Wideband, Microwave, 0.5W
Monolithic Amplifier Subsystem  
AVM-273HPK+

50Ω  13 to 26.5GHz

The Big Deal
- Wideband 13 to 26.5 GHz
- Output power up to +27 dBm
- Excellent directivity, 43 dB typ. @ 20 GHz
- Unconditionally stable
- Excellent gain flatness, ±1 dB
- Sequencing and DC Control module included

Product Overview
Mini-Circuits' AVM-273HPK+ is a MMIC amplifier subsystem consisting of a MMIC amplifier and an auto-voltage sequencing module. The MMIC amplifier is designed using 0.15µm PHEMT technology and provides very wideband performance, medium power and unconditional stability. Furthermore, its outstanding isolation enables it to be used as a wideband isolation amplifier or buffer amplifier, making this an ideal amplifier for use in a variety of microwave systems including point-to-point radio, military EW and radar, DBS, and VSAT. The included voltage sequencing and DC control module enables plug-and-play operation without the need for external voltage sequencing circuits.

Key Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wideband</td>
<td>Wide frequency coverage up to 26.5 GHz supports many microwave applications.</td>
</tr>
<tr>
<td>Pout up to +27 dBm</td>
<td>Can be used as a low-cost driver for high power amplifiers.</td>
</tr>
<tr>
<td>Excellent active directivity, 43 dB @ 20 GHz</td>
<td>Can be used as an inter-stage isolation amplifier, minimizing interaction of adjacent components.</td>
</tr>
<tr>
<td>Unconditionally stable</td>
<td>Eliminates the need for any compensating network to prevent unintended oscillation.</td>
</tr>
<tr>
<td>Small package</td>
<td>Small size for high power with low inductance, repeatable transitions, and excellent thermal contact to PCB.</td>
</tr>
<tr>
<td>Voltage Sequencing and DC Control Module included.</td>
<td>Provides correct voltage sequence and DC control, as well as reverse polarity protection, replacing over 20 discrete components and greatly simplifying circuit design.</td>
</tr>
</tbody>
</table>
**Wideband, Microwave, 0.5W**

**Monolithic Amplifier Subsystem**  
13-26.5 GHz

**Product Features**
- Gain, 13 dB typ.
- Output Power, up to +27 dBm typ.
- Excellent directivity, 43 dB typ. at 20 GHz
- Unconditionally Stable
- Aqueous washable; 5 mm x 5 mm SMT package
- DC Control and voltage sequencing module included

**Typical Applications**
- Point to Point Radio
- Military EW and Radar
- DBS
- VSAT
- Wideband Isolation amplifier

**General Description**

Mini-Circuits’ AVM-273HPK+ is a MMIC amplifier subsystem consisting of a MMIC amplifier and an auto-voltage sequencing module. The MMIC amplifier is designed using 0.15µm PHEMT technology and provides very wideband performance, medium power and unconditional stability. Furthermore, its outstanding isolation enables it to be used as a wideband isolation amplifier or buffer amplifier, making this an ideal amplifier for use in a variety of microwave systems including point-to-point radio, military EW and radar, DBS, and VSAT. The included voltage sequencing and DC control module enables plug-and-play operation without the need for external voltage sequencing circuits.

**Simplified Schematic**

Notes:
- H - 90° Hybrid
- M - Matching Network
- VD and VG connections from VCM-1+ to AVM-273HP+ are required via application PCB; see Figure 1 for details.

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

+RoHS Compliant
## Electrical Specifications \(^{(1)}\) at 25°C, Zo=50Ω

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition (GHz)</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>13.0</td>
<td>26.5</td>
<td>GHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC Voltage (V+)</td>
<td>+5.9</td>
<td>+6.0</td>
<td>+6.3</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>DC Voltage (V-)</td>
<td>-5.5</td>
<td>-5.0</td>
<td>-4.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>DC Current (I+)</td>
<td>559</td>
<td>590</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC Current (I-)</td>
<td>0.5</td>
<td></td>
<td>mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuits applicable established test performance criteria and measurement instructions.

### C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, “Standard Terms”); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits’ website at [www.minicircuits.com/MCLStore/terms.jsp](http://www.minicircuits.com/MCLStore/terms.jsp).

