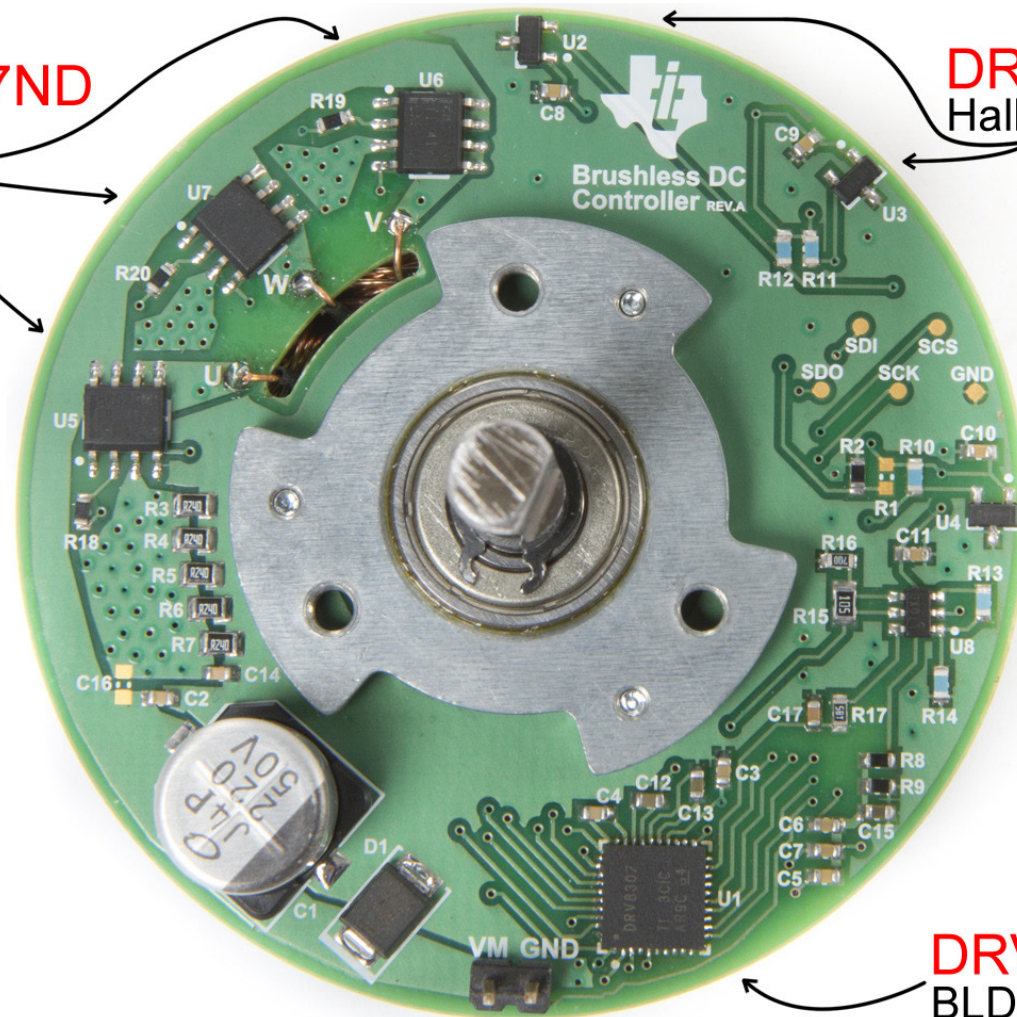


## Brushless DC Motor, TI Design

This design has a simple power connector that accepts 8.5V to 32V. The speed input to the DRV8307 is set by resistors R13 and R14, and they are set for a constant 79% duty cycle. Motor current is limited to 5.2A using the DRV8307  $V_{LIMITER}$  feature.

