Pole/Zero® Product Catalog
Advanced Cosite Communication Solutions for your Platform
Pole/Zero® offers a comprehensive suite of RF interference mitigation products including tunable filters, Integrated Cosite Equipment (ICE), Low Noise Amplifiers (LNA), cosite power amplifiers and other products that are ideal for solving communication problems caused by various types of RF interference. These interfering sources can include self-interference due to collocation of transmitters and receivers, (known as cosite interference), intentional jammers, broadband noise, spectral splatter and spurious transmit signals, rusty bolt effects or any number of other sources. Our approach to business and our ability to cost-effectively solve the most difficult interference problems has made us one of the fastest growing companies in our field. The company was founded in 1989 with the belief that the military and commercial RF markets were changing. Although military budgets were shrinking, the role and the requirements of the military were not. In fact, one may argue that the role of the conventional military was expanding with the global police force and peacekeeping actions being taken. At the same time, real battlefield situations demonstrated that commercial equipment can provide the sophistication and reliability required in a military environment. Using current state-of-the-art technology we focused on the technological advances of the last couple of decades and applied it to solid-state tunable filters. The result was a leap forward in miniaturization and standardization, permitting a totally self-contained single structure with improved production capability and reduced cost. In addition to these filters, we have developed other building blocks such as low noise amplifiers, cosite power amplifiers, solid-state switches, mixers and synthesizers that now make up a catalog of “off-the-shelf” building blocks. These building block modules are available both as stand-alone modules and also in the systems that we design and manufacture. These products share a common attribute in the support of very high dynamic range communications. In 1994 Pole/Zero® branched into the Integrated Cosite Equipment (ICE) field with the development of both an airborne and shipboard filter/amplifier cascade product. ICE integrates elements of our standard product line to achieve enhanced performance beyond that achievable with our basic products. Both of these ICE units are still in production. Further, Pole/Zero® has significantly expanded the breadth of our IEC products, providing our customers the ability to select optimum cost-effective solutions for their interference mitigation needs. Many of our products are purchased as commercial items, while other customers require modification to the existing products to meet their needs. In both cases, Pole/Zero® provides low risk, cost-effective solutions. Our products can be found in the harshest RF environments on CASIR (command, control, communications, computers, intelligence, surveillance and reconnaissance) platforms and tactical applications. Today, Pole/Zero® is delivering hardware to customers around the world for a variety of applications. For the military, our equipment is flying on airborne command posts and jet fighters and is fielded at both ground-fixed and ground-mobile systems. The same hardware is being used in commercial applications from radio telescopes to wireless office communications and from industrial inspection equipment to MRI machines. Applications for our filters range from stand-alone units in a test environment to units embedded in the design of high performance communication equipment. As we continue to grow in number of employees and yearly sales, we have maintained our focus on supplying readily available, digitally tuned hopping filter modules and components with wide dynamic range performance to provide new flexibility to the RF system designer. Additionally, Pole/Zero® has increased its focus on providing quality products to our customers by instituting the following quality policy: “Pole/Zero® is dedicated to providing defect-free products on time to internal and external customers. Customer satisfaction, quality and continuous improvement are the personal responsibility of each employee.” Building on this policy, Pole/Zero® has established and complies with many processes focused on improving performance throughout the company. As a result, Pole/Zero® has maintained third-party certification of our conformance to the ISO9001:2008 standard with AS9100:2009, Revision C, since October 2005. All products are manufactured and thoroughly tested in our West Chester, Ohio facility, which is fully equipped with modern computer controlled testing and manufacturing equipment. Pole/Zero® is dedicated to innovation, quality and absolute customer satisfaction.
And as always, cost is a major driver in engineering decisions.

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- Tuning Range
- Tuning Speed
- Power Consumption

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Selecting the right filter for your application.

Tuning Components

Changing the resonant frequency of a tuned circuit can be done by varying either its inductance or capacitance. Because of their smaller size and higher Q, capacitors are generally chosen as the tuning element. One way to accomplish this is by allowing the capacitance to be a bank of switched discrete capacitors. Far from ideal, the PIN diode remains the choice RF switching component when medium to high-in-band RF power handling, 1 to 100 watts or greater, is required. Once a high cost component, diode manufacturers now offer high performance parts in low cost SMD packages. Some JFETs are available that exhibit usable RF switch characteristics, but RF power handling can only approach the 1 watt level. Varactor diodes remain a choice tuning element for RF power handling to 20 mW.

Selecting the Right Tunable Filter

Selecting the right filter for the job requires the designer to consider a number of aspects. These relate to technical performance, size/weight, and cost. On the technical side, the filter performance characteristics can be summarized:

- Insertion Loss (IL) & Bandwidth/Selectivity
- RF Power Handling
- Intercept Point (Third Order Intercept)
- Tuning Range
- Tuning Speed
- Power Consumption

Additionally, the size and weight of the filter must be considered, especially for portable and airborne equipment.

Intercept Point (IP3)

The Third Order intercept point is a figure of merit for linearity and is closely related to the 1 dB compression of the filter. When two large “interfering” signals (F1 and F2) are applied to a filter (input or output), two new signals are generated which appear one on either side of the interfering and spaced from them by F1 – F2. If these interfering signals occur within the filter’s passband, the distortion products can be large and easily fall right on top of a desired signal. In a tunable filter, this distortion is caused by the non-linearity of the active components when large RF voltages are imposed on them. In-band Third Order intercept is generally 10 to 15 dB higher than the 1 dB compression level of a filter. The amplitude of the distortion products decreases as the interfering signals are moved out of the passband and on to the filter skirts. Note that even though the filter being specified may not have to handle high RF levels, the requirement for Third Order intercept may drive its size, weight and cost due to the relationship between RF power handling and Third Order intercept.

Tuning Range

PoleZero® filter products offer frequency coverage up to a full octave. The narrower the tuning range required of the filter, the higher the performance. If your tuning range can be reduced, or two half-band filters can be utilized, usually at least one other technical parameter can be significantly improved.

Power Consumption

PIN diodes require DC power when forward biased. Generally, by increasing the forward bias of a diode, unloaded Q is increased and thus IL improved.

An unfortunate rule of nature dictates that a filter’s insertion loss and bandwidth are inversely related; the narrower the bandwidth of a filter of a given technology, the higher its loss. The bandwidth-loss relationships are measured by a filter designer using the property called “unloaded Q”. This property measures the Q of an unloaded resonant circuit. Q is mathematically defined for a resonant circuit by the equation:

\[ Q = \frac{\omega}{R} \cdot \frac{R}{L} = \frac{R}{\omega L} \]

It is readily obvious that the higher the value of R, which for an unloaded resonator represents the lossy component, the higher the value for Q. The insertion loss of a 2-pole Butterworth filter is given by the equation:

\[ IL = 20 \log_{10} \left( \frac{1}{\sqrt{2}} \cdot \frac{1}{\omega Q} \right) \]

Again, the only way to improve a filter’s IL, for a given technology and bandwidth, is to increase the Q of its resonant circuits. Generally, this means larger size and/or increased DC power consumption, and higher cost, due to higher quality components.

RF Power Handling

This parameter can be the most important one in selecting a tunable filter. As opposed to fixed tuned filters that consist of passive components, tunable filters contain active components, which have limited linearity. The 1 dB compression point of a filter is the RF signal level where IL increases by 1 dB. As a tunable filter, this occurs when the RF signal’s peak voltage imposed across an active tuning component, whether PIN diode or varactor, approaches the DC bias voltage applied. For PIN diodes, power handling can be improved with increased reverse bias. However, care must be taken to ensure the sum of the bias voltage and the peak RF voltage do not exceed the breakdown voltage of the parts. Insufficient forward bias current can also limit power handling but is usually of secondary importance.

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These Selection Guides show a comparison of the different standard filter series available by Pole/Zero®. Customized units are always available as well as Tunable Notch Filters and Integrated Cosite Equipment (ICE).

### Tunable Bandpass Filters

<table>
<thead>
<tr>
<th>Filter Series</th>
<th>NANO-POLE®</th>
<th>MINI-POLE®</th>
<th>MINI-SMT™</th>
<th>MAXI-POLE®</th>
<th>POWER-POLE®</th>
<th>MAXI/3</th>
<th>MAXI/4R</th>
<th>MEGA-POLE®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>30 MHz to 1.2 GHz</td>
<td>1.3 GHz to 2.6 GHz</td>
<td>3.1 GHz to 6 GHz</td>
<td>10 GHz to 14 GHz</td>
<td>14 GHz to 20 GHz</td>
<td>20 GHz to 30 GHz</td>
<td>30 GHz to 45 GHz</td>
<td>45 GHz to 60 GHz</td>
</tr>
<tr>
<td>DC Power Consumption (Static)</td>
<td>+5 VDC @ 400 mA (Max.)</td>
<td>+40 VDC @ 150 mA (Max.)</td>
<td>+30 VDC @ 200 mA (Max.)</td>
<td>+50 VDC @ 100 mA (Max.)</td>
<td>+70 VDC @ 50 mA (Max.)</td>
<td>+100 VDC @ 20 mA (Max.)</td>
<td>+150 VDC @ 15 mA (Max.)</td>
<td>+200 VDC @ 10 mA (Max.)</td>
</tr>
<tr>
<td><strong>Weight (Typical)</strong></td>
<td>1.5 g</td>
<td>0.6 g</td>
<td>1.0 g</td>
<td>1.7 g</td>
<td>2.5 g</td>
<td>4.0 g</td>
<td>6.5 g</td>
<td>9.5 g</td>
</tr>
<tr>
<td>Size (H × W × L) in.</td>
<td>0.93 × 0.93 × 0.21</td>
<td>0.6 × 1.4 × 2.3</td>
<td>1.50 × 1/50 × 0.25</td>
<td>1.5 × 2.5 × 3.3</td>
<td>2.6 × 3.0 × 4.0</td>
<td>1.5 × 2.5 × 4.3</td>
<td>3.1 × 3.5 × 7.0</td>
<td>6.0 × 7.5 × 3.6</td>
</tr>
<tr>
<td>IL &amp; BW Product</td>
<td>24 (Typical)</td>
<td>20 (Typical)</td>
<td>20 (Typical)</td>
<td>10 (Typical)</td>
<td>8.5 (Typical)</td>
<td>15 (Typical)</td>
<td>18 (Typical)</td>
<td>4.5 (Typical)</td>
</tr>
<tr>
<td><strong>Tuning Speed (Typical)</strong>*</td>
<td>15 µS</td>
<td>10 µS</td>
<td>4 µS</td>
<td>10 µS</td>
<td>15 µS</td>
<td>&lt; 25 µS</td>
<td>50 µS</td>
<td>&lt; 25 µS</td>
</tr>
</tbody>
</table>

**Tunability**: Weight varies by configuration, power supply, options, etc.

* Tuning Speed shown is a typical value for each filter series; the actual tune time can vary significantly based on frequency range and configuration. Please refer to the Switching Characteristics section of each filter series for the maximum tune time.

### Tunable Notch Filters

<table>
<thead>
<tr>
<th>Filter Series</th>
<th>MINI-POLE®</th>
<th>MINI-SMT™</th>
<th>MAXI-POLE®</th>
<th>POWER-POLE®</th>
<th>MAXI/3</th>
<th>MAXI/4R</th>
<th>MEGA-POLE®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>30 MHz to 455 MHz</td>
<td>1.3 GHz to 400 MHz</td>
<td>300 MHz to 800 MHz</td>
<td>1.4 GHz to 2.2 GHz</td>
<td>300 MHz to 800 MHz</td>
<td>1.3 GHz to 400 MHz</td>
<td>300 MHz to 800 MHz</td>
</tr>
<tr>
<td><strong>Weight (Typical)</strong></td>
<td>1.4 lbs.</td>
<td>0.3 lbs.</td>
<td>1.0 lbs.</td>
<td>2.0 lbs.</td>
<td>3.5 lbs.</td>
<td>5.0 lbs.</td>
<td>7.0 lbs.</td>
</tr>
<tr>
<td>Size (H × W × L) in.</td>
<td>2.0 × 2.78 × 0.6</td>
<td>1.10 × 1.10 × 0.216</td>
<td>2.40 × 1.75 × .385</td>
<td>2.0 × 2.0 × .293</td>
<td>0.4 × 2.0 × 2.52</td>
<td>Single: 4.70 × 6.8 × 1.0</td>
<td>Single: 4.70 × 6.8 × 1.90</td>
</tr>
<tr>
<td><strong>Tuning Speed (Typical)</strong>*</td>
<td>85 µsec</td>
<td>25 µsec</td>
<td>15 µsec</td>
<td>12 µsec</td>
<td>15 µsec</td>
<td>25 µsec</td>
<td>25 µsec</td>
</tr>
</tbody>
</table>

**Tuning Speed**: Weight varies by configuration, power supply, options, etc.

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### Extended Range Tunable Bandpass Filters

The Extended Range Filter (ERF) was developed in support of the new family of radios with extended frequency coverage. These products provide broad tunable filtering while focusing on lower cost and smaller size.