## Electrical Specifications

### Frequency Range
- 13.0 GHz
- 26.5 GHz

### DC Voltage (V+)
- +5.9 V
- +6.0 V
- +6.3 V

### DC Voltage (V-)
- -5.5 V
- -5.0 V
- -4.5 V

### DC Current (I+)
- 559 mA
- 590 mA

### DC Current (I-)
- 0.5 mA

### Gain
- 13.0 GHz: 12.8 dB
- 14.0 GHz: 12.8 dB
- 16.0 GHz: 13.6 dB
- 18.0 GHz: 15.1 dB
- 20.0 GHz: 14.7 dB
- 24.0 GHz: 13.8 dB
- 26.5 GHz: 13.2 dB

### Input Return Loss
- 13.0 GHz: 16.9 dB
- 14.0 GHz: 17.1 dB
- 16.0 GHz: 17.0 dB
- 17.0 GHz: 19.4 dB
- 20.0 GHz: 8.9 dB
- 24.0 GHz: 9.0 dB
- 26.5 GHz: 7.2 dB

### Output Return Loss
- 13.0 GHz: 8.1 dB
- 14.0 GHz: 12.7 dB
- 16.0 GHz: 19.3 dB
- 17.0 GHz: 16.6 dB
- 20.0 GHz: 8.0 dB
- 24.0 GHz: 10.6 dB
- 26.5 GHz: 8.8 dB

### Directivity (Isolation- Gain)
- 20.0 GHz: 43 dB

### Output Power @ 1 dB compression
- 13.0 GHz: 22.6 dBm
- 14.0 GHz: 24.3 dBm
- 16.0 GHz: 26.3 dBm
- 17.0 GHz: 26.4 dBm
- 20.0 GHz: 26.6 dBm
- 24.0 GHz: 26.5 dBm
- 26.5 GHz: 25.7 dBm

### OIP3
- 13.0 GHz: 28.7 dBm
- 14.0 GHz: 30.6 dBm
- 16.0 GHz: 32.4 dBm
- 17.0 GHz: 33.2 dBm
- 20.0 GHz: 31.0 dBm
- 24.0 GHz: 29.7 dBm
- 26.4 GHz: 29.5 dBm

### Noise Figure
- 13.0 GHz: 9.8 dB
- 14.0 GHz: 9.6 dB
- 16.0 GHz: 8.9 dB
- 17.0 GHz: 8.8 dB
- 20.0 GHz: 8.5 dB
- 24.0 GHz: 7.5 dB
- 26.5 GHz: 8.5 dB

### DC Current Variation vs. Temperature (2)
- 0.32 mA/°C

### DC Current Variation vs. Voltage
- 0.145 mA/mV

### Thermal Resistance
- 16.3 °C/W

---

**Absolute Maximum Ratings\(^{(3)}\)**

<table>
<thead>
<tr>
<th>Operating Temperature (^{(4)})</th>
<th>-40°C to 85°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature</td>
<td>-65°C to 150°C</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>136°C</td>
</tr>
<tr>
<td>DC Voltage: V+</td>
<td>+7.4 V</td>
</tr>
<tr>
<td>DC Voltage: V-</td>
<td>-6 V</td>
</tr>
<tr>
<td>DC Current: V+</td>
<td>620mA</td>
</tr>
<tr>
<td>DC Current: V-</td>
<td>1mA</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>3.1 W</td>
</tr>
<tr>
<td>Input Power (CW)</td>
<td>16 dBm</td>
</tr>
</tbody>
</table>

---

**Notes:**
1. Measured on Mini-Circuits Test Board TB-715-5V.
2. Gain, Output power at 1dB compression (P1dB), Noise Figure, Output IP3 (OIP3) are measured using Keysight N5242A PNA-X microwave network analyzer.
3. Conditions:
   - 1. Gain: Pin=-25 dBm
   - 2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/tone at output.
   - 3. V+ set to +6.1V to account for 1.1V drop in bias circuit resulting in +5V at drain (VD1 to VD3 (A&B))

**Absolute Maximum Ratings**

1. Defined with reference to ground pad temperature.
2. Operating temperature is not intended for continuous normal operation.
3. Permanent damage may occur if any of these limits are exceeded. These maximum ratings are not intended for continuous normal operation.
4. Measured on Mini-Circuits Test Board TB-715-5V.
5. Gain, Output power at 1dB compression (P1dB), Noise Figure, Output IP3 (OIP3) are measured using Keysight N5242A PNA-X microwave network analyzer.