**CSD88537ND**  
Power FETs

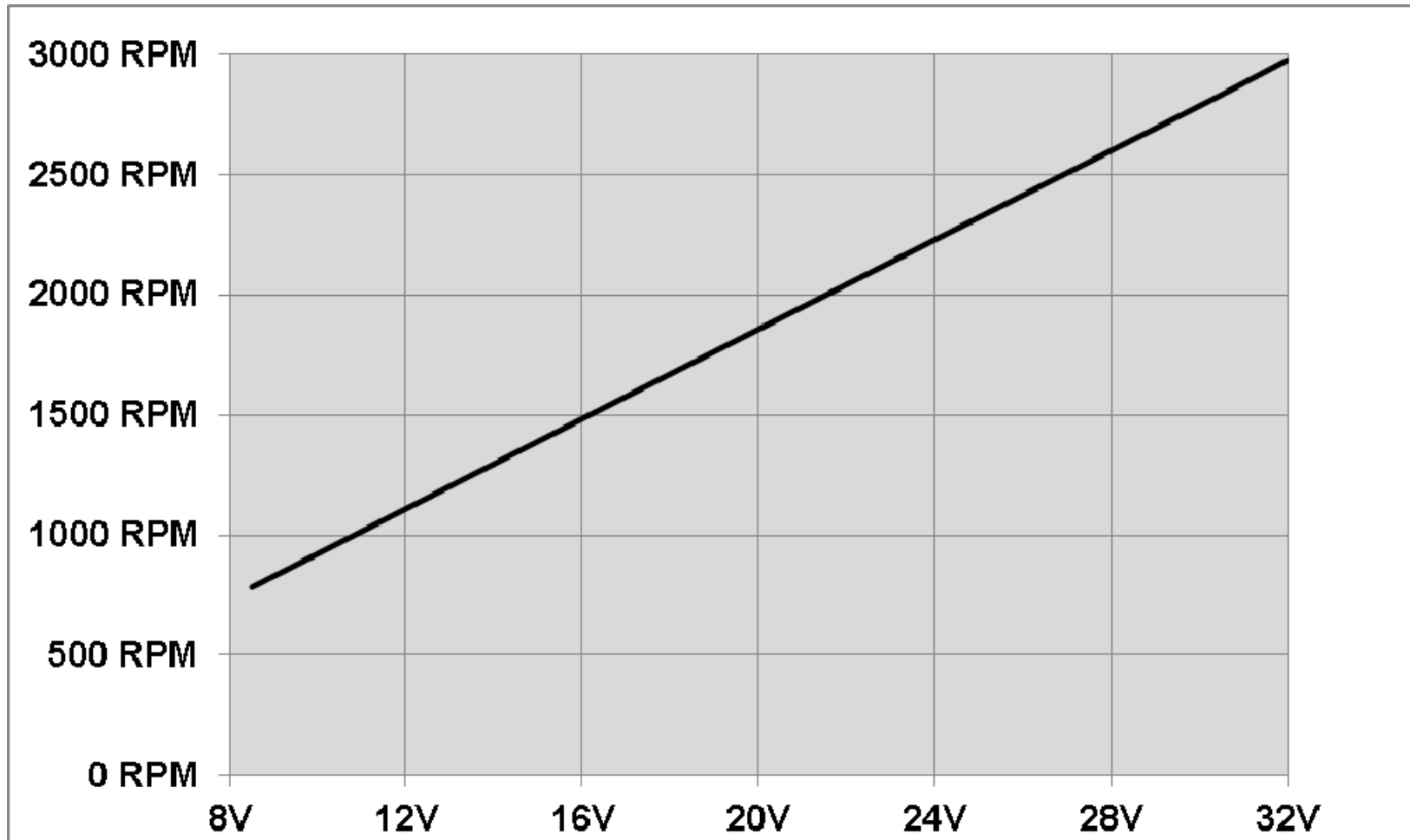
**DRV5013**  
Hall-effect sensors



