Voltage Variable Attenuator  
PVA-453-34+
50Ω  10 to 45 GHz

THE BIG DEAL
- Ultra-broad band, 10 to 45 GHz
- Wide attenuation range, up to 51 dB typ. at 30 GHz
- Excellent return loss for all attenuation states
- Low insertion loss, 2 dB typ.
- High IIP3 in all attenuation states

APPLICATIONS
- 5G MIMO and Back Haul Radio Systems
- Satellite Communications
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems

PRODUCT OVERVIEW
The PVA-453-34+ is an absorptive voltage variable attenuator MMIC die fabricated using GaAs pHEMT technology packaged in a small 3.5x2.5 mm SMT package. This VVA covers the frequency range of 10 to 45 GHz offering high dynamic range, low distortion, and low insertion loss. It features two independently controlled attenuators using analog control voltages from -4V to 0V. This product is ideal for applications where a DC voltage is utilized to control RF signal levels such as temperature compensation and AGC circuits.

KEY FEATURES
<table>
<thead>
<tr>
<th>Feature</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>High IIP3, +26 to +43 dBm typ. over attenuation range</td>
<td>Low distortion enabling improved system performance.</td>
</tr>
<tr>
<td>Wide attenuation range, • 45 dB typ. at 20 GHz • 51 dB typ. at 30 GHz • 38 dB typ. at 40 GHz</td>
<td>Low insertion loss and high dynamic range simplify the use of analog signal control.</td>
</tr>
</tbody>
</table>
### Voltage Variable Attenuator

#### MMIC SURFACE MOUNT

**PVA-453-34+**

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### Electrical Specifications at 25°C, 50Ω, Unless Noted Otherwise

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>Condition</th>
<th>Min Attenuation (dB)</th>
<th>Max Attenuation (dB)</th>
<th>Attenuation Range (dB)</th>
<th>Return Loss (dB)</th>
<th>IIP3 (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-20</td>
<td>VCTRL1 = -4 V to 0 V, VCTRL2 = -4 V</td>
<td>2.1</td>
<td>3.5</td>
<td>18.8</td>
<td>23.8</td>
<td>15.3</td>
</tr>
<tr>
<td>20-30</td>
<td>VCTRL1 = 0 V, VCTRL2 = -4 V to 0 V</td>
<td>2.2</td>
<td>3.7</td>
<td>22.9</td>
<td>27.6</td>
<td>19.2</td>
</tr>
<tr>
<td>30-40</td>
<td>VCTRL1 = -4 V to 0 V, VCTRL2 = -4 V</td>
<td>3.0</td>
<td>5.9</td>
<td>26.4</td>
<td>31.1</td>
<td>20.5</td>
</tr>
<tr>
<td>40-45</td>
<td>VCTRL1 = -4 V to 0 V, VCTRL2 = -4 V</td>
<td>4.1</td>
<td>6.3</td>
<td>28.8</td>
<td>34.0</td>
<td>22.5</td>
</tr>
</tbody>
</table>

1. VCTRL1 and VCTRL2 -4V (min. attenuation) to 0V (max. attenuation). Maximum current for VCTRL1 or VCTRL2: 5 mA (max at VCTRL = -4V)
2. Min attenuation state is the insertion loss.

### Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Case Temperature</td>
<td>-40°C to 85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65°C to 150°C</td>
</tr>
<tr>
<td>Control Voltage (Vctrl1/Vctrl2)</td>
<td>-5 to +1 V</td>
</tr>
<tr>
<td>Absolute Max. RF Input Level</td>
<td>+23 dBm</td>
</tr>
<tr>
<td>Thermal Resistance at max. attenuation</td>
<td>44.8°C/W</td>
</tr>
</tbody>
</table>

3. Permanent damage may occur if any of these limits are exceeded.
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**APPLICATION CIRCUIT & PAD DESCRIPTION**

**PAD CONNECTIONS**

<table>
<thead>
<tr>
<th>Components</th>
<th>Size</th>
<th>Value</th>
<th>Qty</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1, R3</td>
<td>0201</td>
<td>6.2 kΩ</td>
<td>2</td>
<td>RK73414TTC6201F</td>
</tr>
<tr>
<td>R2, R4</td>
<td>0201</td>
<td>2.1 kΩ</td>
<td>2</td>
<td>RK73H1HT2010F</td>
</tr>
</tbody>
</table>

Note: The voltage divider network is required to increase the tuning voltage range of the VVA

**PRODUCT MARKING**

- Index over pin 1
- Black body
- Model family designation

Marking may contain other features or characters for internal lot control
Voltage Variable Attenuator

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TYPICAL PERFORMANCE CURVES

Attenuation vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = -4 V

Input Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = -4 V

Output Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = -4 V to 0 V, VCTRL 2 = -4 V

