Wide-range single-output demonstration board based on the
VIPER26HN

Features

- Universal input mains range:
  - input voltage 90 - 264 V\text{AC}
  - frequency 45 - 65 Hz
- Single-output voltage: 12 V at 1 A continuous
  operation
- Standby mains consumption: < 30 mW at
  230 V\text{AC}
- Average efficiency: > 80%
- Fully protected against faults (overload,
  feedback disconnection and overheating)
- EMI: according to EN55022-Class-B
- RoHS compliant

Description

The STEVAL-ISA111V1 demonstration board is a
12 V, 1 A power supply set in non-isolated flyback
topology using the VIPER26HN, the new offline
high voltage converter by STMicroelectronics.

The features include an 800 V avalanche rugged
power section, PWM operation at 115 kHz with
frequency jittering for lower EMI, current limiting
with adjustable set point, onboard soft-start, a
safe auto-restart after a fault condition and a low
standby power. The protections include thermal
shutdown with hysteresis, delayed overload
protection, and open loop failure protection.
1 Adapter features

Table 1. Electrical specifications

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IN}$</td>
<td>Input voltage range</td>
<td>$[90,\text{V}<em>{\text{AC}} - 265,\text{V}</em>{\text{AC}}]$</td>
</tr>
<tr>
<td>$V_{OUT}$</td>
<td>Output voltage</td>
<td>12 V</td>
</tr>
<tr>
<td>$I_{OUT}$</td>
<td>Max. output current</td>
<td>1 A</td>
</tr>
<tr>
<td>$\Delta V_{OUT,LF}$</td>
<td>Precision of output regulation</td>
<td>$\pm 5%$</td>
</tr>
<tr>
<td>$\Delta V_{OUT,HF}$</td>
<td>High frequency output voltage ripple</td>
<td>50 mV</td>
</tr>
<tr>
<td>$T_{AMB}$</td>
<td>Max. ambient operating temperature</td>
<td>60 °C</td>
</tr>
</tbody>
</table>
2 Circuit description

Figure 1. Application schematic - simplified for $V_{OUT} \geq 12$ V
### Table 2. Bill of material

<table>
<thead>
<tr>
<th>Reference</th>
<th>Part</th>
<th>Description</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTC</td>
<td>2.2 NTC</td>
<td>Thermistor, S236 series</td>
<td>Epcos</td>
</tr>
<tr>
<td>F</td>
<td>T2A 250 V</td>
<td>2 A, 250 Vac fuse, TR5 series</td>
<td>Wickmann</td>
</tr>
<tr>
<td>C1</td>
<td>10 µF, 400 V</td>
<td>NHG series electrolytic capacitor</td>
<td>Panasonic</td>
</tr>
<tr>
<td>C2</td>
<td>22 µF, 35 V</td>
<td>SMG series electrolytic capacitor</td>
<td>Panasonic</td>
</tr>
<tr>
<td>C4</td>
<td>2.2 µF, 63 V</td>
<td>electrolytic capacitor</td>
<td></td>
</tr>
<tr>
<td>C5, C7</td>
<td>100 nF, 50 V</td>
<td>ceramic capacitor</td>
<td></td>
</tr>
<tr>
<td>C6</td>
<td>2.2 nF, 50 V</td>
<td>ceramic capacitor</td>
<td></td>
</tr>
<tr>
<td>C8</td>
<td>2.2 nF, 50 V</td>
<td>ceramic capacitor</td>
<td></td>
</tr>
<tr>
<td>C10</td>
<td>1000 F, 16 V</td>
<td>ultra low ESR electrolytic capacitor ZL series</td>
<td>Rubycon</td>
</tr>
<tr>
<td>C11</td>
<td>680 F, 16 V</td>
<td>ultra low ESR electrolytic capacitor ZL series</td>
<td>Rubycon</td>
</tr>
<tr>
<td>D0</td>
<td>DF06M</td>
<td>1 A - 600 V diode bridge</td>
<td>Vishay</td>
</tr>
<tr>
<td>D1</td>
<td>STTH1L06</td>
<td>1 A - 600 V ultrafast diode</td>
<td>ST</td>
</tr>
<tr>
<td>D3</td>
<td>STPS3150</td>
<td>3 A - 150 V power Schottky (output diode)</td>
<td>ST</td>
</tr>
<tr>
<td>D4</td>
<td>1.5KE300A</td>
<td>Transil</td>
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</tr>
<tr>
<td>D6</td>
<td>1N4148</td>
<td>Small signal diode</td>
<td>Fairchild</td>
</tr>
<tr>
<td>R3</td>
<td>47 k 1% 1/4 W</td>
<td>resistor</td>
<td></td>
</tr>
<tr>
<td>R4a</td>
<td>15 k 1% 1/4 W</td>
<td>resistor</td>
<td></td>
</tr>
<tr>
<td>R4b</td>
<td>2.7 k 1% 1/4 W</td>
<td>resistor</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>27 k 1/4 W</td>
<td>resistor</td>
<td></td>
</tr>
<tr>
<td>R7</td>
<td>33 k 1/4 W</td>
<td>resistor</td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>RFB0807-102</td>
<td>Input filter inductor (L = 1 mH,</td>
<td>Coilcraft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_{SAT} = 0.3 A; DCR_{max} = 3.4 Ω)</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>1335.0089</td>
<td>115 Hz switch mode transformer</td>
<td>Magnetica</td>
</tr>
<tr>
<td>IC1</td>
<td>VIPER26HN</td>
<td>High voltage 115 kHz PWM</td>
<td>ST</td>
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</table>
3 Measurements

Figure 2. Line regulation

Figure 3. Load regulation

Figure 4. Efficiency vs. $V_{IN}$

Figure 5. Efficiency vs. load
Figure 6. Active mode efficiency vs. $V_{IN}$

Figure 7. Input voltage averaged efficiency vs. load

Figure 8. $P_{IN}$ vs. $V_{IN}$ at no load and light load

Figure 9. Efficiency vs. $V_{IN}$ at $P_{IN} = 1$ W
4 Board layout

Figure 10. Bottom layer & top overlay
## Revision history

Table 3. Document revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
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<tbody>
<tr>
<td>10-Dec-2012</td>
<td>1</td>
<td>Initial release.</td>
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