200 W Active Clamp Forward DC-DC Converter Reference Guide

RD175-RGUIDE-01

TOSHIBA ELECTRONIC DEVICES & STORAGE CORPORATION
# Table of Contents

1. **Introduction** ................................................................. 3

2. **Specifications** .............................................................. 3
   2.1. Power Supply Specifications ........................................... 3
   2.2. External View of Power Supply ...................................... 4
   2.3. Block diagram ............................................................. 5
   2.4. Component Layout ....................................................... 6
   2.5. PCB Pattern ............................................................... 8

3. **Operating Procedure** .................................................... 12
   3.1. Connecting to External Devices ....................................... 12
   3.2. Start and Stop Procedures ............................................. 13
   3.3. Precautions for Evaluation (To Prevent Electric Shock, Burn Injury, etc.) 13

4. **Power Characteristics** .................................................... 15
   4.1. Efficiency ................................................................. 15
1. Introduction

This reference guide provides information on the specifications, use, and efficiency of the 200 W Active Clamp Forward DC-DC Converter (hereafter referred to as this power supply). This power supply can provide 200 W of power at the outgoing DC 24 V. The input-voltage range is from DC 38.5 to 60 V and can be used in a variety of applications, including industrial equipment and communication related equipment. It provides various design information including a reference design, and contributes to labor saving in designing according to actual specifications.

2. Specifications

2.1. Power Supply Specifications

Table 2.1 lists the I/O characteristics of this power supply.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Voltage</td>
<td>38.5</td>
<td>48</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>Input Current</td>
<td>DC 38.5 V input</td>
<td>5.8</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td><strong>Output Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage</td>
<td></td>
<td>24</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Output Current</td>
<td>0.4</td>
<td>8.3</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Output Power</td>
<td>10</td>
<td>200</td>
<td></td>
<td>W</td>
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<tr>
<td>Output Ripple Voltage</td>
<td></td>
<td>150</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td></td>
<td>200</td>
<td></td>
<td>kHz</td>
</tr>
</tbody>
</table>
2.2. External View of Power Supply

Fig. 2.1 shows the appearance of this power supply.

Fig. 2.1 External View of 200 W Active Clamp Forward DC-DC Converter

External dimensions: 130 mm x 115 mm x 30 mm (excluding input/output terminals on the back side)
2.3. Block diagram

Fig. 2.2 shows the block diagram of this power supply to understand the function operation.
Refer to RD175-SCHEMATIC-01 for the actual schematic and to RD175-BOM-01 for the bill of materials.

Fig. 2.2 Block Diagram
2.4. Component Layout

Fig. 2.3 and Fig. 2.4 show the layout of components on the PCB of this power supply.

Fig. 2.3 PCB Component Layout (Front Side)
Fig. 2.4 PCB Component Layout (Back Side)
2.5. PCB Pattern

PCB-design data of this power supply compatible with various EDA (Electronic Design Automation) tools is provided in the design files. Please refer to them for more information.

Fig. 2.5 shows Layer 1 of the PCB.

Fig. 2.5 Layer 1 (Front Side)
Fig. 2.6 shows Layer 2 of the PCB.

Fig. 2.6 Layer 2
Fig. 2.7 shows Layer 3 of the PCB.
Fig. 2.8 shows Layer 4 of the PCB.

Fig. 2.8 Layer 4 (Back Side)
3. Operating Procedure

3.1. Connecting to External Devices

Fig. 3.1 shows the external connection terminals on the back of the board. The area enclosed in red shows input terminals. Connect a DC stabilized power supply to Input (+) and Input (-) terminals. Use power supplies, cables, leads, and connectors that satisfy the power supply specifications described in Section 2.1. For Enable terminal, connect a jumper with selectable connection/release to GND. The area enclosed in blue shows output terminals. Connect the load unit to Output (+) and Output (-) terminals. Use load devices, cables, and connectors that satisfy the power supply specifications described in Section 2.1.

Fig. 3.1 External Connection Pins
3.2. Start and Stop Procedures

Before starting the power supply, check that all of the following terminal voltages are 0 V.
Input (+) terminal, Input (-) terminal, Output (+) terminal, and Output (-) terminal

[Startup Procedure]
1. Turn on the external stabilized DC power supply
2. Connect the Enable terminal to GND

[Stop Procedure]
1. Release the connection between Enable terminal and GND
2. Turn off the external stabilized DC power supply

3.3. Precautions for Evaluation (To Prevent Electric Shock, Burn Injury, etc.)

Fig. 3.2 shows the primary and secondary areas of this power supply. After this power supply is stopped, there is a risk of electric shock due to the residual charge of various capacitors. Before touching the board, check that the voltage of each component has decreased sufficiently. Semiconductor and Transformer of this power supply generate heat according to the load current. Fig. 3.3 shows the components with large heat generation using a red broken line frame. This power supply is designed to be used with forced air-cooling. Use an air-cooling device that ensures that the temperature of these components stay within the rated temperature range at high loads. Also, do not touch these areas while the power supply is running, as there is a risk of burns.
Fig. 3.3 Components with Large Heat Generation
4. Power Characteristics

The power supply efficiency measurement results of this power supply are described below.

4.1. Efficiency

Fig. 4.1 shows the power supply efficiency measurement results of this power supply. This data is measured by setting the input voltage to 38.5 V, 48 V, and 60 V.

![Efficiency Graph](image)

*Fig. 4.1 Efficiency (Vin = 38.5 V, Vin = 48 V, Vin = 60 V)*
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