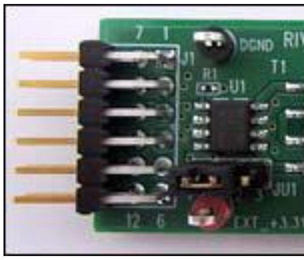
System Board 5512

RIVERSIDE (MAXREFDES8#): 3.3V INPUT, 12V (15V) OUTPUT ISOLATED POWER SUPPLY

Introduction



The Riverside design (MAXREFDES8#) uses an H-bridgetransformerdriver (MAX256) and a low dropout (LDO) linear regulator(MAX1659) to create a 12V (15V) output isolated power supply from a 3.3V voltage input (**Figure 1**). This general-purpose power solution can be used in many different types of isolated power applications, but is mainly targeted for industrial sensors, industrial automation, process control, and medical applications.

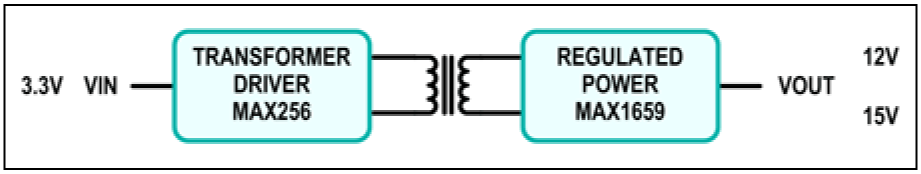


Figure 1. The Riverside subsystem design block diagram.

Features

- Isolated power
- 12V (15V) output
- Small printed circuit board (PCB) area
- Pmod™-compatible form factor

Applications

- Industrial sensors
- Process control
- Industrial automation
- Medical

Detailed Description of Hardware

The Riverside subsystem reference design operates from a 3.3V DC power source. The MAX256 H-bridge transformer driver switches at approximately 475kHz and drives the primary side of the 1:2.6 turns ratio, with the use of a TGM-H281NF transformer from Halo® Electronics. The transformer secondary side is connected to a voltage doubler that rectifies the AC output into DC output. The MAX1659 LDO regulates the voltage to 12V. The Zener diode D3 protects the LDO by keeping its input voltage below 16.1V.

The input power can be from the J1 Pmod-compatible connector or from an external power supply connected to the EXT_+3.3V and DGND connectors. To change the output voltage of this reference design, simply change the feedback resistors (R2, R3) of the LDO.

The output voltage of the MAX1659 LDO is set by the following equation:

$V_{OUT} = V_{SET} \times (1 + R2/R3)$

Where $V_{SET} = 1.21V$.

For example, for the 15V output application, change R2 to 187kΩ and change R3 to 16.2kΩ. In applications sensitive to output voltage ripple, a lowpass LC pi-filter can be added in front of the LDO input.

The isolation transformer in this design has an isolation voltage of 1500VRMS. It is recognized by UL 60950 and EN 60950 and falls into the "functional" insulation class.

Quick Start

Required equipment:

- Riverside (MAXREFDES8#) board
- 3.3V 1A power supply
- One digital voltmeter

Procedure

The Riverside board is fully assembled and tested. Follow the steps below to verify board operation.

1. Place the shunt on jumper JU1 to the 1–2 position.
2. Connect the positive terminal of the power supply to the EXT_+3.3V connector.
3. Connect the negative terminal of the power supply to the DGND connector.
4. Connect the positive terminal of the voltmeter to the +12V connector.
5. Connect the negative terminal of the voltmeter to the GND connector.
6. Turn on the power supply.
7. Use the voltmeter to measure the output voltage.

Lab Measurements

The Riverside design was tested for two output voltage rails: 12V and 15V. Other voltage rails can be achieved by modifying the resistor values of R2 and R3.

When set for 12V output, the circuit can deliver a maximum load current of approximately 165mA. When set for 15V output, the circuit can deliver a maximum load current of approximately 60mA.

To achieve a larger maximum load, the user can either increase the input power supply voltage or increase the transformer turns ratio properly. Refer to the MAX256 data sheet for details. The power efficiencies are illustrated in **Figure 2** and **Figure 3**.

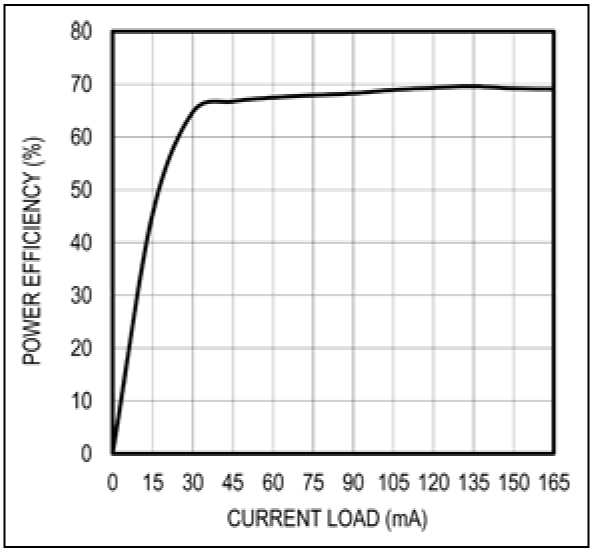


Figure 2. Power efficiency vs. current load for 12V output.

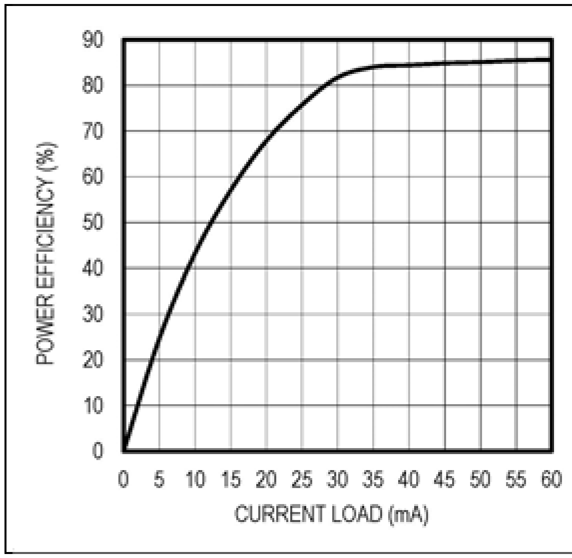
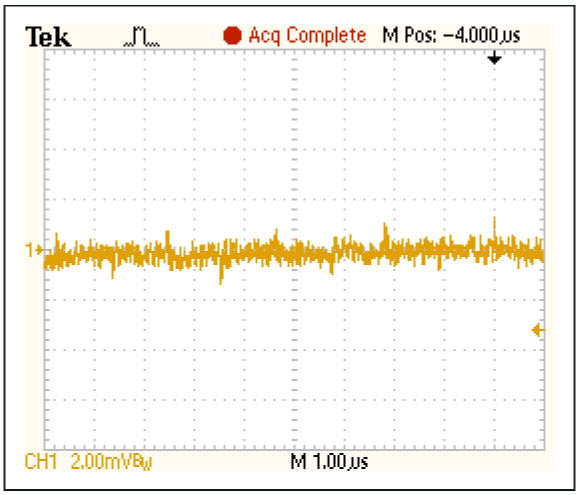


Figure 3. Power efficiency vs. current load fo

The output noise is well below 0.5% of the output voltage. The noise is mainly due to the switching pulses of the MAX256.**Figure 4** and **Figure 5** display the noise at no load for 12V and 15V outputs, respectively. **Figure 6**and **Figure 7** display the noise at the maximum loads for 12V and 15V outputs, respectively.



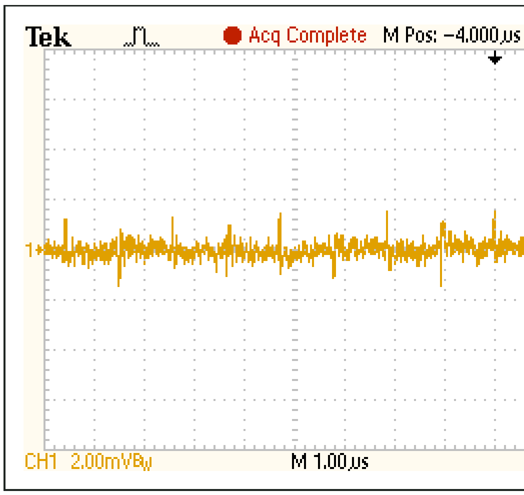


Figure 4. Noise at VOUT = 12V, IOUT = 0mA.

Figure 5. Noise at VOUT = 15V, IOUT =

Figure 6. Noise at VOUT = 12V, IOUT = 165mA.

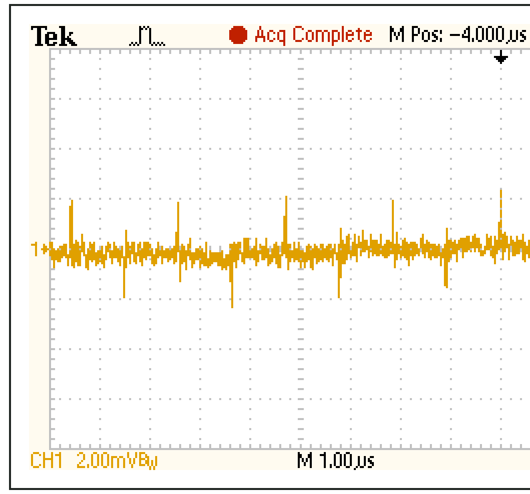


Figure 7. Noise at VOUT = 15V, IOUT =