Attenuation vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = -4 V to 0 V

Input Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = -4 V to 0 V

Output Return Loss vs. Frequency at Various Control Voltages
VCTRL 1 = 0 V, VCTRL 2 = -4 V to 0 V
Voltage Variable Attenuator  

**PVA-453-34+**

50Ω  10 to 45 GHz

- **Attenuation vs. Frequency at Various Control Voltages**
  - VCTRL 1 = VCTRL 2 = -4 V to 0 V

- **Input Return Loss vs. Frequency at Various Control Voltages**
  - VCTRL 1 = VCTRL 2 = -4 V to 0 V

- **Output Return Loss vs. Frequency at Various Control Voltages**
  - VCTRL 1 = VCTRL 2 = -4 V to 0 V

- **Attenuation vs. Control Voltage at Various Frequencies**
  - VCTRL1 = VCTRL2

- **Noise Figure vs. Frequency**

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**Mini-Circuits**

www.minicircuits.com  P.O. Box 350166, Brooklyn, NY 11235-0003  (718) 934-4500  sales@minicircuits.com
1. Package parasitics limit maximum attenuation range above 30 GHz and may cause attenuator to be non-monotonic with control voltages greater than -1.5V
Voltage Variable Attenuator

MMIC SURFACE MOUNT

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Attenuation vs. Input Power Over Control Voltages at 44 GHz
(Fixed VCTRL2)

Attenuation vs. Input Power Over Control Voltages at 44 GHz
(VCTRL1 = VCTRL2)

IIP3 vs. Input Power Over Control Voltages at 10 GHz
(Fixed VCTRL1)

IIP3 vs. Input Power Over Control Voltages at 10 GHz
(VCTRL1 = VCTRL2)
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**IIP3 vs. Input Power Over Control Voltages at 20 GHz**

*Fixed VCTRL2*

VC1 = -4 V  VC2 = -4 V  
VC1 = -3.5 V  VC2 = -4 V  
VC1 = -3 V  VC2 = -4 V  
VC1 = -2.5 V  VC2 = -4 V  
VC1 = -2 V  VC2 = -4 V  
VC1 = -1.5 V  VC2 = -4 V  
VC1 = -1 V  VC2 = -4 V  
VC1 = -0.5 V  VC2 = -4 V  
VC1 = 0 V  VC2 = -4 V

**IIP3 vs. Input Power Over Control Voltages at 20 GHz**

*Fixed VCTRL1*

VC1 = -4 V  VC2 = -4 V  
VC1 = -3.5 V  VC2 = -3.5 V  
VC1 = -3 V  VC2 = -3 V  
VC1 = -2.5 V  VC2 = -2.5 V  
VC1 = -2 V  VC2 = -2 V  
VC1 = -1.5 V  VC2 = -1.5 V  
VC1 = -1 V  VC2 = -1 V  
VC1 = -0.5 V  VC2 = -0.5 V  
VC1 = 0 V  VC2 = 0 V

**IIP3 vs. Input Power Over Control Voltages at 44 GHz**

*Fixed VCTRL1*

VC1 = 0 V  VC2 = -4 V  
VC1 = 0 V  VC2 = -3.5 V  
VC1 = 0 V  VC2 = -3 V  
VC1 = 0 V  VC2 = -2.5 V  
VC1 = 0 V  VC2 = -2 V  
VC1 = 0 V  VC2 = -1.5 V  
VC1 = 0 V  VC2 = -1 V  
VC1 = 0 V  VC2 = -0.5 V  
VC1 = 0 V  VC2 = 0 V

**IIP3 vs. Input Power Over Control Voltages at 44 GHz**

*Fixed VCTRL2*

VC1 = -4 V  VC2 = -4 V  
VC1 = -3.5 V  VC2 = -4 V  
VC1 = -3 V  VC2 = -4 V  
VC1 = -2.5 V  VC2 = -4 V  
VC1 = -2 V  VC2 = -4 V  
VC1 = -1.5 V  VC2 = -4 V  
VC1 = -1 V  VC2 = -4 V  
VC1 = -0.5 V  VC2 = -4 V  
VC1 = 0 V  VC2 = -4 V
ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS CLICK HERE

<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>

| Case Style                     | JV2579 Plastic package, exposed paddle, lead finish: Matte Tin |

<table>
<thead>
<tr>
<th>Tape &amp; Reel</th>
<th>F104</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard quantities available on reel</td>
<td>7&quot; reels with 20, 50, 100, 200, 500, 1K or 2K devices</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suggested Layout for PCB Design</th>
<th>PL-726</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation Board</td>
<td>TB-PVA-453-34+ (without connectors), TB-PVA-453-34C+ (with connectors)</td>
</tr>
<tr>
<td>Environmental Ratings</td>
<td>ENV08T1</td>
</tr>
</tbody>
</table>

**ESD RATING**

Human Body Model (HBM): Class 1A (250 V to < 500 V) in accordance with ANSI/ESD STM 5.1 - 2001

**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

**NOTES**

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.

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

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