TEXAS INSTRUMENTS

Overview

The **3D Printer Controller (12V) Reference Design** is a complete system for controlling common 3-axis, single extruder based 3D printers. The controller runs off of a 12 V power supply for the stepper motor drivers, hot bed heater, extruder heater, and fan driver. The supply is regulated down for 3.3 V in order to supply the microcontroller and sensors. Data in this report was taken running the controller at 12 V and demonstrates the various capabilities of the design.

This design utilizes the MSP430F5529 LaunchPad (mother board) in combination with a 3D Printer specific BoosterPack (daughter board) to provide the system solution. The **MSP430F5529** microcontroller is used to control the stepper motor drivers and power switches. The microcontroller can accept commands from either a USB connection or onboard micro-SD card. The four **DRV8846**'s are used to drive the axis and extruder stepper motors. The three **CSD18534Q5A** are used as the power switches for the hot bed, hot end, and fan. The **UA78M33CDCY** regulates the input supply down to the 3.3 V supply for the microcontroller and sensors. The controller can take in signals from up to six limit switches and two thermistors. The reference design utilizes the **DRV5033** as a contactless limit switch to sense the magnets that are mounted onto each axis.
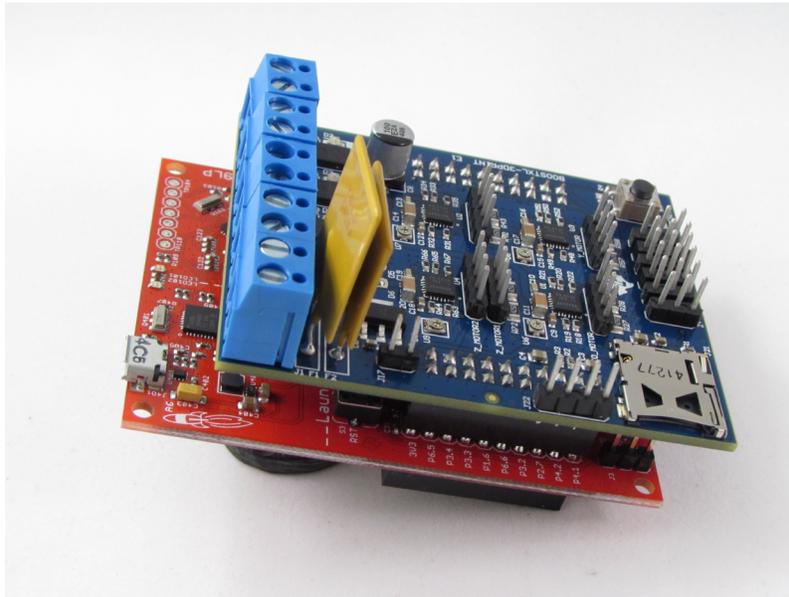
Figure 1: 12V 3D Printer Controller Reference Design

Figure 2: 3D Printer System

Table of Contents

1. Setup

Figure 3: Test Setup

2-Phase Bipolar Stepper Motor

Parameter	Value
Rated Voltage	4.5 V
Rated Phase Current	1.0 A
Phase Resistance	4.5 Ω
Phase Inductance	7.5 mH

DRV8846 Settings:

Parameter	Value
VM	12 V
Microstepping Mode	1/16 Microstepping
Decay Mode	Adaptive Decay
T_{OFF}	10 us
Torque DAC	100 %
Sense Resistor	0.25 Ω

2. DRV8846 Current Regulation

Performance plots of the DRV8846 current regulation at various speeds and current levels.

Full Scale Current = 500 mA
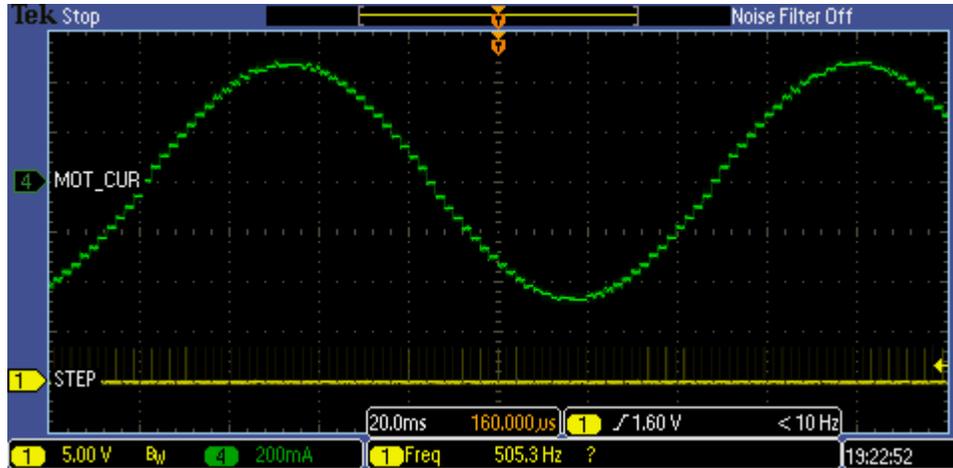
Figure 4: 500 µSteps/s

