Test Data
For TIDA00858
11/03/2015
1. Design Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vin Maximum</td>
<td>42V AC</td>
</tr>
<tr>
<td>Vout</td>
<td>Rectified Vin</td>
</tr>
<tr>
<td>Max AC Voltage Frequency</td>
<td>300Hz</td>
</tr>
<tr>
<td>Max Iout</td>
<td>100A</td>
</tr>
<tr>
<td>Charge pump Capacitors</td>
<td>0.47uF</td>
</tr>
</tbody>
</table>

2. Circuit Description

TIDA00858 is highly efficient Full Bridge Rectifier TI Design which can be used as an AC/DC rectifier for high power applications. In this full bridge rectifier design all 4 schottky diodes are replaced with the LM74670-Q1 ICs combined with N-Channel MOSFETs. The main features and benefits of this design are as followed:
1. A novel Full Bridge Rectifier approach uses four LM74670-Q1 controller ICs combined with four N-Channel MOSFETs for forward conduction (Figure). This design accepts an AC input voltage up to 45Vin and provides rectified output voltage without forward diode drop.

![Smart Diode Full Bridge Rectifier Application](image)

2. The MOSFETs used in this design can comfortably handle 100A output load current.

3. The LM74670-Q1 has zero IQ and it’s used to drive the NFET gate for forward condition. The forward voltage drop of NFETs is significantly smaller than a diode, therefore this TIDesign provides highly efficient alternative for diode bridge rectifier.
3. TIDA00858 Board Photos

Board Dimensions: 4217mil * 3432mil

Board Photo (Top)

Board Photo (Bottom)
4. AC/DC Rectifier Test Results

4.1 Thermal Data at 10A without heat sinks

IR thermal image taken at steady state with 24V AC Vin and @ 10A load (no airflow)
4.2 Thermal Data at 20A

IR thermal image taken at steady state with 24V AC Vin and @ 20A load (no airflow)
4.3 Waveforms

4.3.1 Rectifier Results with 5A Load Current and no output capacitor

Full Bridge Rectifier Results with 60Hz, 24V Peak to Peak VIN, @ 5A Output Load Current

Full Bridge Rectifier at 60Hz AC Input frequencies
Full Bridge Rectifier Results with **100Hz**, 24V Peak to Peak VIN, @ 5A Output Load Current

**100Hz, AC Input**

**Rectified Output**

Full Bridge Rectifier at 100Hz AC Input frequencies
Full Bridge Rectifier Results with **150Hz**, 24V Peak to Peak VIN, @ 5A Output Load Current

**150Hz, AC Input**

**Rectified Output**

Full Bridge Rectifier at **150Hz** AC Input frequencies
Full Bridge Rectifier Results with **200Hz**, 24V Peak to Peak VIN, @ 5A Output Load Current

Full Bridge Rectifier at 200Hz AC Input frequencies
Full Bridge Rectifier Results with **250Hz**, 24V Peak to Peak VIN, @ 5A Output Load Current

Full Bridge Rectifier at **250Hz** AC Input frequencies
Full Bridge Rectifier Results with 300Hz, 24V Peak to Peak VIN, @ 5A Output Load Current

Full Bridge Rectifier at 300Hz AC Input frequencies
4.3.2 Rectifier Results with 10A Load Current and no output capacitor

Full Bridge Rectifier Results with 60Hz, 24V Peak to Peak VIN, @ 10A Output Load Current

Full Bridge Rectifier at 60Hz AC Input frequencies
Full Bridge Rectifier Results with 100Hz, 24V Peak to Peak VIN, @ 10A Output Load Current

Full Bridge Rectifier at 100Hz AC Input frequencies
Full Bridge Rectifier Results with 150Hz, 24V Peak to Peak VIN, @ 10A Output Load Current

Full Bridge Rectifier at 150Hz AC Input frequencies
Full Bridge Rectifier Results with **200Hz**, 24V Peak to Peak VIN, @ 10A Output Load Current

**200Hz, AC Input**

**Rectified Output**

Full Bridge Rectifier at 200Hz AC Input frequencies
Full Bridge Rectifier Results with 300Hz, 24V Peak to Peak VIN, @ 10A Output Load Current

Full Bridge Rectifier at 300Hz AC Input frequencies
4.3.3 Rectifier Output without Diode Drop

- **AC Input**: Input to the rectifier before rectification.
- **Rectified Output**: Output from the rectifier, showing a smoothed wave without diode drop.

The graph shows the comparison between AC input and rectified output, highlighting the reduction in voltage due to the diode drop effect.
5. Thermal Comparison with Diode Rectifier

**Diode Rectifier** IR thermal image taken at steady state with 24V AC Vin and @ 10A load (no airflow) without thermal management

**LM74670-Q1 Rectifier** IR thermal image taken at steady state with 24V AC Vin and @ 10A load (no airflow) without thermal management
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