<table>
<thead>
<tr>
<th>Filter Series</th>
<th>HF-ERF™</th>
<th>MINI-ERF®</th>
<th>MINI-ERF® (S11)</th>
<th>MINI/3-ERF</th>
<th>ERF-5W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>30 MHz to 3 GHz</td>
<td>1.5 MHz to 700 MHz</td>
<td>700 MHz to 3 GHz</td>
<td>1.5 MHz to 1 GHz</td>
<td>30 MHz to 400 MHz</td>
</tr>
<tr>
<td><strong>Weight (Typical)</strong></td>
<td>0.2 lbs.</td>
<td>0.6 lbs.</td>
<td>30 lbs.</td>
<td>30 lbs.</td>
<td>38 lbs.</td>
</tr>
<tr>
<td>Size (H × W × L) in.</td>
<td>0.6 × 1.4 × 2.3</td>
<td>1.50 × 2.5 × 3.3</td>
<td>2.6 × 3.0 × 4.0</td>
<td>1.5 × 2.5 × 4.3</td>
<td>3.1 × 3.5 × 7.0</td>
</tr>
<tr>
<td><strong>Tuning Speed (Typical)</strong>*</td>
<td>10 µS</td>
<td>15 µS</td>
<td>20 µS</td>
<td>40 µS</td>
<td>80 µS</td>
</tr>
</tbody>
</table>

**Tuning Speed**: Weight varies by configuration, power supply, options, etc.

* Tuning Speed shown is a typical value for each filter series; the actual tune time can vary significantly based on frequency range and configuration. Please refer to the Switching Characteristics section of each filter series for the maximum tune time.

### Pre/Post-Selector

<table>
<thead>
<tr>
<th>Filter Series</th>
<th>PFL1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Broadcast Protector</td>
</tr>
<tr>
<td>Frequency Coverage</td>
<td>28 to 2088 MHz</td>
</tr>
<tr>
<td>Input BNC Female</td>
<td>4000 V (RMS)</td>
</tr>
<tr>
<td>Gain</td>
<td>30 dB ± 3 dB</td>
</tr>
<tr>
<td>Selectivity</td>
<td>-25 dB at ± 15%</td>
</tr>
<tr>
<td>Power</td>
<td>30 Wate (± 25%)</td>
</tr>
<tr>
<td><strong>Input IP3</strong></td>
<td>+50 dBm (Typical)</td>
</tr>
<tr>
<td><strong>Output IP3</strong></td>
<td>+65 dBm (Typical)</td>
</tr>
<tr>
<td><strong>Noise Figure</strong></td>
<td>8 dB (Avg)</td>
</tr>
<tr>
<td><strong>Selectivity</strong>: Bandwidth @ 3 dB</td>
<td>200 kHz</td>
</tr>
<tr>
<td><strong>Power</strong>: 50 Watts (± 25%)</td>
<td></td>
</tr>
<tr>
<td><strong>Gain</strong>: 20 dB ± 3 dB</td>
<td></td>
</tr>
</tbody>
</table>

* Tuning Speed shown is a typical value for each filter series; the actual tune time can vary significantly based on frequency range and configuration. Please refer to the Switching Characteristics section of each filter series for the maximum tune time.
The NANO-POLE® is a low-cost, miniature, high-performance tunable filter with SPI customer interface. All filters are fully tested and aligned by Pole/Zero® for convenience and ease of use.

**NANO-POLE® SERIES**

**Specifications:**
- **Frequency Coverage (12 bands):** 30 MHz to 3 GHz
- **Input/Output Impedance:** 50Ω
- **In-band Input/Output SWR:** 1.5:1 typical
- **In-band RF Power Handling:** +4 dBm (input) typical
- **Outband RF Power Handling:** +24 dBm
- **In-band Second Order Intercept Point:** +70 dBm
- **In-band Third Order Intercept Point:** +18 dBm typical
- **Center Frequency Drift:** 100 PPM/ºC
- **Tuning Control:** SPI
- **Tuning Speed:** 15 us typical
- **DC Power Consumption (Static):** +3.3 VDC @ 20 mA typical
- **Shape Factor:** 6.9 typical
- **Operating Temperature Range:** -40°C to +85°C
- **Size:** (30 to 3000 MHz): .787 × .787 × .196 (in.) / 20 × 20 × 5 (mm.)
- **Weight:** .18 oz. / 5.1 g.
- **RF Connection:** SMT castellations

**Performance:**

The following plots illustrate approximate performance (not representative of all frequency ranges):

1. **NN-30-90-4**
   - **Insertion Loss (dB):**
     - Commanded Frequency (MHz)
     - 3 dB Bandwidth (%)
   - **Bandwidth (%):**
     - Commanded Frequency (MHz)

2. **NN-90-200-6**
   - **Insertion Loss (dB):**
     - Commanded Frequency (MHz)
     - 3 dB Bandwidth (%)
   - **Bandwidth (%):**
     - Commanded Frequency (MHz)

3. **NN-200-400-8**
   - **Insertion Loss (dB):**
     - Commanded Frequency (MHz)
     - 3 dB Bandwidth (%)
   - **Bandwidth (%):**
     - Commanded Frequency (MHz)

4. **NN-700-1000-4**
   - **Insertion Loss (dB):**
     - Commanded Frequency (MHz)
     - 3 dB Bandwidth (%)
   - **Bandwidth (%):**
     - Commanded Frequency (MHz)

Data is believed to be accurate. All data is subject to change without notice.
# NANO-POLE® SERIES Selection Guide:

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Suffix</th>
<th>% Bandwidth</th>
<th>Insertion Loss (3 dB)</th>
<th>Shape Factor (30 dB / 3 dB)</th>
<th>Overall</th>
<th>Low Side</th>
<th>High Side</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 to 90 MHz</td>
<td>-3</td>
<td>3</td>
<td>8.32</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>90 to 200 MHz</td>
<td>-3</td>
<td>3</td>
<td>8.7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
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<tr>
<td>200 to 400 MHz</td>
<td>-3</td>
<td>3</td>
<td>8.29</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>400 to 700 MHz</td>
<td>-3</td>
<td>3</td>
<td>8.33</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>700 to 1000 MHz</td>
<td>-3</td>
<td>3</td>
<td>8.33</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>1000 to 1500 MHz</td>
<td>-3</td>
<td>3</td>
<td>8.33</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>1500 to 2000 MHz</td>
<td>-3</td>
<td>3</td>
<td>8.33</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
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</tr>
<tr>
<td>2000 to 3000 MHz</td>
<td>-3</td>
<td>3</td>
<td>8.33</td>
<td>7</td>
<td>7</td>
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</tbody>
</table>

This Selection Guide illustrates approximate performance for the NANO-POLE® Series. Table values are shown as average/maximum.

Data shaded in blue is modeled and shown for reference only. Filter not in production at the time of printing.

## NANO-POLE® Series Product Number Guide:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>% Bandwidth (3 dB)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>NN</td>
<td>30-50</td>
<td>3 thru 15</td>
<td>S02</td>
</tr>
<tr>
<td></td>
<td>90-200</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>200-400</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>225-512</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>450-700</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>700-1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000-1500</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1500-2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000-3000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example: Product # NN-30-90-3-S02

---

## Pinout & Ratings:

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MISO</td>
<td>Master Output, Slave Input</td>
<td>-0.5 to Vcc + 0.5 V</td>
</tr>
<tr>
<td>2</td>
<td>MISO</td>
<td>Master Input, Slave Output</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SCLK</td>
<td>Serial Clock</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CS</td>
<td>Chip Select</td>
<td></td>
</tr>
<tr>
<td>5, 6, 8, 10-20</td>
<td>N/C</td>
<td>No Connect1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>TUNE READY</td>
<td>Tune Ready Output</td>
<td>-</td>
</tr>
<tr>
<td>9, 11, 13, 14, 16, 17</td>
<td>GND</td>
<td>Digital/RF Ground</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Vcc +3.3V</td>
<td>Power Supply Input</td>
<td>-0.3 to 4 V</td>
</tr>
<tr>
<td>12</td>
<td>RF_IN</td>
<td>RF Input +6 dBm, +24 dBm2</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>RF_OUT</td>
<td>RF Output +6 dBm, +24 dBm2</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1 Leave floating for unit to function properly. 2 First number indicates maximum in-band power levels and second number indicates maximum out of band RF power levels either in CW or composite average for multi-tones.

---

## Mechanical Outline:

**S02: 30 - 3000 MHz**

- **250 MAX [6.4]**
- **.780 [19.8]**

(TOP VIEW)

(BOTTOM VIEW)

---

POLE/ZERO® Information/Quote Requests:
support@polezero.com

Tunable Bandpass Filters

---

*Data is believed to be accurate. All data is subject to change without notice.*
The MINI-POLE® Series of tunable filters is optimized for size, RF power handling, low distortion and exceptional selectivity. The product line includes several standard designs in various bands to support a myriad of applications. Approximate performance is summarized in the MINI-POLE® Series Selection Guide. Evaluation cards available for T01 package.

**MINI-POLE® SERIES**

**Specifications: T02**

- **Frequency Coverage (9 bands):** 1.5 MHz to 700 MHz
- **Input/Output Impedance:** 50Ω
- **In-band Input/Output VSWR:** 1.5:1 typical
- **In-band RF Power Handling:** Up to 1 Watt
- **Outband RF Power Handling:** Up to 5 Watt
- **In-band Second Order Intercept Point:** +100 dBm (input)
- **In-band Third Order Intercept:** +40 dBm (input, fo > 30 MHz)
- **Center Frequency Drift:** -80 PPM/°C
- **Tuning Control:** 8 bit parallel
- **Tuning Speed:** 10 µS (fo > 30 MHz, +10 dBm reference)
- 200 µS (fo < 30 MHz, +10 dBm reference)
- **DC Power Consumption (Static):**
  - +5 VDC @ 10 to 250 mA
  - +100 VDC @ 2 mA
- **Shape Factor (30 dB/3 dB):** 6 typical
- **Operating Temperature Range:** -40°C to +85°C
- **Size:** 0.6 × 1.4 × 2.3 (in.) / 15.2 × 35.6 × 58.4 (mm.)
- **Weight:** 3.2 oz. / 90.7 g.
- **RF Connection:** Thru-hole pin

The following plots illustrate approximate insertion loss and bandwidth trends across a given frequency band, and the differences between various bands:

**Performance:**
The following plots illustrate approximate performance (not representative of all frequency ranges):

- **MN-30-90-7 (@ 90 MHz)**
- **MN-225-400-4-701 (@ 225 MHz)**
- **MN-400-700-5 (@ 400 MHz)**
**Source/Load VSWR effects on power handling**

The following Selection Guide illustrates approximate performance for the MINI-POLE® SERIES.

### Frequency Range

<table>
<thead>
<tr>
<th>Series Frequency (MHz)</th>
<th>% Bandwidth (3 dB)</th>
<th>Package</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5-4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90-200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200-400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>225-400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>245-512</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400-700</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Bias Voltage Requirement:

A bias voltage is required to reverse bias the PIN diodes used to tune the filter. Very little static current (less than 2 mA) is needed. A minimum of 30 Volts is recommended for proper filter operation. As this voltage is increased, the power handling capability and intermodulation are improved as shown below. A bias voltage of +100 VDC is recommended for best results, and all filters are tuned and aligned this way from the factory unless otherwise specified by the customer.

### Interface Options:

The filter comes standard with an 8 bit parallel interface, although a serial interface can be specified as an option.

#### DC Control Interface Characteristics:

**Switching Characteristics:**

<table>
<thead>
<tr>
<th>fcc = +5 VDC, ±10%</th>
<th>T = 40°C to +65°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>tACC</td>
<td>±0.5%</td>
</tr>
<tr>
<td>tAC, ti</td>
<td>4 µs</td>
</tr>
<tr>
<td>tBC</td>
<td>±10%</td>
</tr>
<tr>
<td>tBC, ti</td>
<td>4 µs</td>
</tr>
<tr>
<td>tr</td>
<td>±10%</td>
</tr>
<tr>
<td>tr, ti</td>
<td>4 µs</td>
</tr>
<tr>
<td>tAC</td>
<td>±10%</td>
</tr>
<tr>
<td>tAC, ti</td>
<td>4 µs</td>
</tr>
<tr>
<td>tBC, tBC</td>
<td>±10%</td>
</tr>
<tr>
<td>tBC, tBC, ti</td>
<td>4 µs</td>
</tr>
<tr>
<td>tACC, ti</td>
<td>±10%</td>
</tr>
<tr>
<td>tACC, ti, tBC, tBC</td>
<td>4 µs</td>
</tr>
</tbody>
</table>

### Strobe:

The filter is tuned within 10 µs (t0 > 30 MHz) to the frequency designated by the tuneword existing on the eight control bit lines when the STB line is brought low. Once strobed, data existing on the tune control lines is ignored until strobed again. Consult the Selection Guide on page 12 for the maximum strobe rate in each frequency band.

### RF Power Handling Capability:

The filters are designed to operate with RF input power levels up to 1 Watt (+30 dBm) in-band. Signals in the filter stopband up to 5 Watts at the input will not cause damage to the filter.

