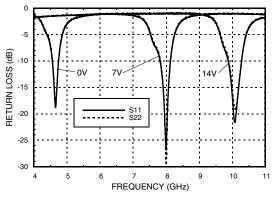


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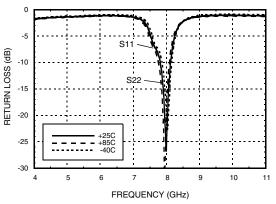
Broadband Return Loss vs. Control Voltages, Vfctl = Vbwctl



Return Loss vs. Control Voltages, Vfctl = Vbwctl



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



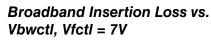
For price, delivery and to place orders: Hittite Microwave Corporation, 2 Elizabeth Drive, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at www.hittite.com Application Support: Phone: 978-250-3343 or apps@hittite.com

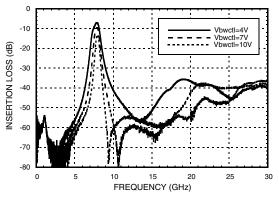




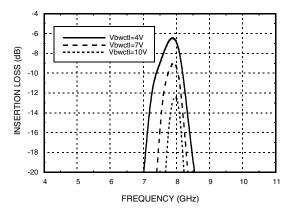
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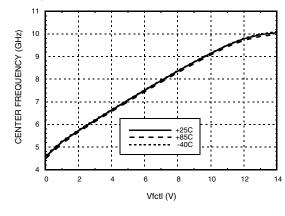




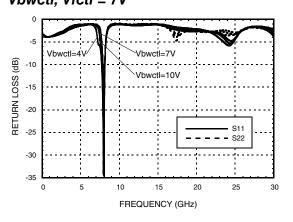
Insertion Loss vs. Vbwctl, Vfctl = 7V



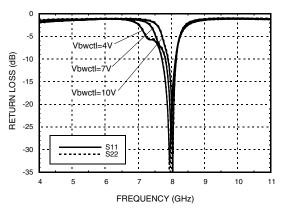
Center Frequency vs. Temperature, Vfctl = Vbwctl

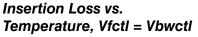


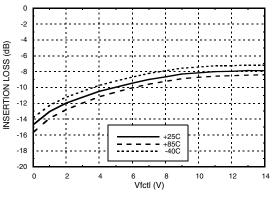
Broadband Return Loss vs. Vbwctl, Vfctl = 7V



Return Loss vs. Vbwctl, Vfctl = 7V



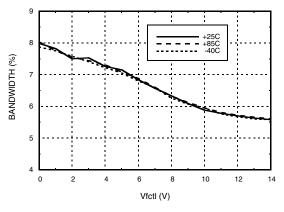




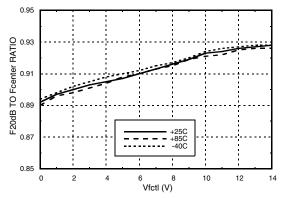




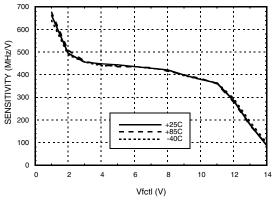
3 dB Bandwidth vs. Temperature, Vfctl = Vbwctl



Low Side Rejection Ratio vs. Temperature, Vfctl = Vbwctl <sup>[1]</sup>

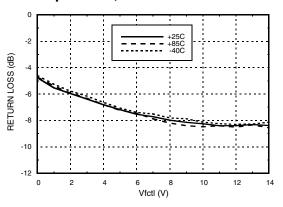


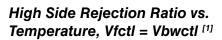
Tuning Sensitivity vs. Temperature, Vfctl = Vbwctl

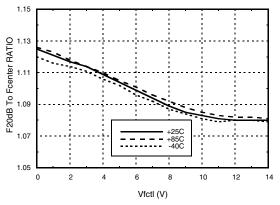


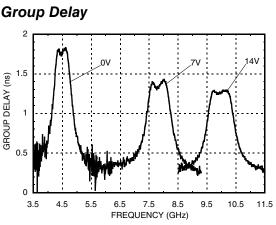
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Maximum Return Loss in a 2 dB Bandwidth vs. Temperature, Vfctl = Vbwctl