**Bias Sequence and Conditions**

**NOTE:** to prevent damage to the AVM-273HPK+, and to ensure proper operation, all bias voltages must be applied through the VCM-1+ module.
Recommended Application Circuit

**AVM-273HP+ Pad Description**

<table>
<thead>
<tr>
<th>Function</th>
<th>Pad Number</th>
<th>Description (See Application Circuit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF-In</td>
<td>4,5</td>
<td>RF Input</td>
</tr>
<tr>
<td>RF-Out</td>
<td>19,20</td>
<td>RF-Output (DC blocked)</td>
</tr>
<tr>
<td>VG1 A</td>
<td>31</td>
<td>Gate Voltage of first stage amplifier (Top)</td>
</tr>
<tr>
<td>VG2 A</td>
<td>29</td>
<td>Gate Voltage of second stage amplifier (Top)</td>
</tr>
<tr>
<td>VG3 A</td>
<td>27</td>
<td>Gate Voltage of third stage amplifier (Top)</td>
</tr>
<tr>
<td>VD1 A</td>
<td>30</td>
<td>Drain Voltage of first stage amplifier (Top)</td>
</tr>
<tr>
<td>VD2 A</td>
<td>28</td>
<td>Drain Voltage of second stage amplifier (Top)</td>
</tr>
<tr>
<td>VD3 A</td>
<td>26</td>
<td>Drain Voltage of third stage amplifier (Top)</td>
</tr>
<tr>
<td>VG1 B</td>
<td>10</td>
<td>Gate Voltage of first stage amplifier (Bottom)</td>
</tr>
<tr>
<td>VG2 B</td>
<td>12</td>
<td>Gate Voltage of second stage amplifier (Bottom)</td>
</tr>
<tr>
<td>VG3 B</td>
<td>14</td>
<td>Gate Voltage of third stage amplifier (Bottom)</td>
</tr>
<tr>
<td>VD1 B</td>
<td>11</td>
<td>Drain Voltage of first stage amplifier (Bottom)</td>
</tr>
<tr>
<td>VD2 B</td>
<td>13</td>
<td>Drain Voltage of second stage amplifier (Bottom)</td>
</tr>
<tr>
<td>VD3 B</td>
<td>15</td>
<td>Drain Voltage of third stage amplifier (Bottom)</td>
</tr>
<tr>
<td>NC</td>
<td>1-3, 6-9, 16-18, 21-25, 32</td>
<td>No Connection, not used internally</td>
</tr>
</tbody>
</table>

**VCM-1+ Pad Description**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value/ Part Number</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>AVM-273HP+</td>
<td>—</td>
</tr>
<tr>
<td>U1</td>
<td>VCM-1+</td>
<td>—</td>
</tr>
<tr>
<td>N1</td>
<td>CONN VERTICAL HEADER 4 POS</td>
<td>—</td>
</tr>
<tr>
<td>C1, C6, C7, C12-C24</td>
<td>0.1 uF</td>
<td>.04 x .02</td>
</tr>
<tr>
<td>C2, C5, C8-C11</td>
<td>470 pF</td>
<td>.02 x .01</td>
</tr>
<tr>
<td>C25</td>
<td>0.1 uF</td>
<td>.04 x .02</td>
</tr>
<tr>
<td>R1-R4</td>
<td>0 Ohm</td>
<td>.08 x .05</td>
</tr>
</tbody>
</table>

Fig 1. Schematic of Test Board TB-715-VCM
VCM-1+ incorporates current stabilization, automatic voltage sequencing, reverse voltage protection circuitry.
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Additional Detailed Technical Information

<table>
<thead>
<tr>
<th>Performance Data</th>
<th>Data Table</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Swept Graphs</td>
</tr>
<tr>
<td></td>
<td>S-Parameter (S2P Files) Data Set (.zip file)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVM-273HP+</td>
</tr>
<tr>
<td>DG1677-1 (SOT 89) Plastic package, exposed paddle, lead finish: tin-silver over nickel</td>
</tr>
<tr>
<td>VCM-1+</td>
</tr>
<tr>
<td>BG1482-1 (14 Pin) Case material: Nickel-Silver Alloy Base: Printed wiring laminate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tape &amp; Reel</th>
</tr>
</thead>
<tbody>
<tr>
<td>13” reels with 10, 20, 50 devices</td>
</tr>
</tbody>
</table>

| Suggested Layout for PCB Design |
| PL-448 |

| Evaluation Board |
| TB-715-VCM |

ESD Rating (AVM-273HP+)

Human Body Model (HBM): Class 1A in accordance with JESD22-A114F
Machine Model (MM): Class A (pass 25V) in accordance JESD22-A115

MSL Rating (AVM-273HP+)

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL Test Flow Chart

Start
Visual Inspection  ➔  Electrical Test  ➔  SAM Analysis
Reflow 3 cycles, 260°C  ➔  Soak 85°C/85RH 168 hours  ➔  Bake at 125°C, 24 hours
Visual Inspection  ➔  Electrical Test  ➔  SAM Analysis
Finish

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