### Temperature Effects:

Over the -40°C to +85°C temperature range, filters will exhibit a negative temperature drift of less than 80 PPM/°C, or a total of less than ±0.5% of the center frequency.
MINI-POLE® SERIES (Continued)

Pinout & Ratings:

**MINI-POLE®**

**PARALLEL INTERFACE**

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>RF I/O</td>
<td>RF Input/Output</td>
<td>+30 dBm</td>
</tr>
<tr>
<td>3-5, 15, 16, 18, 20, 22, 42</td>
<td>GND</td>
<td>Digital/RF Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>+/- Power Supply Pins 1 &amp; 2</td>
<td>±5V Power Supply ±5%</td>
<td>±0.5 to +15V</td>
</tr>
<tr>
<td>7, 8</td>
<td>A7, A8</td>
<td>Parallel Bit 7, 8</td>
<td></td>
</tr>
<tr>
<td>9, 10</td>
<td>A7, A8</td>
<td>Parallel Bit 9, 10</td>
<td></td>
</tr>
<tr>
<td>11, 12</td>
<td>A7, A8</td>
<td>Parallel Bit 11, 12</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>A7, A8</td>
<td>Parallel Bit 13</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>VBB</td>
<td>±5V Power Supply ±5%</td>
<td>±0.5 to +15V</td>
</tr>
<tr>
<td>23, 28-35</td>
<td>N/C</td>
<td>No Connect (1)</td>
<td></td>
</tr>
<tr>
<td>24-27, 36-41</td>
<td>Filter Enable Pins (2)</td>
<td>Filter Enable Pins (2)</td>
<td></td>
</tr>
</tbody>
</table>

**SERIAL INTERFACE**

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>RF I/O</td>
<td>RF Input/Output</td>
<td>+30 dBm</td>
</tr>
<tr>
<td>3, 5, 15, 16, 18-20, 22, 42</td>
<td>GND</td>
<td>Digital/RF Ground</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>+/- Power Supply Pins 1 &amp; 2</td>
<td>±5V Power Supply ±5%</td>
<td>±0.5 to +15V</td>
</tr>
<tr>
<td>6-10</td>
<td>N/C</td>
<td>No Connect (1)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>SDO</td>
<td>Serial Data Out</td>
<td>±0.5 to (Vcc + 0.5)V</td>
</tr>
<tr>
<td>12</td>
<td>SDI</td>
<td>Serial Data In</td>
<td>±0.5 to (Vcc + 0.5)V</td>
</tr>
<tr>
<td>13</td>
<td>SCLK</td>
<td>Serial Clock</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>STB</td>
<td>Serial Strobe</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>VBB</td>
<td>±100V Supply Input</td>
<td>±0.5 to ±150V</td>
</tr>
<tr>
<td>24-27, 36-41</td>
<td>Filter Enable Pins (2)</td>
<td>Filter Enable Pins (2)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Leave pins disconnected for unit to function properly.
2. Pins must be jumpered as shown in package outline for filter to function properly.

**Mechanical Outline:**

**MINI-POLE® T01**

**Mechanical Outline:**

**MINI-POLE® T02**

Data is believed to be accurate. All data is subject to change without notice.
MINI-SMT™ SERIES

Specifications:

Frequency Coverage (multiple bands): 700 MHz to 3000 MHz
Input/Output Impedance: 50 Ω
In-band Input/Output VSWR: 1.5:1 typical, 2.2:1 max
In-band RF Power Handling: +30 dBm (input)
Outband RF Power Handling: +36 dBm (input)
In-band Second Order Intercept Point: +100 dBm
In-band Third Order Intercept Point: +100 dBm
Center Frequency Drift: 60 PPM/ºC
Tuning Control: Parallel or Serial
Tuning Speed: 4 µS
DC Power Consumption (Static): 100 mA typical
Shape Factor (30 dB / 3 dB): 7 typical
Operating Temperature Range: -40ºC to +85ºC
Size: 1.50 × 1.50 × 0.25 (in.) / 38.1 × 38.1 × 6.35 (mm.)
Weight: 0.6 oz. / 18 g.
RF Connection: SMT castellation

MINI-SMT Filters Product Number Guide:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>% Bandwidth (3 dB)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN</td>
<td>700-1000</td>
<td>5</td>
<td>S03</td>
</tr>
<tr>
<td>MN</td>
<td>900-1200</td>
<td>5</td>
<td>S03</td>
</tr>
<tr>
<td>MN</td>
<td>1000-1500</td>
<td>5</td>
<td>S03</td>
</tr>
<tr>
<td>MN</td>
<td>1500-2000</td>
<td>5</td>
<td>S03</td>
</tr>
<tr>
<td>MN</td>
<td>2000-2500</td>
<td>5</td>
<td>S03</td>
</tr>
<tr>
<td>MN</td>
<td>2500-3000</td>
<td>5</td>
<td>S03</td>
</tr>
</tbody>
</table>

Example: Product # MN-700-1000-5-S03

Interface & Control Notes:

General Information

The MINI-SMT® filter requires only one +3.3 VDC supply voltage. An on-board +100 VDC DC-DC converter is included. If low frequency noise of concern, then this supply can be disabled and an external +100 VDC supply may be used. This supply voltage should be adequately filtered as noise present on these pins will influence the RF signal purity.

Digital Interface Information

The digital interface format can be either SPI serial or parallel depending on the state of the mode control pin. All data input pins are 3.3V logic.

Performance:

The following plots illustrate approximate performance:

MINI-SMT® SERIES Selection Guide:

Mechanical Outline:

S03
The MAXI-POLE® Series of tunable filters provides improved passband performance (reduced insertion loss for a given bandwidth) in a slightly larger package. The product line includes several standard designs in various frequencies to support almost any application.

**MAXI-POLE® SERIES**

**Specifications:**
- **Frequency Coverage (8 bands):** 1.5 MHz to 1 GHz
- **Input/Output Impedance:** 50Ω
- **In-band Input/Output SWR:** 1.5:1 typical
- **In-band RF Power Handling:** 1 Watt (input)
- **Outband RF Power Handling:** Up to 5 Watt
- **In-band Second Order Intercept Point:** +100 dBm (input)
- **In-band Third Order Intercept Point:** +40 dBm (input)
- **Center Frequency Drift:** -80 PPM/°C
- **Tuning Control:** 8 bit parallel
- **Tuning Speed:** 10 µS (fo > 30 MHz, +10 dBm reference)
- **DC Power Consumption (Static):** +5 VDC @ 10 to 500 mA
  - +100 VDC @ 2 mA
- **Shape Factor (30 dB/ 3 dB):** 6 typical
- **Operating Temperature Range:** -40°C to +85°C
- **Size:** 1.5 x 2.5 x 3.3 (in.) / 38.1 x 63.5 x 82.6 (mm.)
- **Weight:** 9.2 oz. / 260.8 g.
- **RF Connection:** SMA jack

**Performance:**

The following plots illustrate approximate performance (not representative of all frequency ranges):

The following plots illustrate approximate insertion loss and bandwidth trends across a given frequency band, and the differences between various bands:

**Data is believed to be accurate. All data is subject to change without notice.**
**MAXI-POLE® SERIES Selection Guide:**

The following Selection Guide illustrates approximate performance for the MAXI-POLE® Series. Table values are shown as average/maximum.

<table>
<thead>
<tr>
<th>Range</th>
<th>Suffix</th>
<th>400 to 700 MHz</th>
<th>200 to 400 MHz</th>
<th>90 to 200 MHz</th>
<th>30 to 90 MHz</th>
<th>10 to 30 MHz</th>
<th>4 to 10 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 to 4 MHz</td>
<td>-4</td>
<td>1.9/2.2</td>
<td>4.3/6.3</td>
<td>5.8/6.1</td>
<td>6.4/6.8</td>
<td>5.2/5.6</td>
<td></td>
</tr>
<tr>
<td>4 to 10 MHz</td>
<td>-4</td>
<td>2.5/2.9</td>
<td>3.2/4.6</td>
<td>6.0/6.1</td>
<td>6.8/7.0</td>
<td>5.1/5.2</td>
<td></td>
</tr>
<tr>
<td>90 to 200 MHz</td>
<td>-2</td>
<td>4.8/5.5</td>
<td>1.4/2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 to 400 MHz</td>
<td>-3</td>
<td>3.4/3.9</td>
<td>1.8/3.3</td>
<td>6.4/6.6</td>
<td>8.4/9.1</td>
<td>4.4/4.6</td>
<td></td>
</tr>
<tr>
<td>30 to 90 MHz</td>
<td>-2</td>
<td>4.8/5.5</td>
<td>1.4/2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to 30 MHz</td>
<td>-4</td>
<td>2.5/2.7</td>
<td>3.3/5.3</td>
<td>5.8/6.1</td>
<td>6.7/7.0</td>
<td>5.0/5.2</td>
<td></td>
</tr>
<tr>
<td>4 to 10 MHz</td>
<td>-3</td>
<td>3.5/3.9</td>
<td>2.7/3.5</td>
<td>5.8/6.0</td>
<td>6.7/7.2</td>
<td>4.9/5.1</td>
<td></td>
</tr>
<tr>
<td>90 to 200 MHz</td>
<td>-2</td>
<td>5.3/5.5</td>
<td>1.7/2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 to 400 MHz</td>
<td>-5</td>
<td>1.9/2.2</td>
<td>3.8/6.3</td>
<td>6.1/6.2</td>
<td>6.9/7.0</td>
<td>5.3/5.4</td>
<td></td>
</tr>
<tr>
<td>30 to 90 MHz</td>
<td>-4</td>
<td>3.4/3.8</td>
<td>2.2/3.5</td>
<td>5.9/6.2</td>
<td>7.1/7.6</td>
<td>4.8/5.0</td>
<td></td>
</tr>
<tr>
<td>10 to 30 MHz</td>
<td>-3</td>
<td>3.5/3.9</td>
<td>2.4/3.5</td>
<td>5.9/6.3</td>
<td>6.6/7.6</td>
<td>5.2/6.0</td>
<td></td>
</tr>
<tr>
<td>4 to 10 MHz</td>
<td>-2</td>
<td>5.3/5.5</td>
<td>1.8/2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Available Options:**

- Internal DC-DC Converter (Eliminates need for high voltage supply. Requires additional 250 mA of 5 VDC current.)
- Serial Interface
- Custom Frequency Bands (Specify START and STOP frequencies in MHz.)
- Filtered O-conductor

**Note(s):**
- Options may be limited to particular frequency bands and/or configurations. Consult factory for your application.
- Filters are aligned and tested using a High Bias of +100 VDC unless otherwise specified by the customer.

**Interface & Control Options:**

**Frequency Tuning Address**: There are 250 equally spaced tuning increments across each standard filter band, resulting in 251 tunewords from 00000000 to 11111110. The last 5 tunewords are reserved for housekeeping functions.

**Calculating a Tune Word:**

The binary tuning word is determined by the following relationship:

\[
\text{tuneword} = \left( \frac{F_{\text{desired}} - F_{\text{low}}}{F_{\text{high}} - F_{\text{low}}} \right) \times 250
\]

**Example:** If you wish to tune to 322 MHz using a 225 to 400 MHz filter, the tuneword is:

\[
\left( \frac{322 - 225}{400 - 225} \right) \times 250 = 138.57 (10001011 binary)
\]

**Bias Voltage Requirement:**

A bias voltage is required to reverse bias the PIN diodes used to tune the filter. Very little static current (less than 2 mA) is needed. A minimum of 30 Volts is recommended for proper filter operation. As this voltage is increased, the power handling capability and intermodulation are improved as shown below. A bias voltage of +100 VDC is recommended for best results, and all filters are tuned and aligned this way from the factory unless otherwise specified by the customer. An internal low EMI supply, powered from the +5 VDC input, is available as an option.

**Switching Characteristics:**

- DC Control Interface Characteristics:
  - **Symbol** | **Parameter** | **Condition** | **Minimum** | **Maximum** | **Units** |
  - $T_{\text{ACC}}$ | Access Time from STB to $f_0$ | 15 ms |
  - $T_{\text{W}}$ | STB Pulse Width | 20 nS |
  - $V_{\text{IL1}}$ | Input Low Voltage A0-A7 | 0 V |
  - $V_{\text{IH1}}$ | Input High Voltage A0-A7 | $0.7 V_{\text{cc}}$ |
  - $V_{\text{IL2}}$ | Input Low Voltage Control signals | 0 V |
  - $V_{\text{IH2}}$ | Input High Voltage Control signals | $0.7 V_{\text{cc}}$ |
  - $t_{\text{SH}}$ | STB High Time | 25 µS |
  - $t_{\text{DH}}$ | Hold Time, A0-A7 from STB | 6 µS |
  - $t_{\text{HH}}$ | Access Time from STB to $f_0$ | 500 µS |
  - $t_{\text{TH}}$ | Access Time from STB to $f_0$ | 500 µS |

**Strobe**

The filter is tuned within 10 µs ($f_0 > 30$ MHz, +10 dBm reference) to the frequency designated by the tuneword existing on the eight control bit lines when the STB line is brought low. Once strobed, data existing on the control line controls is ignored until strobed again. Consult the Selection Guide on page 20 for the maximum strobe rate in each frequency band.