**DRV8307**  
BLDC controller

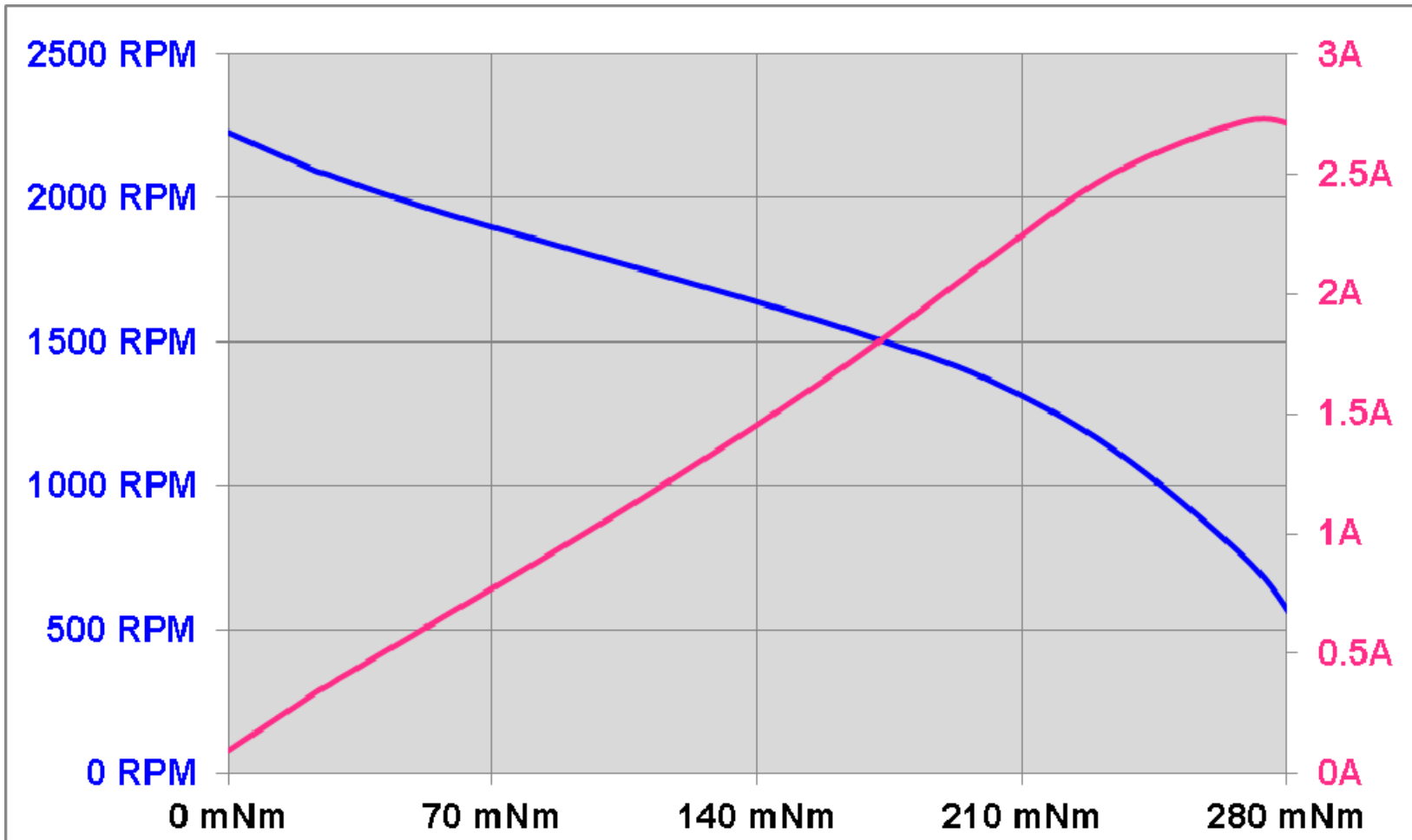


RPM vs Voltage (no load)