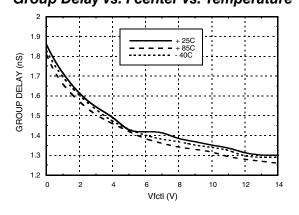


[1] Rejection ratio is defined as the ratio of the frequency at which the relative insertion loss is 20 dB to fcenter

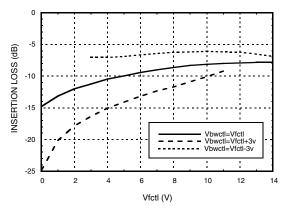




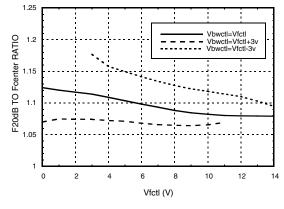
## Group Delay vs. Fcenter vs. Temperature



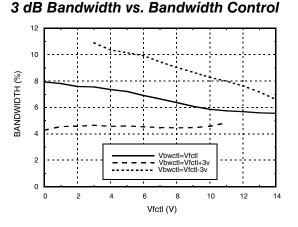
Insertion Loss vs. Bandwidth Control



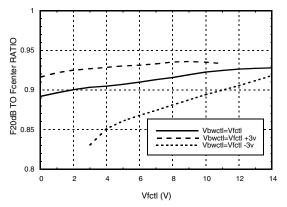
High Side Rejection Ratio vs. Bandwidth Control <sup>[1]</sup>



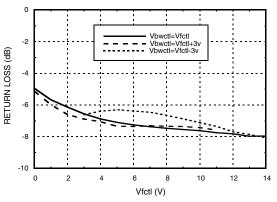
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# Low Side Rejection Ratio vs. Bandwidth Control <sup>[1]</sup>



#### Maximum Return Loss in a 2 dB Bandwidth vs. Bandwidth Control

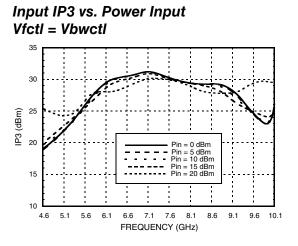


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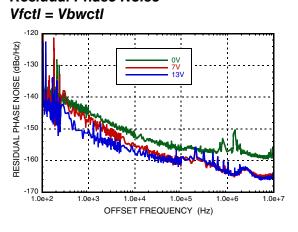
#### Absolute Maximum Ratings

| Frequency Control Voltage (Vfctl)  | -0.5 to +15V             |  |
|------------------------------------|--------------------------|--|
| Bandwidth Control Voltage (Vbwctl) | -0.5 to +15V             |  |
| RF Power Input                     | 26 dBm                   |  |
| Storage Temperature                | nperature -65 to +150 °C |  |
| ESD Rating (HBM)                   | Class 1B                 |  |



ELECTROSTATIC SENSITIVE DEVICE OBSERVE HANDLING PRECAUTIONS

## Residual Phase Noise



### **Reliability Information**

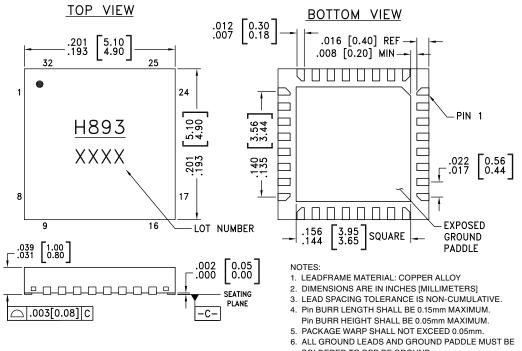
| Junction Temperature to Maintain<br>1 Million Hour MTTF     | 150 °C        |
|---|---------------|
| Nominal Junction Temperature<br>(T= 85 °C and Pin = 10 dBm) | 90 °C         |
| Operating Temperature                                       | -40 to +85 °C |