**Temperature Effects**

- Over the -40ºC to +85°C temperature range, filters will exhibit a negative temperature drift of less than 80 PPM/°C, or a total of less than ±0.5% of the center frequency.

**Bias Voltage Requirement**

A bias voltage is required to reverse bias the PIN diodes used to tune the filter. Very little static current (less than 2 mA) is needed. A minimum of 30 Volts is recommended for proper filter operation. As this voltage is increased, the power handling capability and intermodulation are improved as shown below. A bias voltage of +100 VDC is recommended for best results, and all filters are tuned and aligned this way from the factory unless otherwise specified by the customer. An internal low EMI supply, powered from the +5 VDC input, is available as an option.

**Interface Options:**

The filter comes standard with an 8 bit parallel interface, although a serial interface can be specified as an option.

**Switching Characteristics:**

- $V_{\text{cc}} = +5$ VDC, ±10%, $T = -40^\circ$C to $+85^\circ$C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{\text{ACC}}$</td>
<td>Access Time</td>
<td>15 ms</td>
</tr>
<tr>
<td>$T_{\text{W}}$</td>
<td>Pulse Width</td>
<td>20 nS</td>
</tr>
<tr>
<td>$V_{\text{IL1}}$</td>
<td>Input Low Voltage A0-A7</td>
<td>0 V</td>
</tr>
<tr>
<td>$V_{\text{IH1}}$</td>
<td>Input High Voltage A0-A7</td>
<td>$0.7 V_{\text{cc}}$</td>
</tr>
<tr>
<td>$V_{\text{IL2}}$</td>
<td>Input Low Voltage Control signals</td>
<td>0 V</td>
</tr>
<tr>
<td>$V_{\text{IH2}}$</td>
<td>Input High Voltage Control signals</td>
<td>$0.7 V_{\text{cc}}$</td>
</tr>
<tr>
<td>$t_{\text{SH}}$</td>
<td>STB High Time</td>
<td>25 µS</td>
</tr>
<tr>
<td>$t_{\text{DH}}$</td>
<td>Hold Time, A0-A7 from STB</td>
<td>6 µS</td>
</tr>
<tr>
<td>$t_{\text{TH}}$</td>
<td>Access Time from STB to $f_0$</td>
<td>500 µS</td>
</tr>
</tbody>
</table>

**Note(s):**

- Leave pins disconnected for unit to function properly.

---

**Pinout & Ratings:**

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A0</td>
<td>Parallel Bit 1</td>
<td>$-0.5 \text{ to } (V_{\text{cc}} + 0.5) \text{ V}$</td>
</tr>
<tr>
<td>2</td>
<td>A1</td>
<td>Parallel Bit 2</td>
<td>$-0.5 \text{ to } (V_{\text{cc}} + 0.5) \text{ V}$</td>
</tr>
<tr>
<td>3</td>
<td>A2</td>
<td>Parallel Bit 3</td>
<td>$-0.5 \text{ to } (V_{\text{cc}} + 0.5) \text{ V}$</td>
</tr>
<tr>
<td>4</td>
<td>A3</td>
<td>Parallel Bit 4</td>
<td>$-0.5 \text{ to } (V_{\text{cc}} + 0.5) \text{ V}$</td>
</tr>
<tr>
<td>5</td>
<td>A4</td>
<td>Parallel Bit 5</td>
<td>$-0.5 \text{ to } (V_{\text{cc}} + 0.5) \text{ V}$</td>
</tr>
<tr>
<td>6</td>
<td>A5</td>
<td>Parallel Bit 6</td>
<td>$-0.5 \text{ to } (V_{\text{cc}} + 0.5) \text{ V}$</td>
</tr>
<tr>
<td>7</td>
<td>PARALLEL INTERFACE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>A7</td>
<td>Parallel Bit 7</td>
<td>$-0.5 \text{ to } (V_{\text{cc}} + 0.5) \text{ V}$</td>
</tr>
<tr>
<td>9</td>
<td>VCC</td>
<td>+5V Power Supply Input</td>
<td>±10% -0.5 to +6 V</td>
</tr>
<tr>
<td>10</td>
<td>VBB</td>
<td>High Bias +100 V Supply</td>
<td>0 to +125 V</td>
</tr>
<tr>
<td>11</td>
<td>GND</td>
<td>Digital/RF Ground</td>
<td>–</td>
</tr>
</tbody>
</table>
### MAXI/3 Specifications

- **Frequency Coverage:** 300 to 805 MHz
- **Input/Output Impedance:** 50Ω
- **In-band Input/Output VSWR:** 1.3:1 typical
- **Center Frequency Drift:** -80 PPM/°C
- **RF Power Handling:** 1 Watt (+30 dBm) in-band, 1 Watt (+100 dBm) and/or configurations. Consult factory for your application.
- **Frequency (MHz):** 300 to 805 MHz
- **Shape Factor:** 3.3 to 3.75 typical, 4.0 max.
- **DC Power Consumption (Static):** +5 VDC @ 125 to 750 mA
- **RF Power Handling Capability:** Over the -40°C to +85°C temperature range, filters will exhibit a negative temperature drift of less than 80 PPM/°C, or a total of less than ±0.5% of the center frequency.

### Interface & Control Options

- **Tuning Speed:** < 25 µS
- **Tuning Control:** 8 bit parallel
- **Shape Factor (30 dB / 3 dB):** 3.3 to 3.75 typical, 4.0 max.
- **DC Power Consumption (Static):** +5 VDC input, is available as an option.

### Calculating a Tune Address

The binary tuning word is determined by the following relationship:

\[
\text{tuneword} = \left( \frac{F \text{ high} - F \text{ low}}{F \text{ high} + F \text{ low}} \right) \times 250
\]

### Example: Strobe Dwell Time

Calculating a Tune Address

The binary tuning word is determined by the following relationship:

\[
\text{tuneword} = \left( \frac{F \text{ high} - F \text{ low}}{F \text{ high} + F \text{ low}} \right) \times 250
\]

**Example:** If you wish to tune to 322 MHz using a 225 to 400 MHz filter, the tuneword is:

\[
\left( \frac{322 - 225}{400 - 225} \right) \times 250 = 138.57 (10001011 binary)
\]

**Note:** Round off to the nearest decimal integer. All data is subject to change without notice.

### Bias Voltage Requirement

A bias voltage is required to reverse bias the PIN diodes used to tune the filter. Very little static current (less than 2 mA) is needed. A minimum of 30 Volts is recommended for proper filter operation.

As this voltage is increased, the power handling capability and intermodulation are improved as shown below. A bias voltage of +100 VDC is recommended for best results, and all filters are tuned and aligned this way from the factory unless otherwise specified by the customer. An internal low EMI supply, powered from the +5 VDC input, is available as an option.

### DC Control Interface Characteristics

- **Input High Voltage:** 5 VDC
- **Input Low Voltage:** 0 V
- **Input High Current:** 250 mA
- **Input Low Current:** 100 mA
- **Input High Impedance:** 50kΩ
- **Input Low Impedance:** 50kΩ

### Switching Characteristics

- **Dwell Time:** 500 µS
- **Strobe Dwell Time:** 500 µS

### Strobe:

The filter is tuned within 25 µS to the frequency designated by the tuneword existing on the eight control bit lines when the STB line is brought low. Once strobed, data existing on the control lines is ignored until strobed again. Consult the MAXI-POLE® Selection Guide on page 23 for the maximum strobe rate in each frequency band.

### RF Power Handling Capability

The filters are designed to operate with RF input power levels up to 1 Watt (+30 dBm) in-band (see graphs on page 26). Signals in the filter stopband up to 5 Watts at the input will not cause damage to the filter.
MAXI/3 SERIES (Continued)

Mechanical Outline:

Pinout & Ratings:

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Minimum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1</td>
<td>Parallel Bit 1</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>2</td>
<td>A2</td>
<td>Parallel Bit 2</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>3</td>
<td>A3</td>
<td>Parallel Bit 3</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>4</td>
<td>A4</td>
<td>Parallel Bit 4</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>5</td>
<td>A5</td>
<td>Parallel Bit 5</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>6</td>
<td>A6</td>
<td>Parallel Bit 6</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>7</td>
<td>A7</td>
<td>Parallel Bit 7</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Digital/RF Ground</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>VCC</td>
<td>Power Supply Input</td>
<td>+5 VDC ± 5%</td>
</tr>
<tr>
<td>10</td>
<td>VBB</td>
<td>High Bias Input</td>
<td>+100 VDC ± 5%</td>
</tr>
<tr>
<td>11</td>
<td>STB</td>
<td>Strobe</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>12</td>
<td>A0</td>
<td>Parallel Bit 0</td>
<td>-0.5 to (VCC + 0.5) V</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The MAXI/4R Series of tunable filters provides 4-poles of filtering, for even better rejection than our standard MAXI-POLE® filters. The chassis has been ruggedized to better handle the vibration and shock environments often encountered in customer applications (i.e. ground-mobile, airborne, etc.). The product line includes several standard designs in various frequencies to support almost any application.

Performance:

The following plot illustrates approximate performance (not representative of all frequency ranges):

MAXI/4R SERIES

Specifications:

- Frequency Coverage: 140 to 225 MHz
- Input/Output Impedance: 50Ω
- In-band Input/Output VSWR: 1.5:1 typical
- In-band RF Power Handling: 1 Watt (input)
- Out-band RF Power Handling: Up to 5 Watt
- In-band Second Order Intercept Point: +100 dBm (input)
- In-band Third Order Intercept Point: +40 dBm (input)
- Center Frequency Drift: -80 PPM/°C
- Tuning Control: 8 bit parallel
- Tuning Speed: 50 µs
- DC Power Consumption (Static): +5 VDC @ 20 to 1500 mA
  +100 VDC @ 2 mA
- Shape Factor (30 dB / 3 dB): 3.3 to 3.75 typical
- Operating Temperature Range: -40°C to +85°C
- Size: 3.1 × 3.5 × 7.0 (in.) / 79.4 × 91.4 × 177.8 (mm.)
- Weight: 43.2 oz. / 1.2 kg.
- RF Connection: SMA jack

Data is believed to be accurate. All data is subject to change without notice.
MAXI/4R SERIES (Continued)

Interface Options:
The filter comes standard with an 8 bit parallel interface, although a serial interface can be specified as an option.

**Mechanical Outline:**

![Mechanical Outline Diagram]

**Pinout & Ratings:**

**PARALLEL INTERFACE**

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1</td>
<td>Parallel Bit 2</td>
<td>±0.3 to VCC ± 0.3 V</td>
</tr>
<tr>
<td>2</td>
<td>A2</td>
<td>Parallel Bit 1</td>
<td>±0.3 to VCC ± 0.3 V</td>
</tr>
<tr>
<td>4</td>
<td>A5</td>
<td>Parallel Bit 5</td>
<td>-0.3 to (VCC + 0.3 V)</td>
</tr>
<tr>
<td>3</td>
<td>A4</td>
<td>Parallel Bit 4</td>
<td>-0.3 to (VCC + 0.3 V)</td>
</tr>
<tr>
<td>2-6</td>
<td>N/C</td>
<td>No Connect (1)</td>
<td>-0.3 to VCC ± 0.3 V</td>
</tr>
<tr>
<td>7, 9, 11, 12</td>
<td>GND Digital/RF Ground ––</td>
<td>-0.3 to VCC ± 0.3 V</td>
<td></td>
</tr>
</tbody>
</table>

**SERIAL INTERFACE**

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>TX</td>
<td>Serial Data Out</td>
<td>-0.3 to (VCC + 0.3 V)</td>
</tr>
<tr>
<td>14</td>
<td>RX</td>
<td>Serial Data In</td>
<td>-0.3 to (VCC + 0.3 V)</td>
</tr>
<tr>
<td>15</td>
<td>CLK</td>
<td>Serial Clock</td>
<td>-0.3 to VCC ± 0.3 V</td>
</tr>
</tbody>
</table>

**In-band RF Power Rating**

![In-band RF Power Rating Graph]

**Third Order Intercept Point**

![Third Order Intercept Point Graph]

**Tunable Bandpass Filters**

**MAXI/4R Filters Product Number Guide:**

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>Insertion Loss (dB)</th>
<th>Connector Type</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAXI/VR</td>
<td>140-225</td>
<td>9</td>
<td>SMA (Female)</td>
<td>A, C</td>
</tr>
</tbody>
</table>

**Available Options:**

A. Internal DC-DC Converter (Eliminates need for high voltage supply. Requires additional 250 mA of 5 VDC current.)
B. Serial Interface
C. Custom Frequency Bands (Specify START and STOP frequencies in MHz.)
F. Filtered D-connector

**Note(s):**

1. Options may be limited to particular frequency bands and/or performance levels. Consult factory for your application.
2. Filters are aligned and tested using a High Bias of +100 VDC unless otherwise specified by the customer.