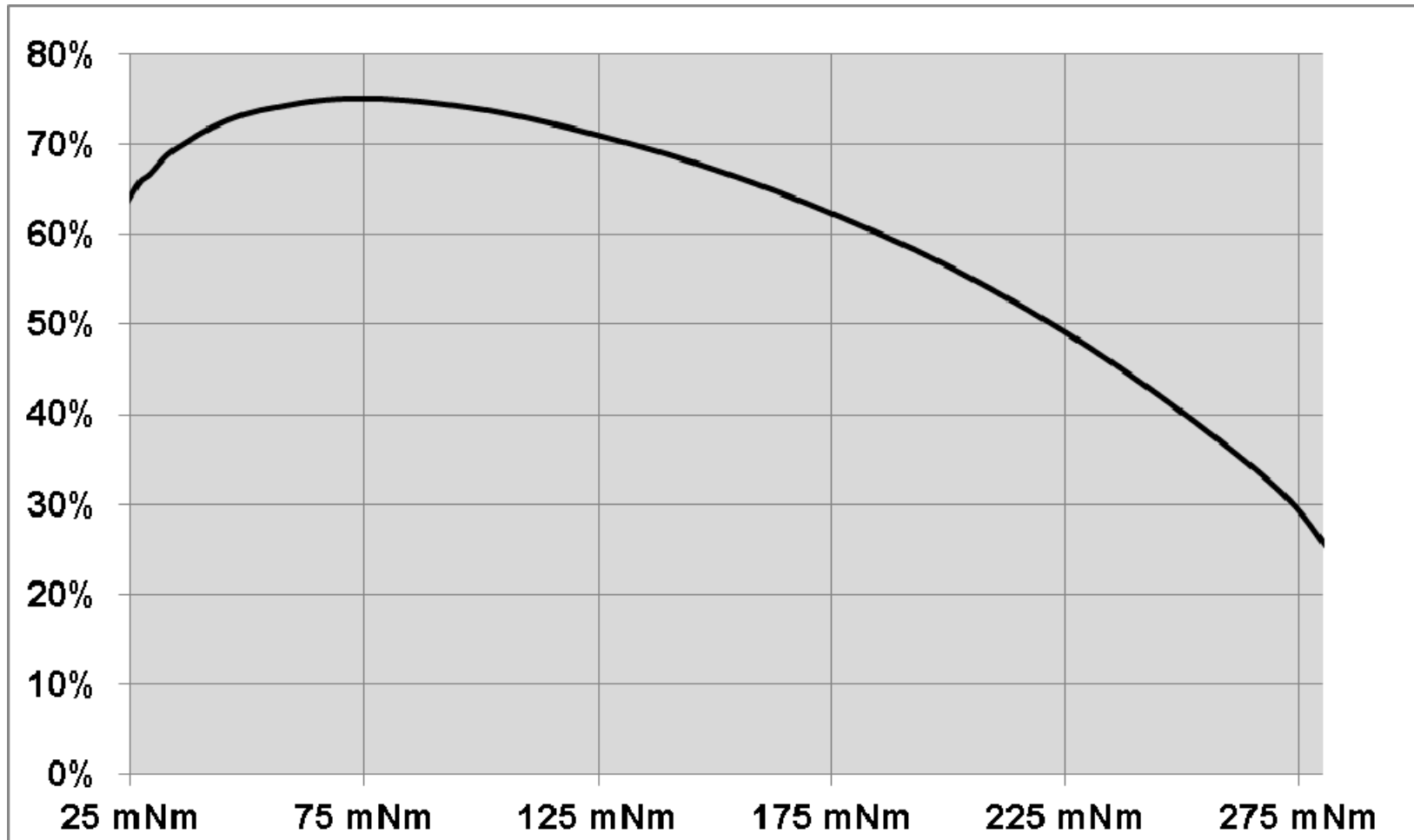
Subsequent data was taken with 24V applied.

RPM and Supply Current vs Torque



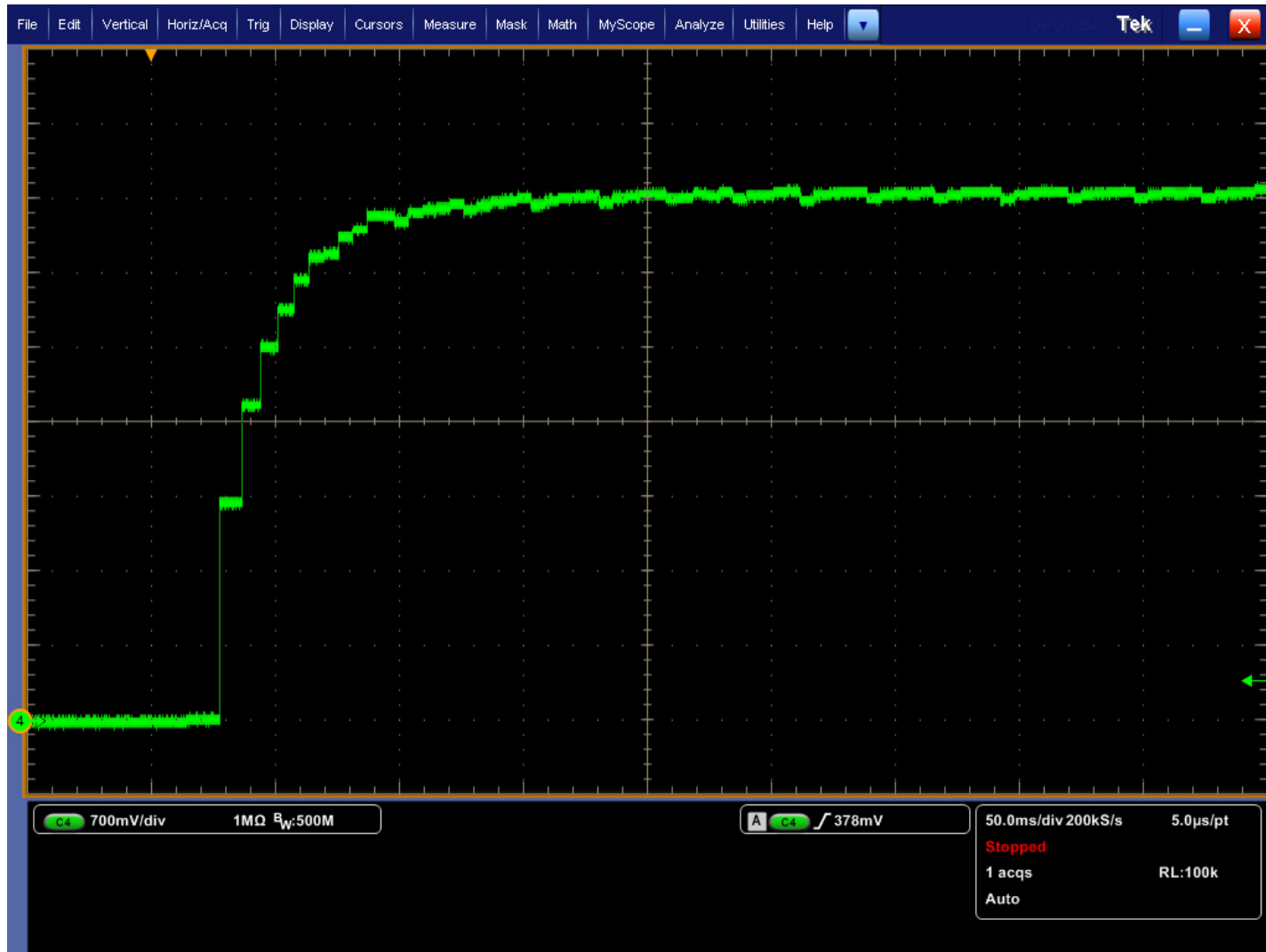
Maximum motor power is 28.8W, at 201 mNm (28.5 oz-in).