Figure 5: 1000 µSteps/s

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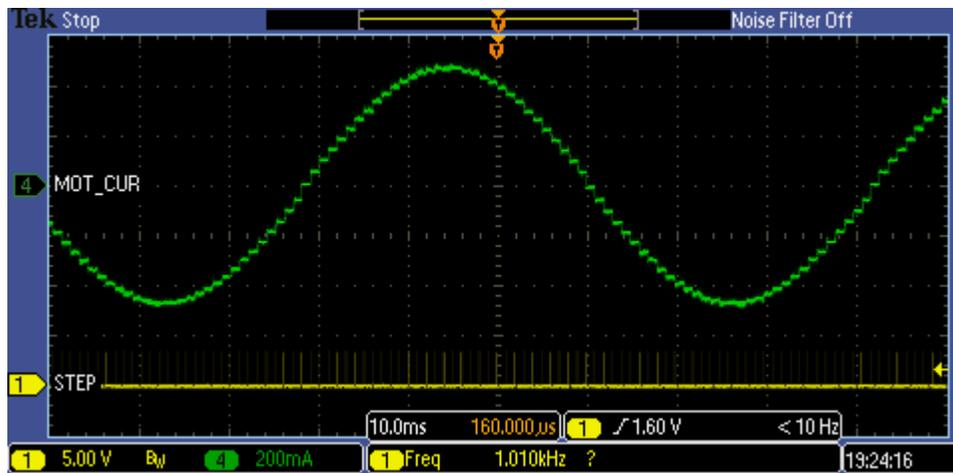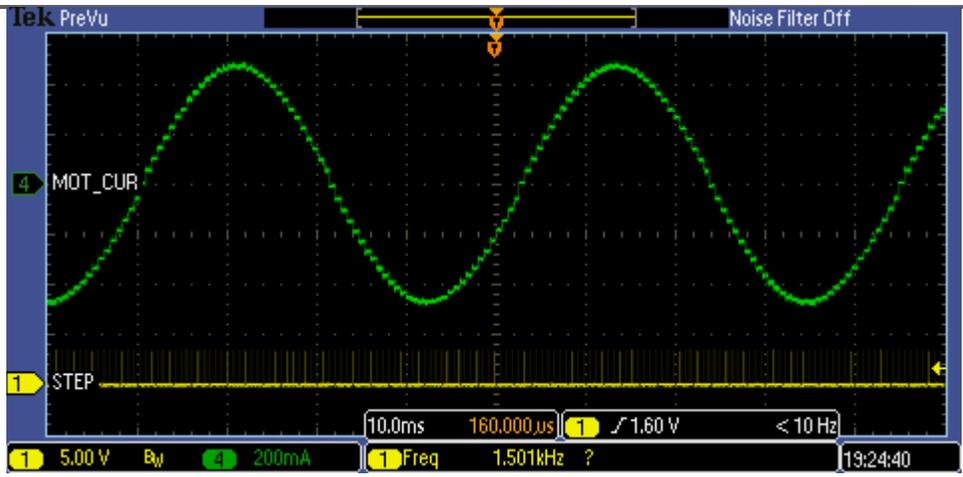
Figure 6: 1500 µSteps/s