**Example:**

Product #: MAXI/VR-140-225-9-SMA

**Interface & Control Options:**

**Frequency Tuning Address**

MAXI-POLE® Series filters utilize an 8 bit scheme for tunewords to digitally control tuning of the center frequency. There are 250 equally spaced tuning increments across each standard filter band, resulting in 251 tunewords from 00000000 to 11111010. The last 5 tunewords are reserved for housekeeping functions:

**Tuneword**

<table>
<thead>
<tr>
<th>Tune Code</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000000</td>
<td>Lowest tuned frequency (0% total tuning code)</td>
</tr>
<tr>
<td>11111010</td>
<td>Highest tuned frequency</td>
</tr>
<tr>
<td>11111111</td>
<td>Power saver mode; all PIN diodes turned off</td>
</tr>
</tbody>
</table>

**Calculating a Tune Address**

The binary tuning word is determined by the following relationship:

\[
\text{tuneword} = \left( \frac{F_{\text{high}} - F_{\text{low}}}{250} \right) \times 250
\]

**Example:**

If you wish to tune to 322 MHz using a 225 to 400 MHz filter, the tuneword is:

\[
\left( \frac{322 - 225}{400 - 225} \right) \times 250 = 138.57 (10001011 binary)
\]

**Note:** Round off to the nearest decimal integer.

**Bias Voltage Requirement:**

A bias voltage is required to reverse bias the PIN diodes used to tune the filter. Very little static current (less than 2 mA) is needed. A minimum of 30 Volts is recommended for proper filter operation. As this voltage is increased, the power handling capability and intermodulation are improved as shown on the right. A bias voltage of +100 VDC is recommended for best results, and all filters are tuned and aligned this way from the factory unless otherwise specified by the customer. An internal low EMI supply, powered from the +5 VDC input, is available as an option.

**DC Control Interface Characteristics:**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIH</td>
<td>Input High Voltage</td>
<td>Control signals</td>
<td>+0.8 V</td>
<td>+2 V</td>
<td>V</td>
</tr>
<tr>
<td>VIL</td>
<td>Input Low Voltage</td>
<td>Control signals</td>
<td>-0.7 V</td>
<td>0 V</td>
<td>V</td>
</tr>
<tr>
<td>tW</td>
<td>STB Pulse Width</td>
<td>25 µS</td>
<td>100 nS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tSH</td>
<td>STB High Time</td>
<td>25 µS</td>
<td>100 nS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tACC</td>
<td>Access Time from STB</td>
<td></td>
<td>50 µS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tS</td>
<td>Setup Time, A0-A7 to STB</td>
<td></td>
<td>100 nS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tH</td>
<td>Hold Time, A0-A7 from STB</td>
<td></td>
<td>6 µS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tDW</td>
<td>STB Pulse Width</td>
<td></td>
<td>100 nS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Switching Characteristics:**

(60°C = +5 VDC, ± 10%, T = -40°C to +85°C)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>trH</td>
<td>Rise Time, A0-A7 to</td>
<td>Output</td>
<td>5 µS</td>
<td>25 µS</td>
<td>µS</td>
</tr>
<tr>
<td>trF</td>
<td>Fall Time, A0-A7 to</td>
<td>Output</td>
<td>5 µS</td>
<td>25 µS</td>
<td>µS</td>
</tr>
<tr>
<td>tWB</td>
<td>Power Supply Input</td>
<td></td>
<td>6 ms</td>
<td>25 ms</td>
<td>ms</td>
</tr>
<tr>
<td>tPD</td>
<td>Power Supply Input</td>
<td></td>
<td>10 ms</td>
<td>25 ms</td>
<td>ms</td>
</tr>
<tr>
<td>tPL</td>
<td>Power Supply Input</td>
<td></td>
<td>10 ms</td>
<td>25 ms</td>
<td>ms</td>
</tr>
<tr>
<td>tsL</td>
<td>Power Supply Input</td>
<td></td>
<td>10 µS</td>
<td>25 µS</td>
<td>µS</td>
</tr>
<tr>
<td>tOS</td>
<td>Output Settling Time</td>
<td></td>
<td>10 µS</td>
<td>25 µS</td>
<td>µS</td>
</tr>
<tr>
<td>tOL</td>
<td>Output Settling Time</td>
<td></td>
<td>10 µS</td>
<td>25 µS</td>
<td>µS</td>
</tr>
<tr>
<td>tACR</td>
<td>Access Time from</td>
<td></td>
<td>10 µS</td>
<td>25 µS</td>
<td>µS</td>
</tr>
<tr>
<td>tAC</td>
<td>Access Time from</td>
<td></td>
<td>10 µS</td>
<td>25 µS</td>
<td>µS</td>
</tr>
</tbody>
</table>

**Strobe**

The filter is tuned within 50 µs to the frequency designated by the tuneword existing on the eight control bit lines when the STB line is ignored until strobed again. Consult the MAXI-POLE® Selection Guide page 20 for the maximum strobe rate in each frequency band.

**RF Power Handling Capability**

The filters are designed to operate with RF input power levels up to 1 Watt (+30 dBm) in-band (see graphs on page 26). Signals in the filter stopband up to 5 Watts at the input will not cause damage to the filter.

**Temperature Effects**

Over the -40°C to +85°C temperature range, filters will exhibit a negative temperature drift of less than 80 PPM/°C, or a total of less than ±0.5% of the center frequency.
The POWER-POLE® Series of tunable filters provides improved RF performance with increased power handling capability and the lowest insertion loss for a given bandwidth. The product line includes several standard designs in various frequencies to support almost any application.

**POWER-POLE® SERIES**

**Specifications:**
- **Frequency Coverage (Multiple Bands):** 30 to 400 MHz
- **Input/Output Impedance:** 50Ω
- **In-band Input/Output VSWR:** 1.5:1 typical
- **In-band RF Power Handling:** refer to chart below
- **Outband RF Power Handling:** Up to 20 Watt
- **In-band Second Order Intercept Point:** +100 dBm (input)
- **In-band Third Order Intercept Point:** +50 dBm (input)
- **Center Frequency Drift:** -80 PPM/°C
- **Tuning Control:** 8 bit parallel
- **Tuning Speed:** 15 µS*
- **DC Power Consumption (Static):** +5 VDC @ 400 mA to 1.5 A
- **Shape Factor (30 dB / 3 dB):** 6 typical
- **Operating Temperature Range:** -40°C to +65°C
- **Size:** 2.6 × 3.0 × 4.0 (in.) / 66.7 × 76.2 × 101.6 (mm.)
- **Weight:** 18.7 oz. / 530.1 g. / .5 kg
- **RF Connection:** SMA jack

* 15 µS typical for UHF band filters. Consult factory for details on other bands.

Important Application Notes:
- While changing RF center frequencies, RF input power must be reduced to < +20 dBm. These filters will not support "Hot RF Switching Conditions". Please contact the factory in regards to custom features.
- Maximum strobe rate is 2 kHz; Actual rate is dependent upon frequency band.

---

**Tunable Bandpass Filters**

The following plots illustrate approximate insertion loss and bandwidth trends across a given frequency band, and the differences between various bands:

- **POWER-30-90-3**
- **POWER-225-400-4**
- **POWER-30-90-3**

**Performance:**

The following plot illustrates approximate performance (not representative of all frequency ranges):
This Selection Guide illustrates approximate performance for the POWER-POLE® SERIES.

**Frequency Range**
- 30 to 90 MHz
- 200 to 400 MHz
- 225 to 400 MHz
- 400 to 225 MHz

**Power-POLE® Series**
- Bandwidth
- % Absolute (dB)
- Insertion Loss
- Parallel Side (dB)
- Low Side (dB)
- High Side (dB)

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Bandwidth</th>
<th>% Absolute (dB)</th>
<th>Insertion Loss</th>
<th>Parallel Side (dB)</th>
<th>Low Side (dB)</th>
<th>High Side (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 to 90 MHz</td>
<td>1.3/2.2</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 to 400 MHz</td>
<td>1.3/2.2</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>225 to 400 MHz</td>
<td>1.3/2.2</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 to 225 MHz</td>
<td>1.3/2.2</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mechanical Outline:**
- Dimensions: 1224.0 x 792.0

---

**POWER-POLE® Filters Product Number Guide:**

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>Insertion Loss (dB)</th>
<th>Connector Type</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER</td>
<td>30-90</td>
<td>1</td>
<td>SMA (Female)</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>90-200</td>
<td>2</td>
<td></td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>200-400</td>
<td>3</td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>225-400</td>
<td>4</td>
<td></td>
<td>E</td>
</tr>
</tbody>
</table>

**Interface Options:**
- The filter comes standard with an 8 bit parallel interface, although a serial interface can be specified as an option.

**Serial Interface Options:***

**DC Control Interface Characteristics:**

**Switching Characteristics:**

---

**Calculating a Tune Address**

The binary tuning word is determined by the following relationship:

\[ \text{tuneword} = \left( \frac{F \text{ tuned} - F \text{ low}}{F \text{ high} - F \text{ low}} \right) \times 250 \]

**Example:**
- If you wish to tune to 322 MHz using a 225 to 400 MHz filter, the tuneword is:
  
  \[ \left( \frac{322 - 225}{400 - 225} \right) \times 250 = 138.57 \text{ (10010111 binary)} \]

Note: Round off to the nearest decimal integer.

---

**Strobe**

The filter is tuned within 15 µs to the frequency designated by the tuneword existing on the eight control bit lines when the STB line is brought low. Once strobed, data existing on the tune control lines is ignored until strobed again. Maximum strobe rate is 2 kHz. Actual rate is dependent upon frequency band.

---

**Temperature Effects**

Over the -40°C to +65°C temperature range, filters will exhibit a negative temperature drift of less than 80 PPM/°C, or a total of less than ±0.5% of the center frequency.

---

**Figure 10**

---

**Figure 11**

---

**Figure 12**
**MEGA-POLE® Series**

Specifications:

- **Frequency Coverage (VHF-L, VHF-H or UHF):** 30 to 450 MHz
- **Input/Output Impedance:** 50Ω
- **In-band RF Power Handling:** 50 W average, 100 W peak
- **In-band Third Order Intercept:** > +60 dBm
- **Tuning Control:** Flexible control design for ARC-210 and VHF-4000. Standard options available.
- **Tuning Speed:** < 25 µs typical
- **Supports frequency hopping waveforms**
- **DC Power:** +28 VDC, < 1A, MIL-STD-704
- **Center Frequency Stability:** Internally compensated
- **Shape Factor (30 dB / 3 dB):** 3.3 to 3.75 typical
- **Operating Temperature Range:** -40°C to +55°C
- **Size:** 6 × 7.55 × 3.6 (in.) / 152 × 190 × 91 (mm.)
- **Available Finishes:** Chem-Film per MIL-C-5541 CARC Tan or Green and Lusterless Grey or Black available on request.
- **RF Connection:** TNC jack

The MEGA-POLE® filter series covers the standard frequency bands within the 30 to 450 MHz range with VHF-L, VHF-H or UHF versions. This new filter series provides excellent selectivity while maintaining very low insertion loss. The product line also has exceptional RF power handling capability with a high third order intercept point. The MEGA-POLE® filter series can be used for transmitter applications to reduce power amplifier noise, harmonics and intermodulation products, to provide bi-directional filtering directly at a transceiver’s antenna port, or other applications requiring extremely linear, high power RF bandpass filtering. It has been designed for rugged environments per MIL-STD-810.

**Performance:**

The following plots illustrate approximate performance (not representative of all frequency ranges):

**MEGA-POLE® Filters Product Number Guide:**

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>Insertion Loss</th>
<th>Connector Type</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEGA</td>
<td>108-174, 225-400</td>
<td>1-1.5 dB</td>
<td>TNC (Female)</td>
<td>C</td>
</tr>
</tbody>
</table>

Available Options:
- C: Custom Frequency Bands (Specify START and STOP frequencies in MHz.)

Note(s):
- Options may be limited to particular frequency bands and/or performance levels. Consult factory for your application.
- * Preliminary

**Enhance the performance of your transceiver in frequency hopping cosite applications through use of the direct radio interface connection to the MEGA-POLE®.**

MEGA-POLE® is available in multiple frequency bands with potential customizations:
- • additional poles for sharper customizations
- • expanded frequency range or multi-band solutions
- • size/selectivity trade-offs for small form factors

**Mechanical Outline:**

Data is believed to be accurate. All data is subject to change without notice.
**Specifications:**

- **Frequency Coverage:** 1 to 30 MHz
- **Input/Output Impedance:** 50Ω
- **In-band RF Power Handling (Input):** 24 dBm typical
- **Outband RF Power Handling:** 33 dBm
- **Center Frequency Drift:** 55 PPM/°C
- **Tuning Control:** Parallel or Serial
- **Tuning Speed:** 85 µs
- **DC Power Consumption (Static):**
  - +5 DC: 150 mA typical
  - +100 DC: 1.5 mA typical
- **Shape Factor:** 30 dB / 3 dB: 6 + 0.5 typical; 7 maximum
- **Operating Temperature Range:** -40°C to +85°C
- **Size:** 2.0 × 2.78 × 0.6 (in.) / 50.8 × 70.61 × 15.24 (mm.)
- **Weight:** 1.5 oz. / 43 g.
- **RF Connection:** Surface Mount

**Interface & Control Options:**

**General Information**

The HF-ERF™ (S13) requires two supply voltages: a +5 VDC analog supply and a +100 VDC supply. These supply voltages should be adequately filtered as noise present on these pins will influence the RF signal purity. Digital Logic control signals can be anything from 1.2V to 5.5V and is set by the VCCD line.

**Digital Interface Information**

The digital interface format can be either SPI serial or parallel depending on the state of the SER/PAR pin.

---

**Pinout & Ratings:**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Reference Designator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SDI</td>
<td>Serial Parallel Conversion Interface – Leasing SPI/SPMI handshake to the host. Will enable the SPI command logic to be executed. The rising edge of the SPI slave select (CS) pin enables the SPI logic to be enabled. (This pin is internally pulled up to +5 VDC to prevent floating.)</td>
</tr>
<tr>
<td>2</td>
<td>TUNE READY</td>
<td>The digital interface logic voltage level between 3.3 V and 5.0 V is used to control the device. The digital interface logic level is set by the host. (This pin is internally pulled up to +5 VDC to prevent floating.)</td>
</tr>
<tr>
<td>3</td>
<td>VCC</td>
<td>Digital Interface Supply – Used to set the digital interface logic voltage level between 3.3 V and 5.0 V to control the digital interface logic. (This pin is internally pulled up to +5 VDC to prevent floating.)</td>
</tr>
<tr>
<td>4</td>
<td>AV</td>
<td>Parallel Data A7 – SPI Parallel interface mode, data is clocked on the rising edge of SCLK and indicates which frequency the filter should tune to. (This pin is internally pulled up to +5 VDC to prevent floating.)</td>
</tr>
<tr>
<td>5</td>
<td>AV</td>
<td>Parallel Data A4 – In Parallel interface mode, data is clocked on the rising edge of SCLK and indicates which frequency the filter should tune to. (This pin is internally pulled up to +5 VDC to prevent floating.)</td>
</tr>
<tr>
<td>6</td>
<td>AV</td>
<td>Parallel Data A1 – The TUNE READY pin is latched on the rising edge of SCLK. The filter accepts control commands of no more than 16 bits. (This pin is internally pulled up to +5 VDC to prevent floating.)</td>
</tr>
<tr>
<td>7</td>
<td>AV</td>
<td>Parallel Data A0 – The TUNE READY pin is latched on the rising edge of SCLK. The filter accepts control commands of no more than 16 bits. (This pin is internally pulled up to +5 VDC to prevent floating.)</td>
</tr>
<tr>
<td>8</td>
<td>A7-11</td>
<td>Serial Tune Interface Chip Select – Chip select only for the device. Data is applied to MOSI for transferring a tune command to the device. Each bit of data is latched on the rising edge of SCLK. The filter accepts control commands of no more than 16 bits. (This pin is internally pulled up to +5 VDC to prevent floating.)</td>
</tr>
<tr>
<td>9</td>
<td>A1</td>
<td>Digital and Analog Ground.</td>
</tr>
</tbody>
</table>

**Example**

- **Product #** MN-1.5-30-3-S13 or MN-1.5-30-3-S13-C017

---

**HF-ERF™ G3 Product Number Guide:**

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>% Bandwidth (3 dB)</th>
<th>Connector Type</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1.5-30-3-S13</td>
<td>1.5 - 30</td>
<td>3</td>
<td>S13</td>
<td>(+2400°C/µs)</td>
</tr>
</tbody>
</table>

**Notes:** Options may be limited to particular frequency bands and/or configurations. Consult factory for your application.

---

**Digital Interface Logic Voltage Levels:**

- Supply Voltage (Input to Output): 3 V to 5.25 V.
- SPI Serial Interface – Data is applied to MOSI for transferring a tune command to the device. Each bit of data is latched on the rising edge of SCLK. The filter accepts control commands of no more than 16 bits.

---

**HF-ERF™ Series (S13)**

The HF-ERF™ is an internally switched 3-band, low cost, miniature, high performance tunable filter. The HF-ERF™ was designed to have the best insertion loss and Q in the smallest package possible.

The size is 2.0" x 2.78" x 0.6" (50.8 mm x 70.61 mm x 15.24 mm.). All HF-ERF™ filters are fully tested and aligned by PoleZero® for convenience and ease of use. Both SPI and Parallel control interfaces are available in one filter. Modified variants are available upon request.
Performance:
The following plots illustrate approximate performance (not representative of all frequency ranges)

Parallel Timing Diagram:

Serial Timing Diagram:

Mechanical Outline:

Data is believed to be accurate. All data is subject to change without notice.
The NANO-ERF® is an internally switched multi-band, low-cost, miniature, high-performance tunable filter. The NANO-ERF® was designed to have the smallest possible dimensions while maintaining suitable electrical performance. The NANO-ERF® is 1.1” x 1.1” x 0.216”. All filters are fully tested and aligned by Pole/Zero for convenience and ease of use. The NANO-ERF® uses an SPI interface.

### NANO-ERF® SERIES

#### Specifications:
- **Frequency Coverage**: 30 to 520 MHz
- **Input/Output Impedance**: 50Ω, nominal
- **In-band Input/Output VSWR**: 1.5:1 typical, 2.2:1 max.
- **In-band RF Power Handling**: +6 dBm (input) typical
- **Outband RF Power Handling**: +20 dBm @ ±15%
- **In-band Second Order Intercept Point**: +70 dBm (input) typical
- **In-band Third Order Intercept Point**: +16 dBm (input) typical
- **Center Frequency Drift**: 180 PPM/°C typical
- **Tuning Control**: Serial
- **Tuning Speed**: 25 µsec typical, 35 µsec max.
- **DC Power Consumption (Static)**: +3.3 VDC @ 15 mA typical
- **Shape Factor (30 dB / 3 dB)**: 6 ± 0.5 typical, 8 max.
- **Operating Temperature Range**: -40°C to +85°C
- **Size**: 1.10 × 1.10 × 0.216 (in.) / 28 × 28 × 5.5 (mm.)
- **Weight**: .2 oz. / 6 g.
- **RF Connection**: SMT castellation

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 5, 6, 18</td>
<td>N/E</td>
<td>No Connect</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>GCLK</td>
<td>Serial Clock</td>
<td>-0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>RF Ground</td>
<td>-0.3 to 3.6 V</td>
</tr>
<tr>
<td>4</td>
<td>CS</td>
<td>Chip Select</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>TUNE READY</td>
<td>Tune Ready Output</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Vcc</td>
<td>Power Supply Input</td>
<td>+3.3 V</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>Power Supply Ground</td>
<td>-</td>
</tr>
<tr>
<td>11, 13, 14, 16</td>
<td>GND</td>
<td>RF Ground</td>
<td>-</td>
</tr>
<tr>
<td>12, 15</td>
<td>RF I/O</td>
<td>RF Input/Output</td>
<td>+6 dBm, +20 dBm</td>
</tr>
<tr>
<td>20</td>
<td>MOSI</td>
<td>Master Output, Slave Input</td>
<td>-0.5 to (Vcc + 0.5) V</td>
</tr>
</tbody>
</table>

**Note(s):**
1. Leave floating for unit to function properly.
2. First number indicates maximum in-band power levels and second number indicates maximum out of band RF power levels either in CW or composite average for multi-tones.

### Performance:

The following plots illustrate approximate performance:

#### Interface & Control Options:

**General Information**

The NANO-ERF® tunable filter requires a +3.3 VDC supply. This supply voltage must be adequately filtered as noise present on this pin will directly influence the RF signal purity.

**Digital Interface Information**

The digital interface format is SPI. All data input pins are data bus capable of 3.3 V logic levels.

### Pinout & Ratings:

The following table provides a summary of the pinout and ratings:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>Bandwidth (3 dB)</th>
<th>Connector Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>NN</td>
<td>30-520</td>
<td>6</td>
<td>T0</td>
</tr>
</tbody>
</table>

**Note(s):** Options may be limited to particular frequency bands and/or configurations. Consult factory for your application.

**Product Number Example:** NN-30-520-6-S06

**Part Number Example:** Product # NN-30-520-10-506
MINI-ERF® (S04) SERIES

Specifications:

Frequency Coverage: 30 to 520 MHz
Input/Output Impedance: 50Ω
In-band Input/Output VSWR: 1.5:1 typical, 2.2:1 max.
In-band RF Power Handling: 1 Watt (input)
Outband RF Power Handling: Up to 2 Watts (input)
In-band Second Order Intercept Point: +90 dBm (input)
In-band Third Order Intercept Point: +40 dBm (input)
Center Frequency Drift: <90 PPM/°C
Tuning Control: Parallel or Serial
Tuning Speed: 15 µsec typical @ 0 dBm*
DC Power Consumption (Static): +3.3 VDC @ 200 mA max. +100 VDC @ 2.5 mA max.
Shape Factor (30 dB / 3 dB): 6 ± 0.5 typical, 7.2 max.
Operating Temperature Range: -40°C to +85°C
Size: 2.40 × 1.75 × .385 (in.) / 61 × 44.5 × 9.8 (mm.)
Weight: 30 g. typical / 1.05 oz.
RF Connection: SMT castellation

Interface & Control Options:

General Information
The MINI-ERF® 30-520 requires two supply voltages: a +3.3 VDC analog supply and a +100 VDC supply. These supply voltages should be adequately filtered as noise present on these pins will influence the RF signal purity. Frequency control signals are 3.3V logic level only.

Digital Interface Information
The digital interface format can be either SPI serial or parallel depending on the state of the SER/PAR pin.

MINI-ERF® (S04) Product Number Guide:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>% Bandwidth (dB)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN</td>
<td>30-520</td>
<td>4</td>
<td>S04</td>
</tr>
</tbody>
</table>

Note(s): Options may be limited to particular frequency bands and/or configuration. Consult the factory for your application.

Example: Product # MN-30-520-4-S04

Pinout & Ratings:

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vcc</td>
<td>+3.3 V Power Supply Input ± 5%</td>
<td>0.3 to +6 V</td>
</tr>
<tr>
<td>2, 9, 17, 19-21, 23, 24, 26-28</td>
<td>GND</td>
<td>Digital/RF Ground</td>
<td>––</td>
</tr>
<tr>
<td>3, 4</td>
<td>N/C</td>
<td>No Connect1</td>
<td>––</td>
</tr>
<tr>
<td>5</td>
<td>A7/MOSI</td>
<td>Parallel Bit 7</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>6</td>
<td>A6</td>
<td>Parallel Bit 6</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>7</td>
<td>A5/SCLK</td>
<td>Parallel Bit 5, Serial Clock</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>8</td>
<td>A4/CS</td>
<td>Parallel Bit 4, Chip Select</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>9</td>
<td>A3</td>
<td>Parallel Bit 3</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>10</td>
<td>A2</td>
<td>Parallel Bit 2</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>11</td>
<td>A1</td>
<td>Parallel Bit 1</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>12</td>
<td>A0</td>
<td>Parallel Bit 0</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>13</td>
<td>TUNE READY</td>
<td>Tune Ready Output</td>
<td>––</td>
</tr>
<tr>
<td>14</td>
<td>SER/PAR</td>
<td>Serial/Parallel Mode Selection</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>15</td>
<td>STB</td>
<td>Parallel/Serial Strobe</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>16</td>
<td>TUNE MODE</td>
<td>Tune Mode Selection Pin</td>
<td>–0.5 to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>19</td>
<td>Min</td>
<td>High Bias +100 V Supply Input</td>
<td>&lt;0.65 V to +125 V</td>
</tr>
<tr>
<td>22, 25</td>
<td>RF I/O</td>
<td>RF Input/Output</td>
<td>+30 dBm to +33 dBm</td>
</tr>
</tbody>
</table>

Note(s): Options may be limited to particular frequency bands and/or configuration. Consult the factory for your application.

Example: Product # MN-30-520-4-S04

Interface & Control Options:

General Information
The MINI-ERF® 30-520 requires two supply voltages: a +3.3 VDC analog supply and a +100 VDC supply. These supply voltages should be adequately filtered as noise present on these pins will influence the RF signal purity. Frequency control signals are 3.3V logic level only.

Digital Interface Information
The digital interface format can be either SPI serial or parallel depending on the state of the SER/PAR pin.

NANO-ERF® SERIES (Continued)

Mechanical Outline:

The MINI-ERF® is a low-cost, miniature, high-performance tunable band pass filter. The MINI-ERF® uses PIN diodes to deliver high dynamic range while fitting in a 1.75" × 2.40" × 0.387" package. Serial or parallel tuning interfaces are selectable. All MINI-ERF® filters are fully tuned and tested by POLE/ZERO® for convenience and ease of use.

Note(s):
1. Leave floating for unit to function properly.
2. First number indicates maximum in-band power levels and second number indicates maximum out of band RF power levels either in CW or composite average for multi-tones.
MINI-ERF® (S04) SERIES (Continued)

Performance:
The following plots illustrate approximate performance:

- 30 MHz
- 90 MHz
- 250 MHz
- 500 MHz

Frequency Range       Suffix | % Bandwidth (±3 dB) | Insertion Loss (max.) | Strobe Rate (max.) | Selectivity ±10% (dB) | Selectivity ±20% (dB) |
-----------------------|------------------|-----------------------|--------------------|----------------------|----------------------|
30 MHz to 520 MHz     -4   | 4.150.4          | 5.2/7.0               | 2.0 Hz             | 25 typical (98%)      | 27 typical (84%)      |
-3                      | 7.28.3           | 5.5/6.0               | 2.0 Hz             | 25 typical (98%)      | 27 typical (84%)      |

Parallel Timing Diagram:

Serial Timing Diagram:

Mechanical Outline:
MINI-ERF® (S11) SERIES

Specifications:

- Frequency Coverage: 90 to 520 MHz
- Input/Output Impedance: 50 Ω
- In-band Input/Output VSWR: 1.45:1 typical, 2:1 max.
- In-band RF Power Handling: 2 Watts (7% BW Filters) 1 Watt (4% BW Filters)
- Outband RF Power Handling: Up to 5 Watts (input)
- Center Frequency Drift: 60 PPM/ºC typical
- Tuning Control: Parallel or Serial
- Tuning Speed: 12 µsec typical @ 0 dBm*
- DC Power Consumption (Static): +3.3 VDC @ 75 mA typical +100 VDC @ 1.2 mA typical
- Shape Factor (30 dB / 3 dB): 6 ± 0.5 typical, 7.2 max.
- Operating Temperature Range: 40°C to +85°C
- Size: 2.0 × 2.0 × .293 (in.) / 50.8 × 50.8 × 7.4 (mm.)
- Weight: 1.05 oz. / 30 g. typical
- RF Connection: SMT castellation

The MINI-ERF® (S11) is an internally switched dual band, low-cost, miniature, high-performance tunable filter. The S11 filter was designed to have the best power handling and Q in the smallest package possible. The size is 2.0" x 2.0" x 0.293".

All filters are fully tested and aligned by Pole/Zero for convenience and ease of use. SPI or Parallel control interfaces are available. Custom bandwidths are available upon request.

Performance:

The following plots illustrate approximate performance:

Pinout & Ratings:

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+Vcc</td>
<td>3.3 VDC</td>
<td>-0.3 VDC to +3.6 VDC</td>
</tr>
<tr>
<td>6, 18</td>
<td>GND</td>
<td>GND</td>
<td>N/A</td>
</tr>
<tr>
<td>2, 17, 19-21, 23, 24, 26-28</td>
<td>GND</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>3, 4, 16</td>
<td>N/C</td>
<td>No Connect</td>
<td>1 N/A</td>
</tr>
<tr>
<td>5</td>
<td>A7</td>
<td>MOSI</td>
<td>SPI Master Out Slave In</td>
</tr>
<tr>
<td>6</td>
<td>A6</td>
<td>Parallel Address 6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>A5</td>
<td>SCLK</td>
<td>Parallel Address 5 SPI Clock</td>
</tr>
<tr>
<td>8</td>
<td>CS</td>
<td>Parallel Address 4 SPI Chip Select (Active Low)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>A3</td>
<td>Parallel Address 3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>A2</td>
<td>Parallel Address 2</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>A1</td>
<td>Parallel Address 1</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>A0</td>
<td>Parallel Address 0</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>TUNE READY</td>
<td>Tune Ready Output</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>SER/PAR</td>
<td>Serial/Parallel Selection Pin (High or open for serial)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>STB</td>
<td>Parallel Tune Strobe Serial Filter Wake</td>
<td></td>
</tr>
<tr>
<td>22, 25</td>
<td>RF RF In/Out</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note(s):

1 Maximum rating when recovered from will cause no permanent damage to the part.
2 Do not exceed ratings in order for the filter to function properly.
3 First number indicates maximum in-band power levels and second number indicates maximum out of band RF power levels either in CW or composite average for multi-tones.

Interface & Control Options:
General Information

The MINI-ERF® (S11) requires two supply voltages: a +3.3 VDC analog supply and a +100 VDC supply. These supply voltages should be adequately filtered as noise present on these pins will influence the RF signal purity. Frequency control signals are 3.3V logic level only.

Extended Range Filters

MINI-ERF® (G3) Product Number Guide:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>% Bandwidth (3 dB)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN</td>
<td>90-520</td>
<td>4</td>
<td>S11</td>
</tr>
</tbody>
</table>

Note(s):

Options may be limited to particular frequency bands and/or configurations. Consult factory for your application.

Example:

Product # MN-90-520-4-S11

MINI-ERF® (S11) Selection Guide:

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Ser/Par</th>
<th>% Bandwidth (3 dB)</th>
<th>Insertion Loss (dB)</th>
<th>Sideband Roll-Off (kHz)</th>
<th>Selectivity +10% (MHz)</th>
<th>Selectivity +10% (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 to 520 MHz</td>
<td>4</td>
<td>3.5/4.8</td>
<td>1.5/2</td>
<td>21 typical (19 kHz)</td>
<td>20 typical (20 kHz)</td>
<td>20 typical (20 kHz)</td>
</tr>
<tr>
<td>7</td>
<td>6.6/7.6</td>
<td>3.9/5.5</td>
<td>0</td>
<td>21 typical (19 kHz)</td>
<td>20 typical (20 kHz)</td>
<td>20 typical (20 kHz)</td>
</tr>
</tbody>
</table>

Parallel Timing Diagram:

Serial Timing Diagram:

Mechanical Outline:

Data is believed to be accurate. All data is subject to change without notice.
The MINI-POLE® Extended Range Series of tunable filters was developed to address applications needing a small, surface mount package with wide tunability. Selectivity is enhanced in the MINI-3/3 version by use of 3 pole filter architecture. This tunability is accomplished by the use of multiple internal tunable filters along with high performance RF band select switches all contained in one housing. The tunable filters are designed to minimize size and power consumption while maintaining high RF power handling and linearity characteristics.

MINI/3-ERF SERIES

Specifications:
Frequency Coverage: 30 MHz to 520 MHz
Input/Output Impedance: 50Ω
In-band Input/Output VSWR: 1.5:1 typical, 2.2:1 max
In-band RF Power Handling: 1 Watt (input)
Out-band RF Power Handling: 2 Watts (input)
In-band Second Order Intercept Point: +90 dBm
In-band Third Order Intercept Point: +40 dBm (input)
Center Frequency Drift: -90 PPM/°C
Tuning Control: SPI or 8 bit with load
Tuning Speed: 35 µS max. at +25 dBm
DC Power Consumption (Static): +5 VDC @ 200 mA, typical
Shape Factor (30 dB/3 dB): 4 typical
Operating Temperature Range: -40°C to +85°C
Size: 2.00 × 2.520 × 0.393 (in.) / 51 × 64 × 10 (mm.)
Weight: 1.3 oz. / 38 g.
RF Connection: SMT pin

MINI/3-ERF® Filters Product Number Guide:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>% Bandwidth (3 dB)</th>
<th>Connector Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN3</td>
<td>30-520</td>
<td>10</td>
<td>S05</td>
</tr>
</tbody>
</table>

Example: Product # MIN3-30-520-10-S05

Interface & Control Notes:

General Information

The MINI/3-ERF® requires two supply voltages. A +5 VDC analog supply and a +1.65 to 5.5 VDC digital supply. These supply voltages should be adequately filtered as noise present on these pins will influence the RF signal purity. A third, high voltage supply may be applied to the filter (user enabled feature) for ultra-low EMV sensitivity applications.

Digital Interface Information

The digital interface format is an 8 bit parallel, two byte write with load. The filter band is selected by the first byte and the tune frequency is selected by the second byte. All data input pins are universal data bus capable of 1.8 V, 2.5 V, 3.3 V and 5 VDC logic voltage nodes which is selected by the Vccd supply voltage used.

MINI/3-ERF® SERIES Selection Guide:

| Frequency Range | Series | % Bandwidth (3 dB) | Insertion Loss (max.) | Strobe Rate (max.) | Selectivity ±10% (dB) | Selectivity ±20% (dB) | PIN 

Pinout & Ratings:

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Mechanical Outline (top view)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SER/PAR</td>
<td>Serial/Parallel Mode Selection</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>TUNE READY</td>
<td>Tune Ready Output</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VCCD</td>
<td>Digital Interface Supply Input</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A7/SCLK</td>
<td>Parallel Bit 7, Serial Clock</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A6</td>
<td>Parallel Bit 6</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A5/MOSI</td>
<td>Parallel Bit 5, Master Output, Slave Input</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>A4/CS</td>
<td>Parallel Bit 4, SPI Chip Select</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>A3</td>
<td>Parallel Bit 3</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>A2</td>
<td>Parallel Bit 2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>A1</td>
<td>Parallel Bit 1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>A0</td>
<td>Parallel Bit 0</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>STB</td>
<td>Parallel Strobe</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>VBB</td>
<td>High Bias +5 V Supply Input</td>
<td></td>
</tr>
<tr>
<td>14, 16, 17, 19-29, 31, 32</td>
<td>GND</td>
<td>Digital/RF Ground</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>VCC</td>
<td>+5 V Power Supply Input</td>
<td></td>
</tr>
</tbody>
</table>

Note(s): 1. First number indicates maximum in-band power levels and second number indicates maximum out-of-band RF power levels either in CW or composite average for multi-tones.

POLE/ ZERO®

Information/Quote Requests: support@polezero.com

Extended Range Filters

Performance:
The following plots illustrate approximate performance:
ERF-5W™ SERIES Specifications:

* Frequency Coverage: 30 to 520 MHz
* Input/Output Impedance: 50Ω
* In-band Input/Output VSWR: 1.65:1 max.
* Center Frequency Drift: -80 PPM/ºC
* Tuning Speed: 25 µsec typical, 50 µsec max.
* Tuning Control: Parallel or Serial
* In-band Third Order Intercept Point: +47 dBm (input)
* In-band Second Order Intercept Point: +100 dBm (input)
* Outband RF Power Handling: (up to 10 Watts, see note 1)
* Operating Temperature Range: -40°C to +85°C
* DC Power Consumption (Static): +5 VDC @ 1.5 A max.

ERF-5W™ Filter Products Number Selection Guide:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>% Bandwidth (3 dB)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>30-520</td>
<td>10</td>
<td>M01</td>
</tr>
</tbody>
</table>

Note: Options may be limited to particular frequency bands and/or configurations. Consult factory for your application.

Example: Product # 5W-30-520-10-M01

ERF-5W™ (Single) M01

ERF-5W™ (Dual) M02

Mechanical Outline:

Data is believed to be accurate. All data is subject to change without notice.

### Interface & Control Notes:

**General Information**

The ERF-5W™ requires a single +5 VDC analog supply and a +1.65 to +5.5 VDC digital supply. These supply voltages should be adequately filtered as noise present on these pins will influence the RF signal purity.

**Digital Tune Interface**

The ERF-5W™ tune interface is capable of operating at a variable input logic level. In order to set the logic level, tie the "Digital Interface Supply", VCCD, pins to the voltage of the logic level that will interface with the ERF-5W™. For instance, if the tune interface should operate at +3.3 V CMOS, tie the "Digital Interface Supply" pins to +3.3 V. If the tune interface should operate at +5 V CMOS, tie the "Digital Interface Supply" pins to +5 V. The digital inputs can be driven with CMOS or TTL signals. All digital outputs are CMOS.

The ERF-5W™ can operate in Serial Mode or Parallel mode. The tune mode is chosen at power-up by sampling the PAR/NSER input. To operate in serial mode either pull the PAR/NSER pin high or tie it to ground. To operate in parallel mode, pull the PAR/NSER pin to +3.3 V or greater (this pin can be tied to VCCD if VCCD is >= +3.3 V).

**DC Control Interface Characteristics:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>Unit</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-level</td>
<td>1.65</td>
<td>1.85</td>
<td>5.50</td>
<td>V</td>
<td>workplace</td>
</tr>
<tr>
<td>Low-level</td>
<td>3.30</td>
<td>2.70</td>
<td>2.0</td>
<td>V</td>
<td>Data</td>
</tr>
</tbody>
</table>

Note: 1. Leave pins disconnected for unit to function properly.
MINI-POLE® NOTCH Filters are optimized for small physical size and low power consumption. Standard package is Thru-Hole Mount. For interface and mechanical outline, please refer to the bandpass MINI-POLE® section on pages 10-15.

MINI-POLE® NOTCH SERIES Specifications:

- Frequency Coverage (7 Bands): 1.5 to 400 MHz
- Input/Output Impedance: 50Ω
- Passband Input/Output VSWR: 2:1 max.
- Notch RF Power Handling: +24 dBm
- Passband RF Power Handling: (offset dependent) > 5 Watts @ ± 20% offset typical
- Notch Depth: 20 dB
- 3 dB Bandwidth: 10% typical
- Passband IL: <1 dB
- Center Frequency Drift: -80 PPM/°C
- Tuning Control: 8 bit parallel
- Tuning Speed: 10 µS (fo > 30 MHz, +10 dBm reference)
- DC Power Consumption (Static): +5 VDC @ 10 to 250 mA
- +100 VDC @ 2 mA
- Operating Temperature Range: -40°C to +85°C
- Size: 0.6 × 1.4 × 2.3 (in.) / 15.2 × 35.6 × 58.4 (mm.)
- Weight: 3.2 oz. / 90.7 g.
- RF Connection: Thru-hole pin

Pinout & Ratings:

MINI-POLE® NOTCH Filters Product Number Guide:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>Notch Depth (dB)</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINI-NOTCH</td>
<td>6-10</td>
<td>20</td>
<td>B</td>
</tr>
<tr>
<td>10-30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90-200</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Performance:

The following plots illustrate approximate performance (not representative of all frequency ranges)

Data is believed to be accurate. All data is subject to change without notice.
MAXI-POLE® NOTCH Filters offer all of the same performance features as the Mini-Notch filters, with the advantage of an improved notch shape factor. For interface and mechanical outline, please refer to the bandpass the MAXI-POLE® NOTCH section.

MAXI-POLE® NOTCH SERIES

Specifications:

- Frequency Coverage (7 Bands): 1.5 to 400 MHz
- Input/Output Impedance: 50Ω
- Passband Input/Output VSWR: 2:1 max.
- Notch RF Power Handling: +24 dBm typical
- Passband RF Power Handling: >10 Watts @ ±10% offset typical
- Notch Depth: 20 dB
- 3 dB Bandwidth: 5% typical
- Passband IL: <1 dB
- Passband IP3: +50 dBm (input, fo > 30 MHz)
- Center Frequency Drift: -80 PPM/°C
- Tuning Control: 8 bit parallel
- Tuning Speed: 10 µS (fo > 30 MHz, +10 dBm reference)
- DC Power Consumption (Static): +5 VDC @ 10 to 500 mA
- +100 VDC @ 2 mA
- Operating Temperature Range: -40°C to +85°C
- Size: 1.5 × 2.5 × 3.3 (in.) / 38.1 × 63.5 × 83.8 (mm.)
- Weight: 9.2 oz. / 260.8 g.
- RF Connection: SMA jack

Available Options:

A. Internal DC-DC converter (eliminates need for high voltage supply. Requires additional 250 mA of 5 VDC current.)
B. Serial Interface
C. Custom Frequency Bands (Specify START and STOP frequencies in MHz.)
F. Filtered D-connector

Note(s):

1. Options may be limited to particular frequency bands and/or configurations. Consult factory for your application.
2. Filters are aligned and tested using a High Bias of +100 VDC unless otherwise specified by the customer.

Example:

Product # MAXI-NOTCH-10-50-20

Data is believed to be accurate. All data is subject to change without notice.

Pinout & Ratings:

### PARALLEL INTERFACE

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>A1</td>
<td>Digital I/O</td>
<td>±0.5 to 5 VDC</td>
</tr>
<tr>
<td>9</td>
<td>A2</td>
<td>Digital I/O</td>
<td>±0.5 to 5 VDC</td>
</tr>
<tr>
<td>10</td>
<td>A3</td>
<td>Digital I/O</td>
<td>±0.5 to 5 VDC</td>
</tr>
<tr>
<td>11</td>
<td>A4</td>
<td>Digital I/O</td>
<td>±0.5 to 5 VDC</td>
</tr>
<tr>
<td>12</td>
<td>A5</td>
<td>Digital I/O</td>
<td>±0.5 to 5 VDC</td>
</tr>
<tr>
<td>13</td>
<td>A6</td>
<td>Digital I/O</td>
<td>±0.5 to 5 VDC</td>
</tr>
<tr>
<td>14</td>
<td>A7</td>
<td>Digital I/O</td>
<td>±0.5 to 5 VDC</td>
</tr>
<tr>
<td>15</td>
<td>A8</td>
<td>Digital I/O</td>
<td>±0.5 to 5 VDC</td>
</tr>
</tbody>
</table>

### SERIAL INTERFACE

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OC1</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>2</td>
<td>OC2</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>3</td>
<td>OC3</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>4</td>
<td>OC4</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>5</td>
<td>OC5</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>6</td>
<td>OC6</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>7</td>
<td>OC7</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>8</td>
<td>OC8</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>9</td>
<td>OC9</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>10</td>
<td>OC10</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>11</td>
<td>OC11</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>12</td>
<td>OC12</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>13</td>
<td>OC13</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>14</td>
<td>OC14</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
<tr>
<td>15</td>
<td>OC15</td>
<td>Serial Data</td>
<td>-0.5 to 5 VDC</td>
</tr>
</tbody>
</table>

Note(s):

1. Leave pins disconnected for unit to function properly.

### MAXI-POLE® NOTCH FILTERS PRODUCT NUMBER GUIDE:

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>Notch Depth (dB)</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAXI-NOTCH</td>
<td>1.5-4</td>
<td>20</td>
<td>A B F</td>
</tr>
<tr>
<td></td>
<td>4-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10-30</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30-50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50-90</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>90-200</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>200-400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note(s):

- Options may be limited to particular frequency bands and/or configurations. Consult factory for your application.
- Filters are aligned and tested using a High Bias of +100 VDC unless otherwise specified by the customer.
- Example: Product # MAXI-NOTCH-10-50-20

Data is believed to be accurate. All data is subject to change without notice.

Performance:

The following plots illustrate approximate performance (not representative of all frequency ranges)

- MAXI 90-200, 20 dB NOTCH (@ 90 MHz)
- MAXI 90-200, 20 dB NOTCH (@ 150 MHz)
- MAXI 90-200, 20 dB NOTCH (Broadband)

Information/Quote Requests: support@polezero.com

Tunable Notch Filters
The **MAXI/4R NOTCH** contains 4 “poles” of filtering to provide additional rejection at the tuned frequency of the notch when compared to our standard MAXI-POLE® Notches. The unit has been designed for applications in UHF receiver front ends (nearby transmitter carrier rejection) and/or transmitter back ends (broadband noise rejection at the frequency of a nearby receiver). For interface and mechanical outline, please refer to the bandpass MAXI/4R.

**MAXI/4R NOTCH SERIES**

**Specifications:**

- **Frequency Coverage:** 225 to 400 MHz*
- **Input/Output Impedance:** 50Ω
- **Passband Input/Output VSWR:** 2.1 max.
- **Notch RF Power Handling:** 1 Watt
- **Passband RF Power Handling:** 50 Watt @ FN ± 20 MHz typical
- **Notch Depth:** 35 dB min.
- **Notch Width:** FN ± 300 KHz min.
- **3 dB Bandwidth:** 10 MHz typical
- **Passband IL:** < 1 dB
- **Passband IP3:** +50 dBm (10/20 MHz)
- **Center Frequency Drift:** (internal temp. comp.)
- **Tuning Control:** 9 bit serial
- **Tuning Speed:** 40 µS (1 MHz clock)
- **DC Power Consumption (Static):** +5 VDC @ 1.5 A max. +100 VDC @ 2 mA
- **Operating Temperature Range:** -40°C to +70°C
- **Size:** 3.1 x 3.5 x 7.0 (in.) / 79.4 x 88.9 x 177.8 (mm.)
- **Weight:** 56 oz. / 1588 g. / 1.6 kg.
- **RF Connection:** SMA jack

* Consult factory for additional ranges.
POWER-POLE® NOTCH Filters offer improved performance and power handling over our MINI and MAXI-NOTCH Filters. For interface and mechanical outline, please refer to the bandpass POWER-POLE® section.

**POWER-POLE® NOTCH SERIES**

**Specifications:**
- **Frequency Coverage (3 bands):** 30 to 90 MHz
- **Input/Output Impedance:** 50Ω
- **Passband Input/Output VSWR:** 2:1 max.
- **Notch RF Power Handling:** 2 Watt
- **Passband RF Power Handling:** (offset dependent) > 50 Watts @ ±20% offset typical
- **Notch Depth:** 20 dBm
- **3 dB Bandwidth:** 4% typical
- **Passband rolloff:** < 1 dB
- **Passband IP3:** +50 dBm (input, le > 30 MHz)
- **Center Frequency Drift:** -80 PPM/°C
- **Tuning Control:** 8 bit parallel
- **Tuning Speed:** 20 µS
- **DC Power Consumption (Static):** +5 VDC @ 400 mA to 1.5 A
- **Operating Temperature Range:** -40°C to +65°C
- **Size:** 2.6 × 3.0 × 4.0 (in.) / 66.7 × 76.2 × 101.6 (mm.)
- **Weight:** 18.7 oz. / 530.1 g / .5 kg
- **RF Connection:** SMA jack

### Pinout & Ratings:

#### PARALLEL INTERFACE

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A2</td>
<td>PassWord-1</td>
<td>0 to +6 VDC</td>
</tr>
<tr>
<td>2</td>
<td>A3</td>
<td>PassWord-2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A4</td>
<td>PassWord-3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A5</td>
<td>PassWord-4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A6</td>
<td>PassWord-5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A7</td>
<td>PassWord-6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>A8</td>
<td>PassWord-7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>A9</td>
<td>PassWord-8</td>
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<td>9</td>
<td>A10</td>
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<td></td>
</tr>
<tr>
<td>10</td>
<td>A11</td>
<td>PassWord-10</td>
<td></td>
</tr>
</tbody>
</table>

#### SERIAL INTERFACE

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Maximum Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SAC</td>
<td>Serial CS</td>
<td>0 to +6 VDC</td>
</tr>
<tr>
<td>2-6</td>
<td>N/C</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>N/C</td>
<td>Digital/RF Ground</td>
<td>––</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>N/C</td>
<td>Digital/RF Ground</td>
<td>––</td>
</tr>
<tr>
<td>13</td>
<td>VCC</td>
<td>+5 V Power Supply Input</td>
<td>±10% -0.5 to +6 V</td>
</tr>
<tr>
<td>14</td>
<td>STB</td>
<td>Strobe</td>
<td>1650 mV to (Vcc + 0.5) V</td>
</tr>
<tr>
<td>15</td>
<td>SDI</td>
<td>Serial Data In</td>
<td>0 to +6 VDC</td>
</tr>
</tbody>
</table>

### Mechanical Outline:

#### Performance:

The following plots illustrate approximate performance (not representative of all frequency ranges):

**POWER 30-90, 20 dB NOTCH (@ 30 MHz)**

**POWER 30-90, 20 dB NOTCH (@ 90 MHz)**

**POWER 30-90, 20 dB NOTCH (@ 60 MHz)**

---

Data is believed to be accurate. All data is subject to change without notice.

---

**POWER-POLE® NOTCH Filters Product Number Guide:**

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
<th>Notch Depth (dB)</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER-NOTCH</td>
<td>30-90</td>
<td>20</td>
<td>B, C</td>
</tr>
</tbody>
</table>

**Available Options:**
- B: Serial Interface
- C: Custom Frequency Bands (Specify START and STOP frequencies in MHz.)

**Note(s):** Options may be limited to particular frequency bands and/or configurations. Consult factory for your application.

**Example:**
Product # POWER-NOTCH-30-90-20
The PSEL1003 is a broadband preselector designed for applications, such as JTRS, requiring light weight, small size and low power consumption. It provides digitally tunable bandpass filtering from 20 MHz to 2 GHz and high pass filtering from 2 to 3 GHz. The PSEL1003 provides 20 dB of gain for your receiver application and includes an RS-485 interface for easy integration. It can be ordered to provide filtering for one or two receive paths.

**PSEL1003 Specifications:**

**Frequency Coverage:** 20 to 3000 MHz

**Operation:** Broadband Preselector

**Receive Gain:** 20 dB ± 3 dB

**Receive Noise Figure:** 8 dB avg.

**Receive Input IP3:** +3 dBm avg.

**Transmit RF Output Power:** 100 mW max.

**Selectivity:**
- -35 dB @ ± 10% avg.
- -55 dB @ ± 20% avg.
- -65 dB @ ± 30% avg.

**Tuning Speed:** < 1 mS

**Power:** +24V ± 5% or +12V ± 5%

**2 Watts/path**

**Operating Temperature Range:** -40°C to +50°C

**Size:**
- Single: 1.0 × 6.5 × 5.0 (in.) / 25.4 × 165.1 × 127 (mm.)
- Dual: 1.0 × 8.0 × 9.5 (in.) / 25.4 × 203.2 × 241.3 (mm.)

**Weight:**
- Single: 1.4 lbs. / .64 kg.
- Dual: 2.8 lbs. / 1.27 kg.

**RF Connection:** SMA jack

**Performance:**

**Insertion Loss (dB) vs. Frequency (MHz):**

**Customer Support:**

**Information/Quote Requests:** support@polezero.com

**Pre/Post-Selector Series**

**Chassis Outline:**
- Single Channel
- Dual Channel

**PSEL1003 Product Number Guide:**

<table>
<thead>
<tr>
<th>Series</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSEL1003</td>
<td>R-20-3000</td>
</tr>
</tbody>
</table>

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Web: www.polezero.com

Please visit the MPG web site at www.dovermpg.com for additional information.