**Power Efficiency vs Torque**



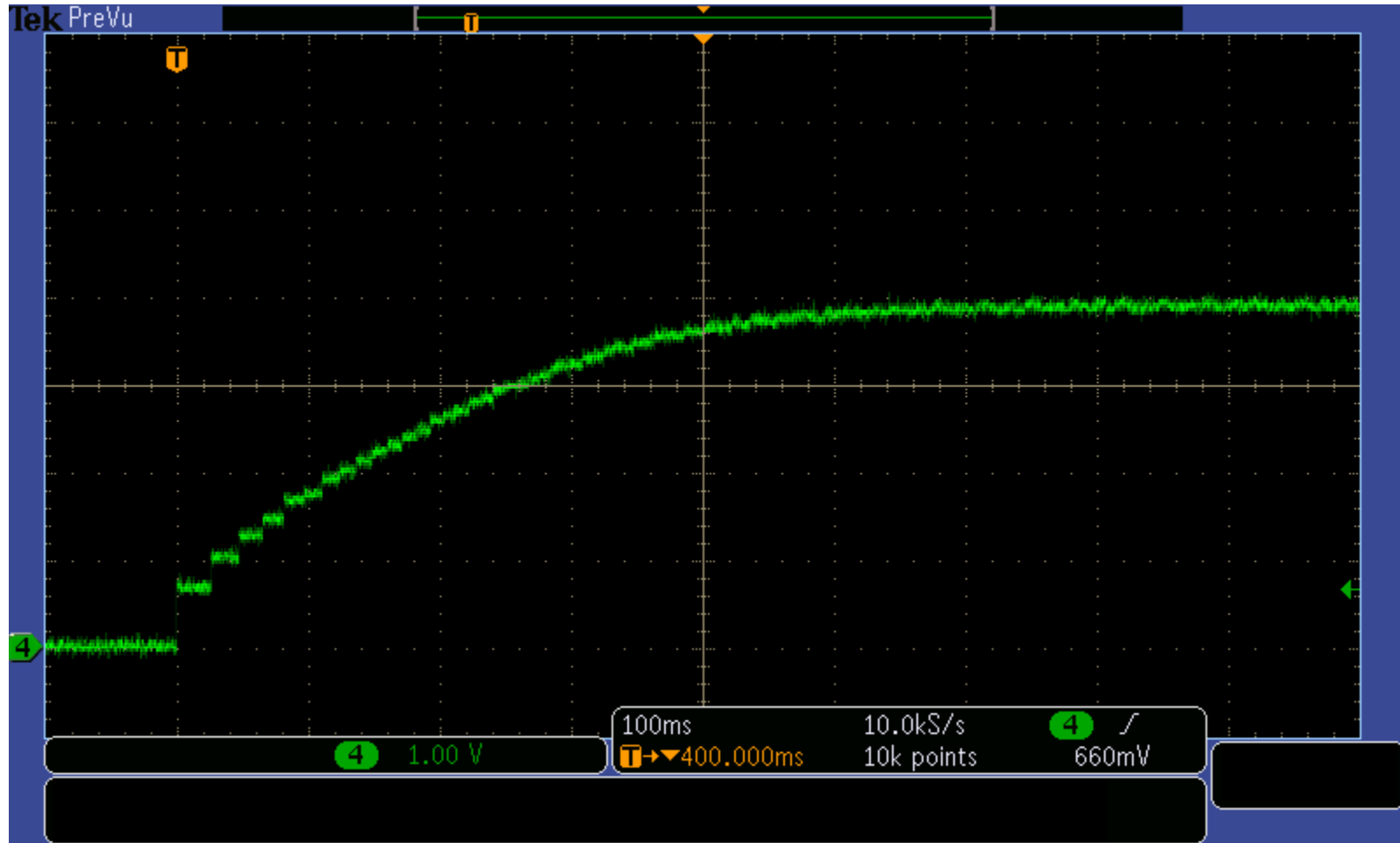
Power Efficiency = Motor Power / Supply Power = (Torque \* Speed) / (Voltage \* Current).

### Spin-up Profile with No Load



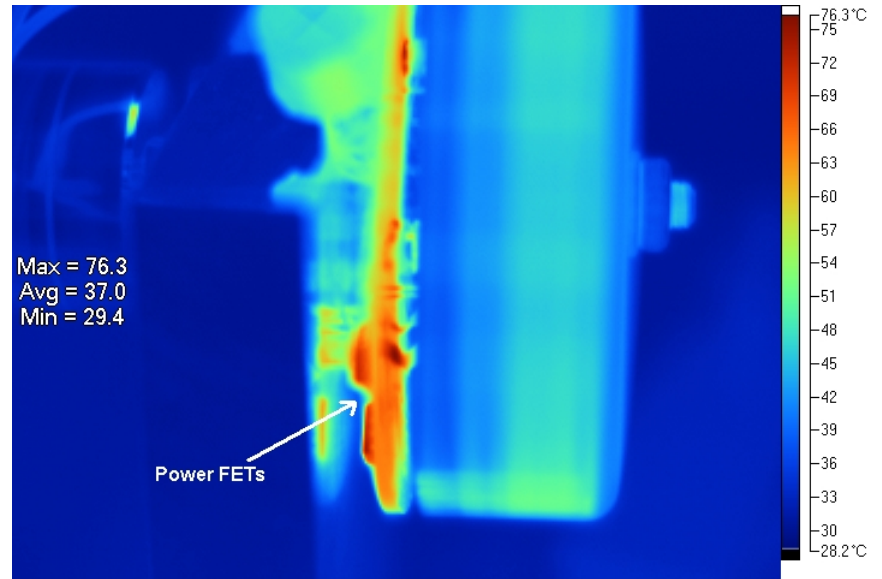
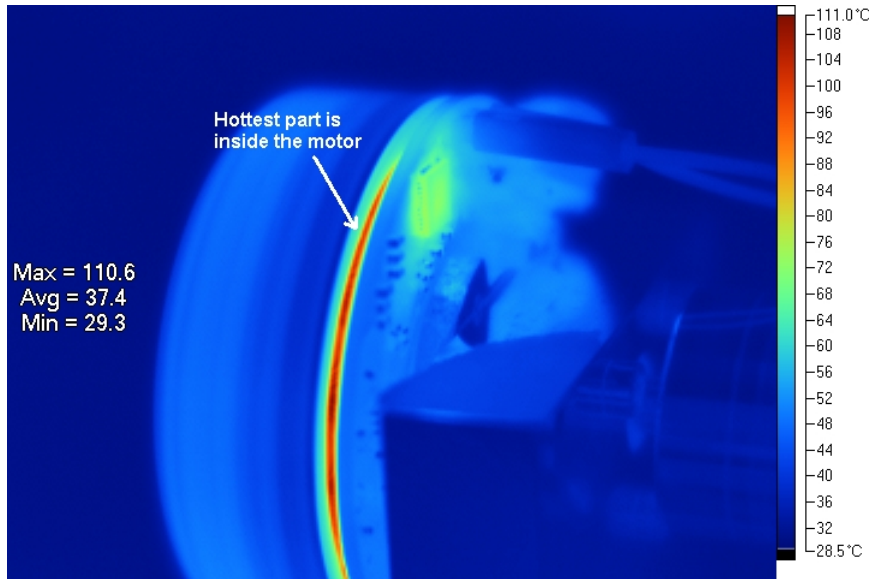
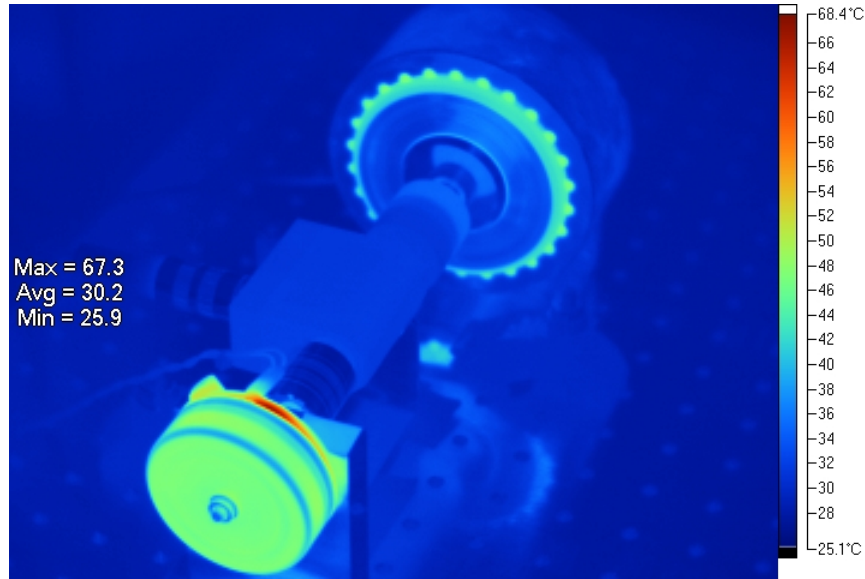
Motor speed was measured from the frequency of one Hall signal, and converted to this analog waveform. Spin-up time was 60ms. The steady-state value represents 2227 RPM.

Spin-up Profile with 105 mNm Load



Motor speed was measured from the frequency of one Hall signal, and converted to this analog waveform. Spin-up time was 500ms. The steady-state value represents 1767 RPM.