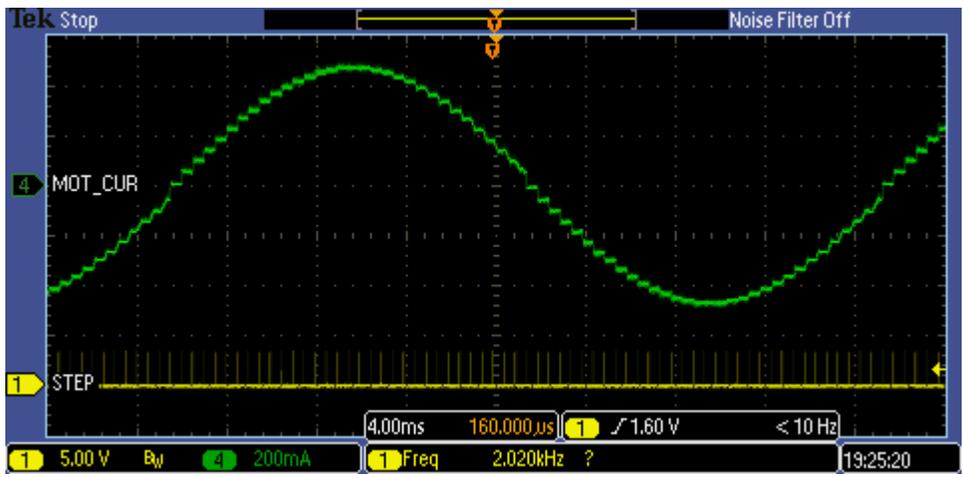
Figure 7: 2000 µSteps/s
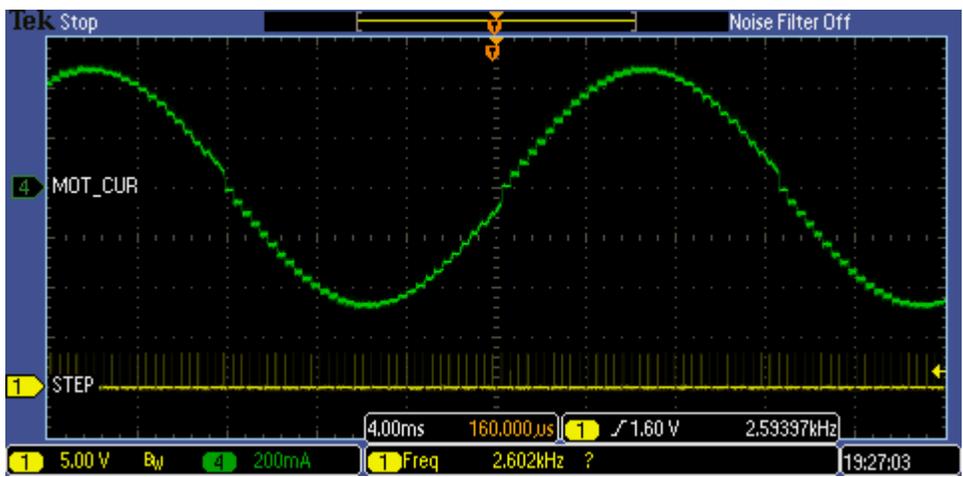
Figure 8: 2500 µSteps/s
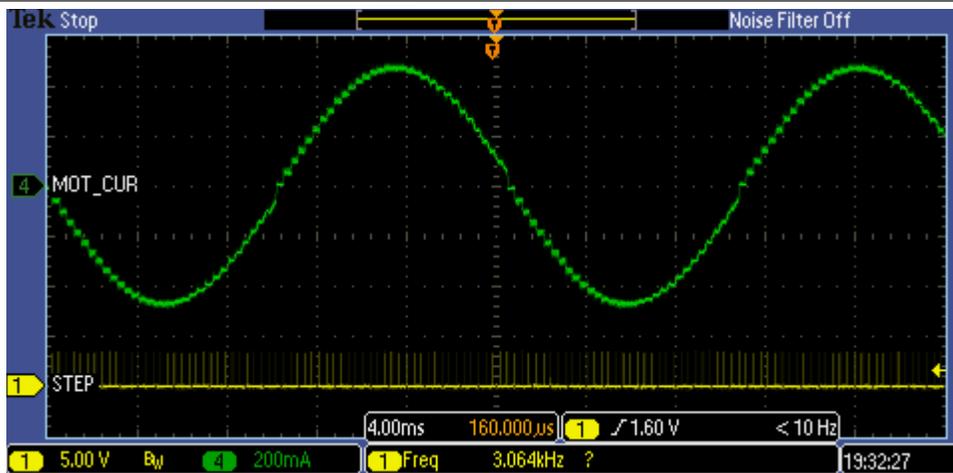
Figure 9: 3000 µSteps/s

Full Scale Current = 1000 mA
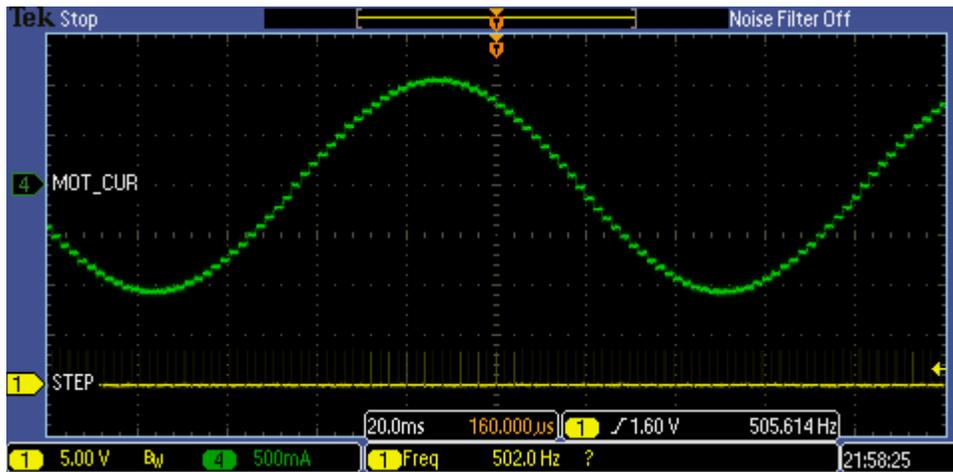
**Figure 10: 500 µSteps/s**
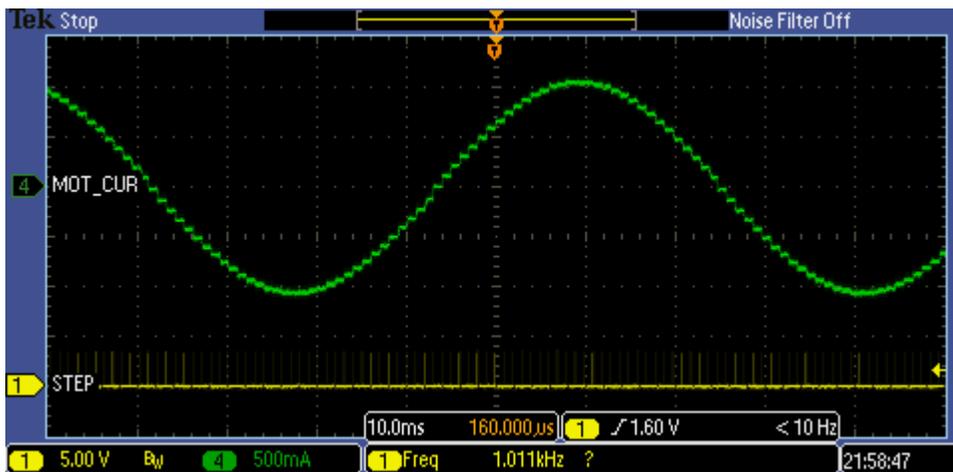
Figure 11: 1000 µSteps/s
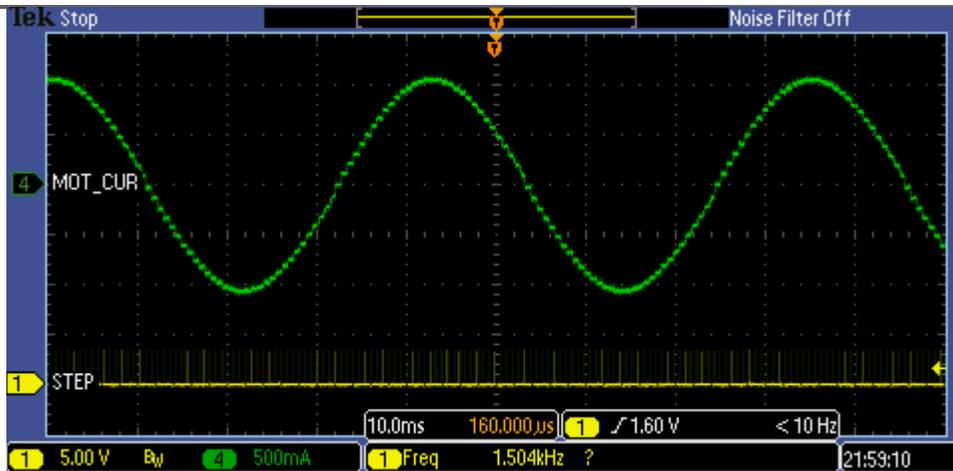
Figure 12: 1500 μSteps/s
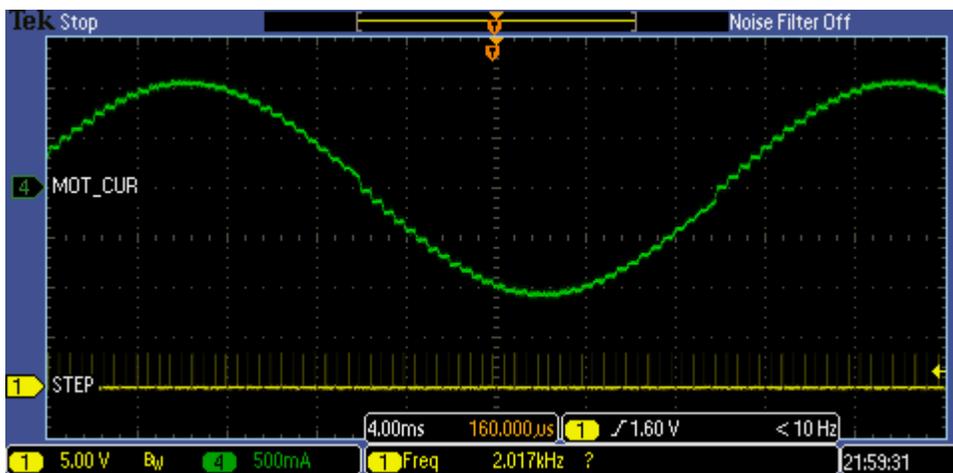
Figure 13: 2000 μSteps/s
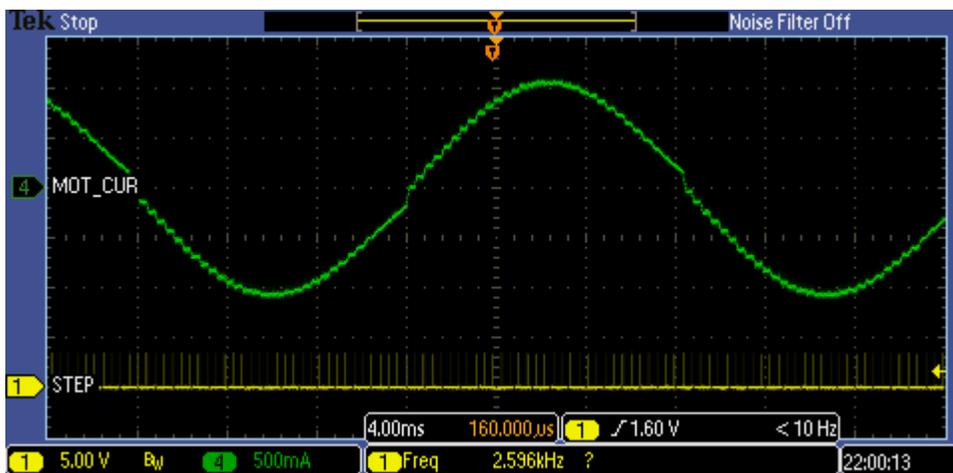
Figure 14: : 2500 μSteps/s
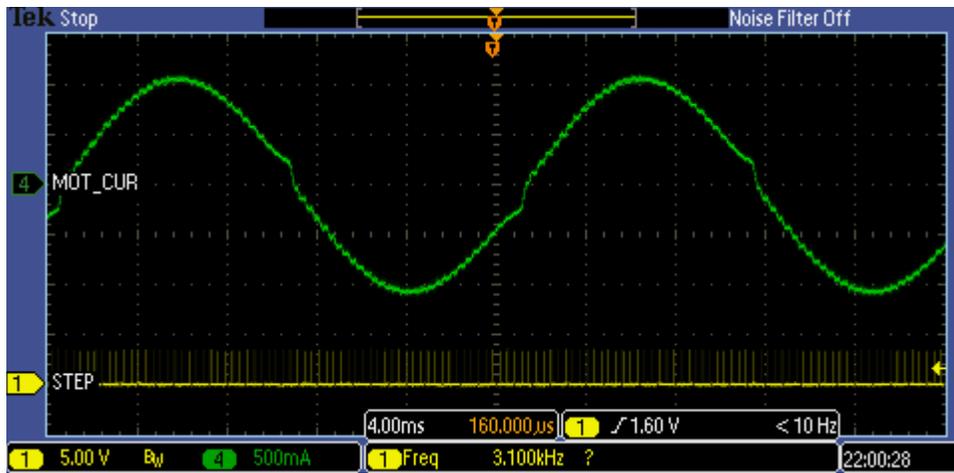
Figure 15: 3000 µSteps/s