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#### **Outline Drawing**



SOLDERED TO PCB RF GROUND. 7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

### Package Information

| I | Part Number | Package Body Material                                      | Lead Finish | MSL Rating          | Package Marking <sup>[1]</sup> |
|---|-------------|--|-------------|---------------------|--------------------------------|
| н | HMC893LP5E  | 893LP5E RoHS-compliant Low Stress Injection Molded Plastic |             | MSL1 <sup>[2]</sup> | <u>H893</u><br>XXXX            |

[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C



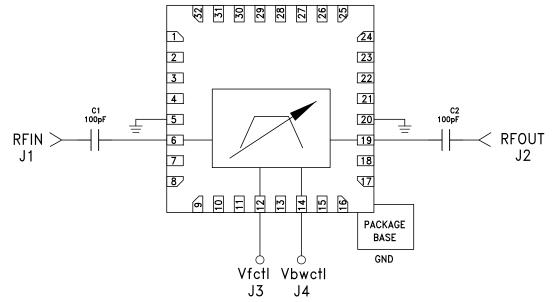


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### **Pin Descriptions**

| Pin Number                            | Function | Description  | Interface Schematic                                      |
|---------------------------------------|----------|--|--|
| 1 - 4, 7 - 11, 13<br>15 - 18, 21 - 32 | N/C      | The pins are not connected internally; however, all data<br>shown herein was measured with these pins connected to<br>RF/DC ground externally. |  |
| 5, 20                                 | GND      | These pins and exposed paddle must be connected to RF/DC ground.   |  |
| 6                                     | RFIN     | This pin is DC coupled and matched to 50 Ohms.<br>External voltage must not be applied to this pin.  | RFIN<br>2500<br>10nH                                     |
| 12                                    | Vfctl    | Center frequency control voltage.  | Vfctl 10nH 2500<br>$\downarrow$ 60pF $\downarrow$ 21.3pF |
| 14                                    | Vbwctl   | Bandwidth control voltage.   | Vbwctl 10nH 2500<br>$\downarrow$ 80pF $\downarrow$ 5.3pF |
| 19                                    | RFOUT    | This pin is DC coupled and matched to 50 Ohms.<br>External voltage must not be applied to this pin.  | RFOUT<br>2500<br>10nH                                    |

### **Application Circuit**





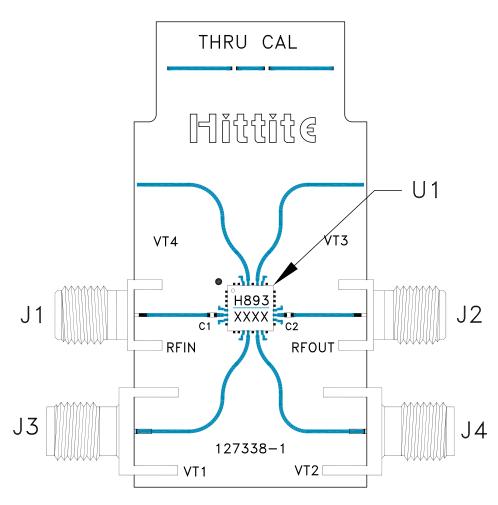


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### **Evaluation PCB**

FILTERS - TUNABLE - SMT



### List of Materials for Evaluation PCB 128531 [1]

| Item    | Description                 |  |
|---------|-----------------------------|--|
| J1, J2  | SMA - SRI                   |  |
| J3, J4  | SMA - Johnson               |  |
| C1, C2  | 100 pF Capacitor, 0402 Pkg. |  |
| U1      | HMC893LP5E Filter - Tunable |  |
| PCB [2] | 127338 Evaluation PCB       |  |

Reference this number when ordering complete evaluation PCB
Circuit Board Material: Arlon 25FR or Rogers 4350

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohms impedance while the package ground leads and exposed paddle 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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Notes: