Wide Input Range (20 Vdc to 140 Vdc) DC to DC Converter

### Device Specifications

<table>
<thead>
<tr>
<th>Device</th>
<th>Application</th>
<th>Input Voltage</th>
<th>Output Power</th>
<th>Topology</th>
<th>I/O Isolation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCP1031</td>
<td>Industrial</td>
<td>20 to 140 Vdc</td>
<td>2.5 W</td>
<td>Flyback</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Other Specifications

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>Output 1</th>
<th>Output 2</th>
<th>Output 3</th>
<th>Output 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage</td>
<td>5.0 Vdc (1%)</td>
<td>12.0 Vdc (5%)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Ripple</td>
<td>100 mV</td>
<td>100 mV</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Nominal Current</td>
<td>180 mA</td>
<td>100 mA</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Max Current</td>
<td>180 mA</td>
<td>100 mA</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Min Current</td>
<td>50 mA</td>
<td>10 mA</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

- PFC (Yes/No): No
- Minimum Efficiency: 55%
- Operating Temp Range: -10 to +60 °C

### Circuit Description

The 2.5 W dc to dc converter utilizes the NCP1031 monolithic controller (U1) in a discontinuous mode flyback converter. An optional EMI filter comprised of C1, C11, and L1 is also included. A simple, isolated voltage feedback scheme is implemented with zener Z1 and optocoupler U2 to control the feedback pin of U1 and regulate the 5 V output. The flyback transformer (T1) utilizes a “stacked” winding configuration for the 12 V output to improve its cross regulation. Input under- and over-voltage shutdown can be configured by selecting the correct values for R6, 7 and 8 (see NCP1031 data sheet on onsemi.com).

### Key Features

- Very wide range input: 20 to 140 Vdc.
- Monolithic PWM controller with 200 V MOSFET
- Dual outputs with “stacked” windings
- Input EMI filter
- Extremely simple design with few components
- 200 kHz switching frequency
NOTES:

1. Crossed lines on schematic are not connected.
2. U2 is Vishay SFH6156A-4 optocoupler or similar.
3. R6, R7, and R8 set input OV and UV trip points. See NCP1031 data sheet to determine values.
4. Z1 sets 5V output voltage (Vout = Vz + 0.9V approximately.)
5. C1, C11, and L1 are for EMI compliance (optional).
6. C10 sets switching frequency to 200 kHz.
7. See magnetics design sheet for T1 details.
Part Description: 3 watt, 200 kHz dual output flyback transformer
Schematic ID: T1
Core Type: Ferroxcube EF16 (E16/8/5); 3C95 material or similar
Core Gap: Gap for 85 - 100 uH
Inductance: 90 uH nominal
Bobbin Type: 8 pin horizontal mount for EF16

Windings (in order):

<table>
<thead>
<tr>
<th>Winding # / type</th>
<th>Turns / Material / Gauge / Insulation Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vcc/Boost (2 - 3)</td>
<td>13 turns of #28HN spiral wound over 1 layer. Insulate with mylar tape for 250V min. insulation to next winding.</td>
</tr>
<tr>
<td>Primary (1 - 4)</td>
<td>24 turns of #28HN over 1 layer. Insulate for 1.5 kV to the next winding with mylar tape.</td>
</tr>
<tr>
<td>5V/12V Secondary (7 - 8, 5 - 6) (stacked winding)</td>
<td>6 turns of two different color strands of #28HN bifilar wound with two additional turns with one of the colors (8 total). This will be the 12V winding. The winding should be centered on the primary with 2 mm end margins approximately.) Terminate as shown in the schematic below with the 8 turn (12V) winding terminating to pins 5 &amp; 6 and The 5V winding (6 turns) terminating to pins 7 &amp; 8.</td>
</tr>
</tbody>
</table>

Hipot: 1.5 kV from Vcc boost & primary to secondary

Suggested prototype vendor: Mesa Power Systems
Escondido, CA
1-800-515-8514

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