3. DRV8846 Thermal Performance
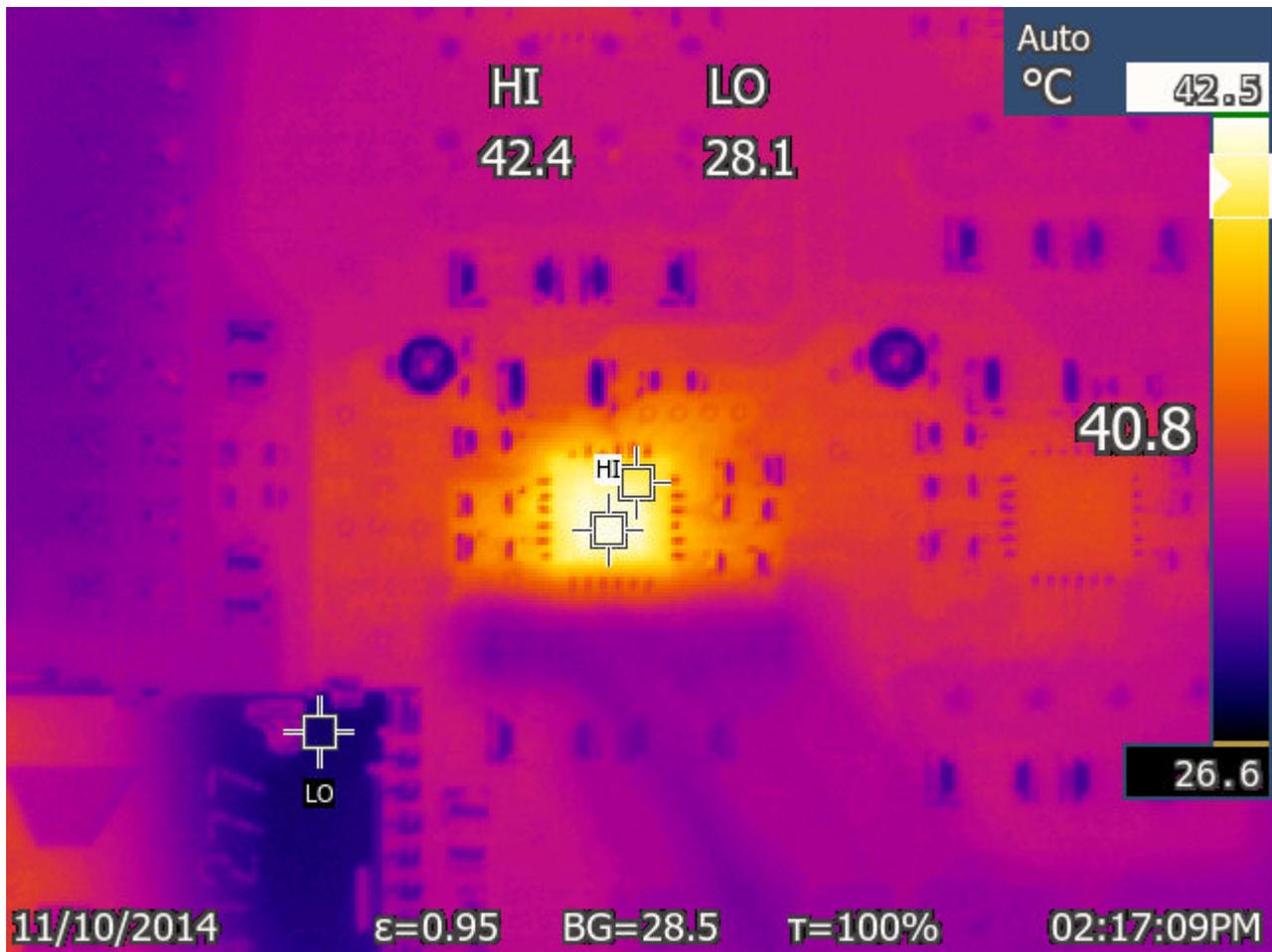
Figure 16: DRV8846 Driving 350 mA RMS
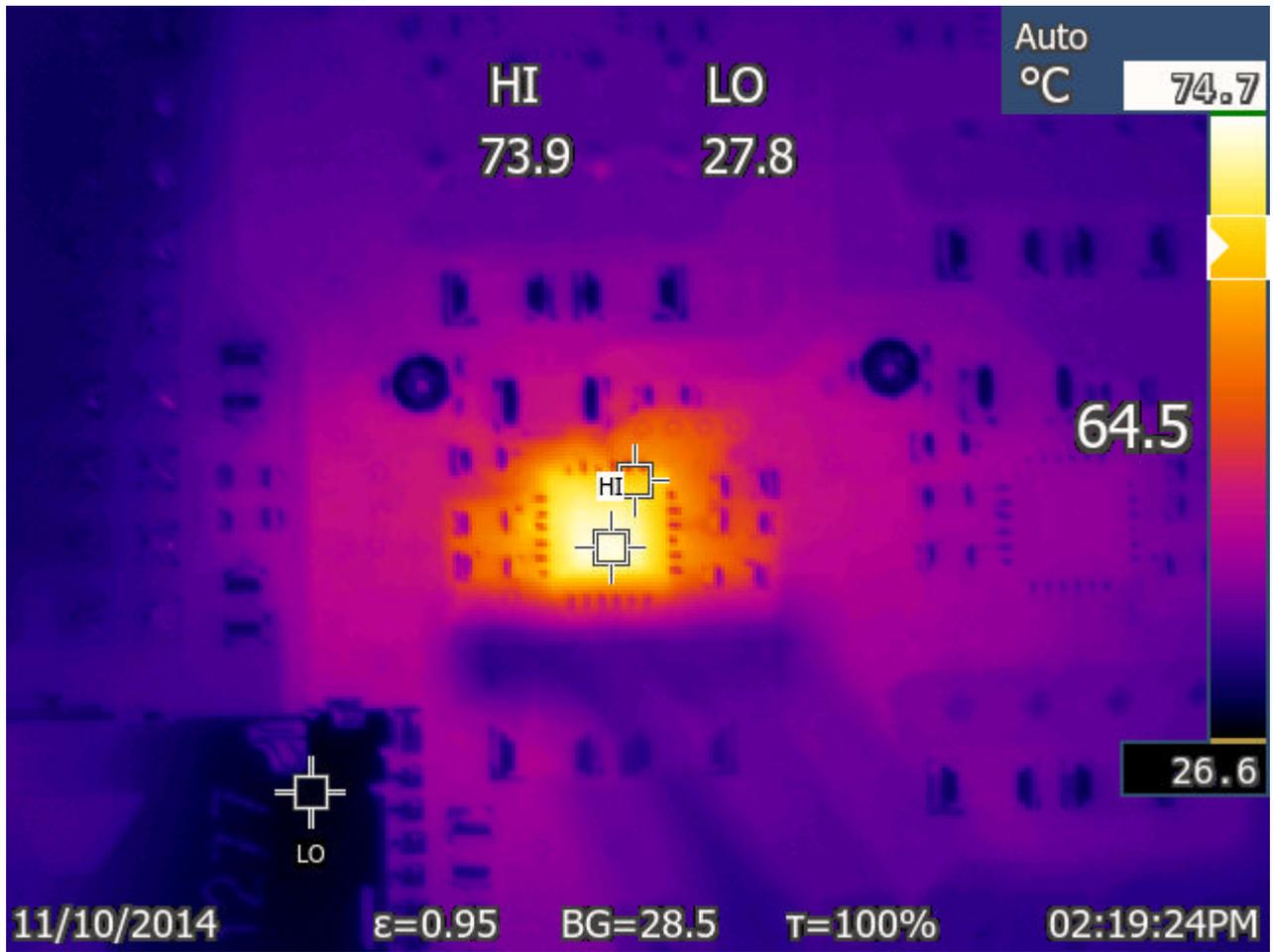
Figure 17: DRV8846 Driving 750 mA RMS
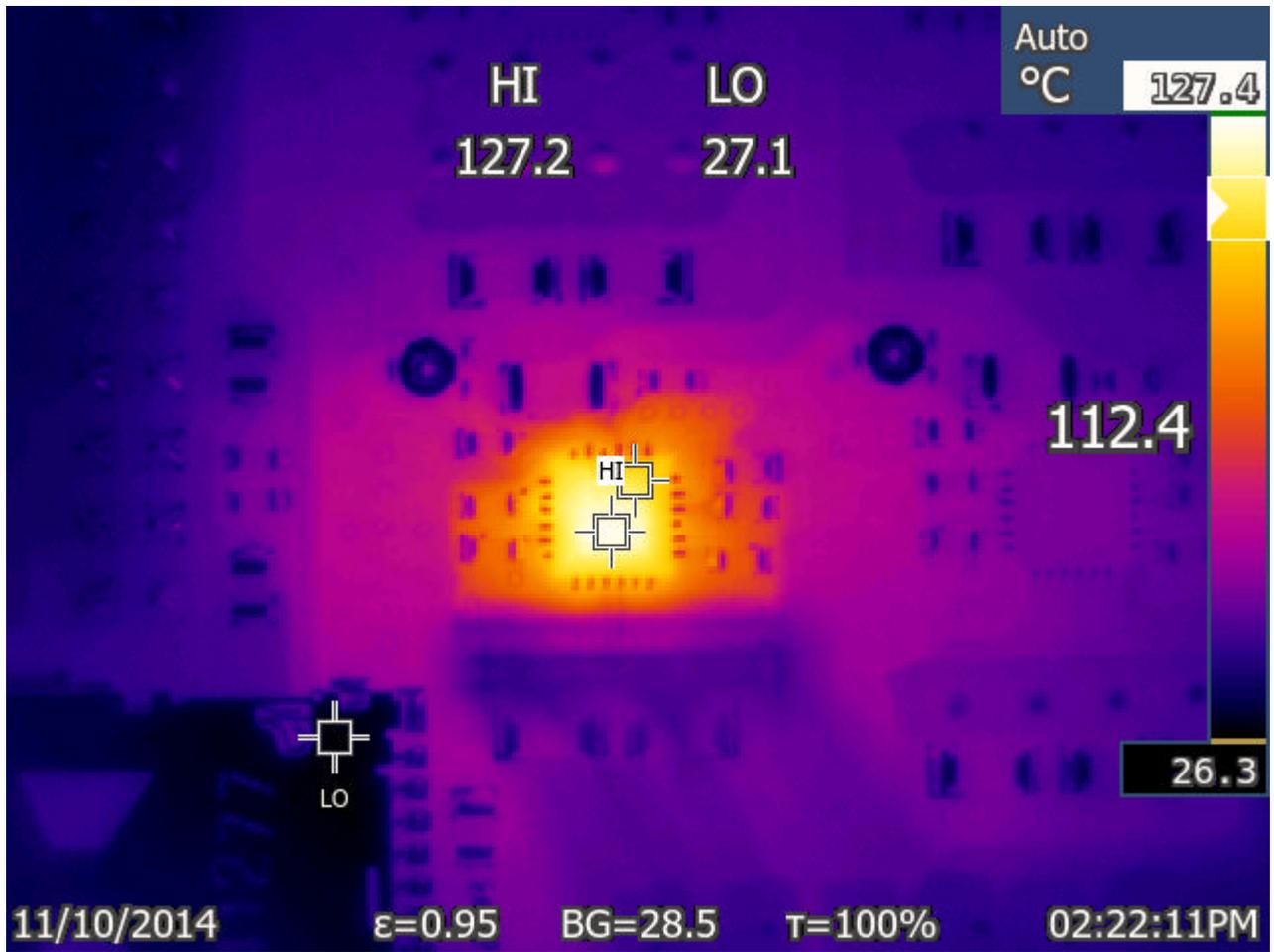
Figure 18: DRV8846 Driving 850mA RMS

4. CSD18534Q5A Thermal Performance
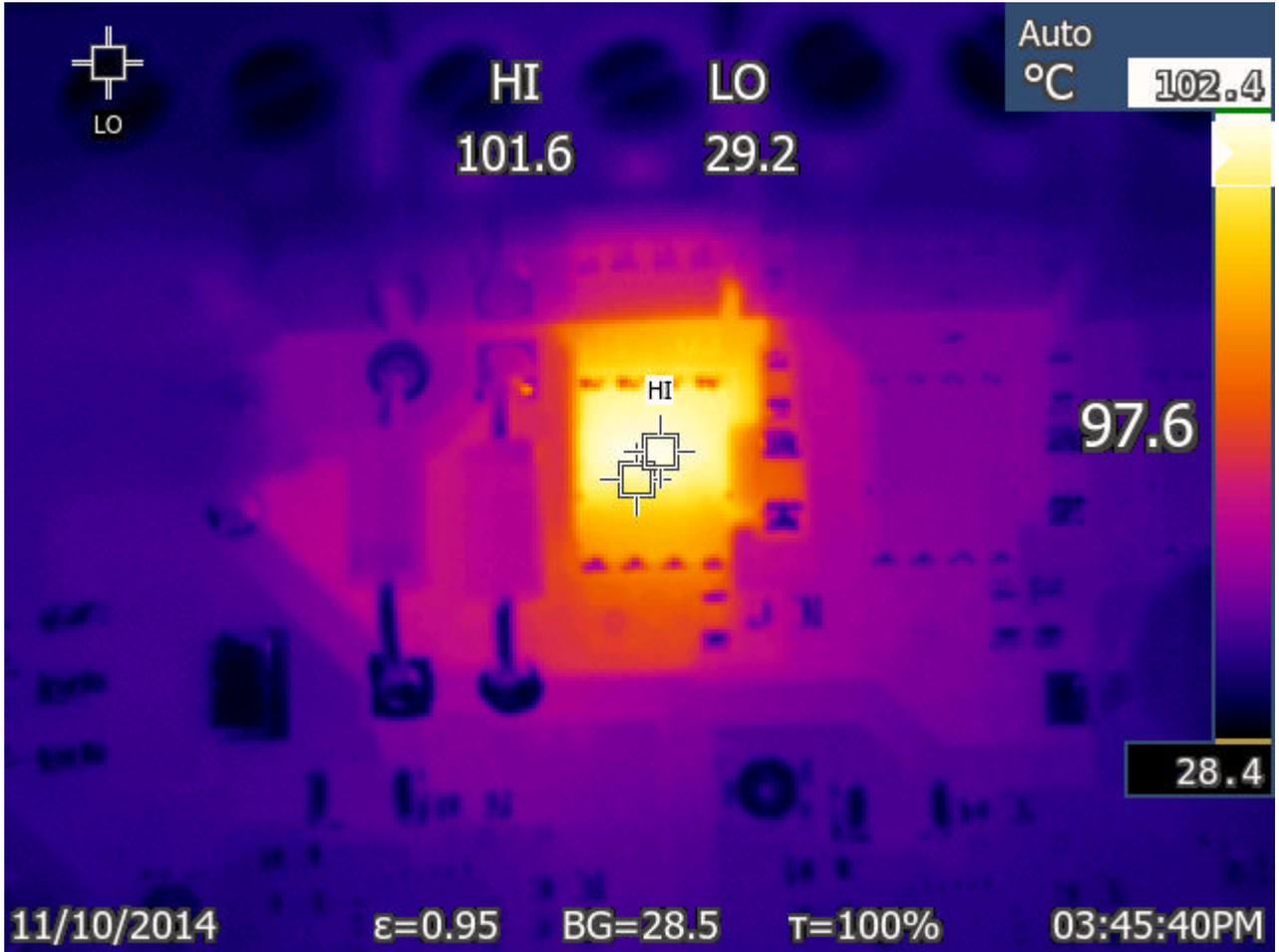
Figure 19: CSD18534Q5A Driving 9A RMS

5.   *Printed Objects*

Figure 20: 3D Printed Gears
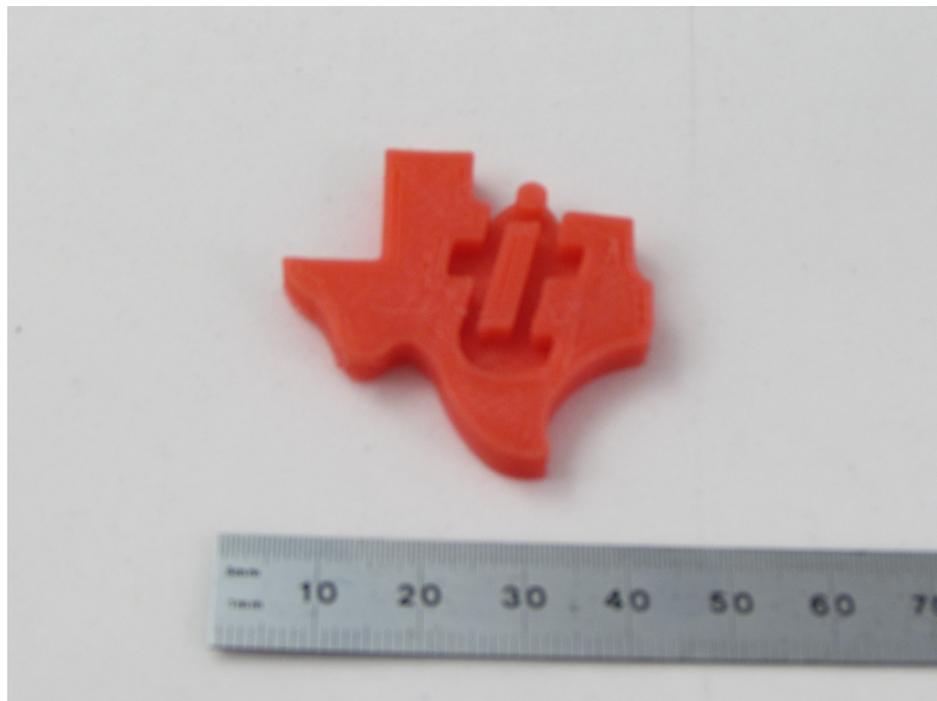
Figure 21: 3D Printed Logo

Figure 22: 3D Printed Figures

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