Thermal Images with 2.2A, 200 mNm Load, and 1310 RPM



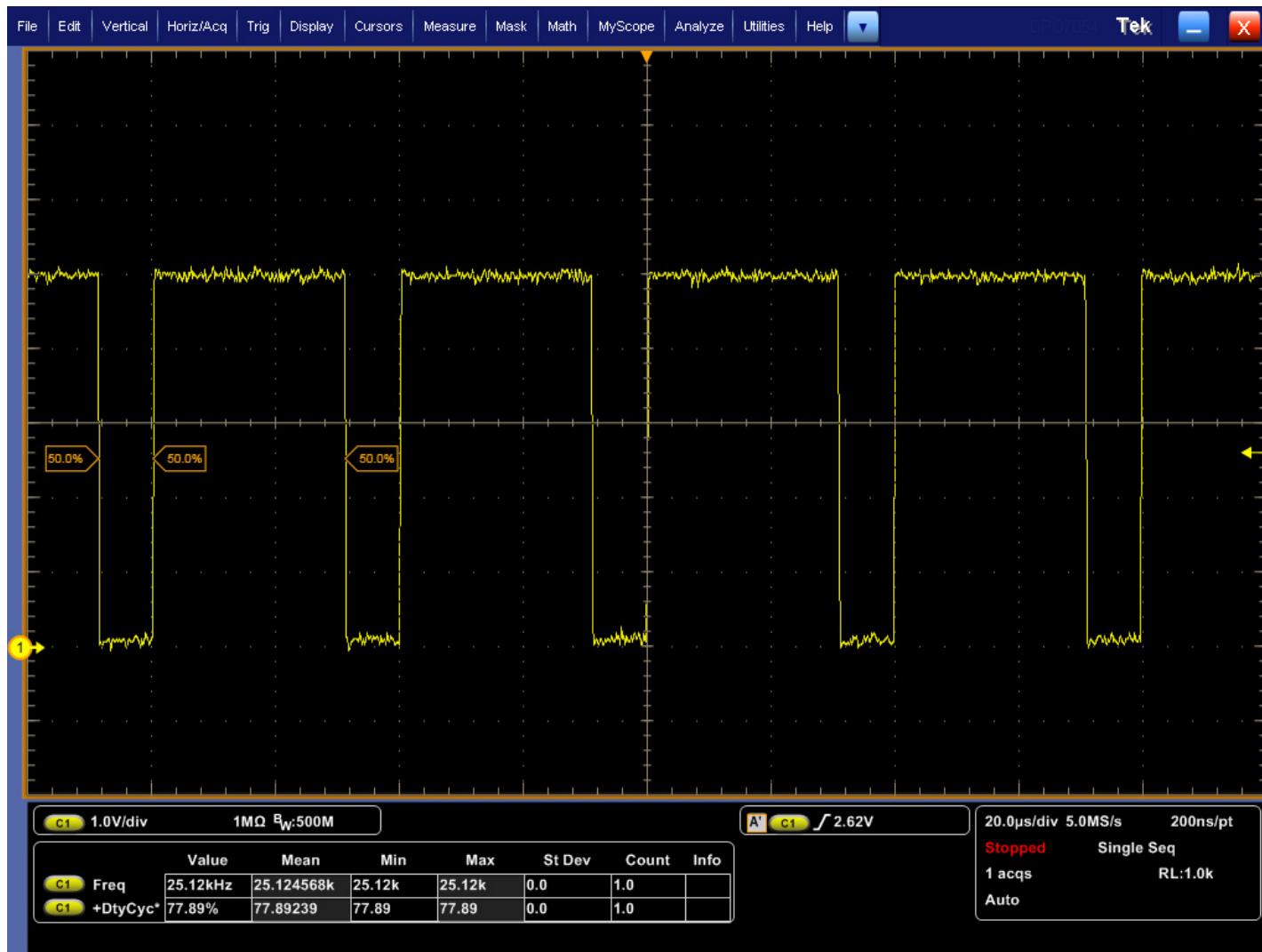


**Flutter with No Load (measured from a Hall signal)**

**0.37%**

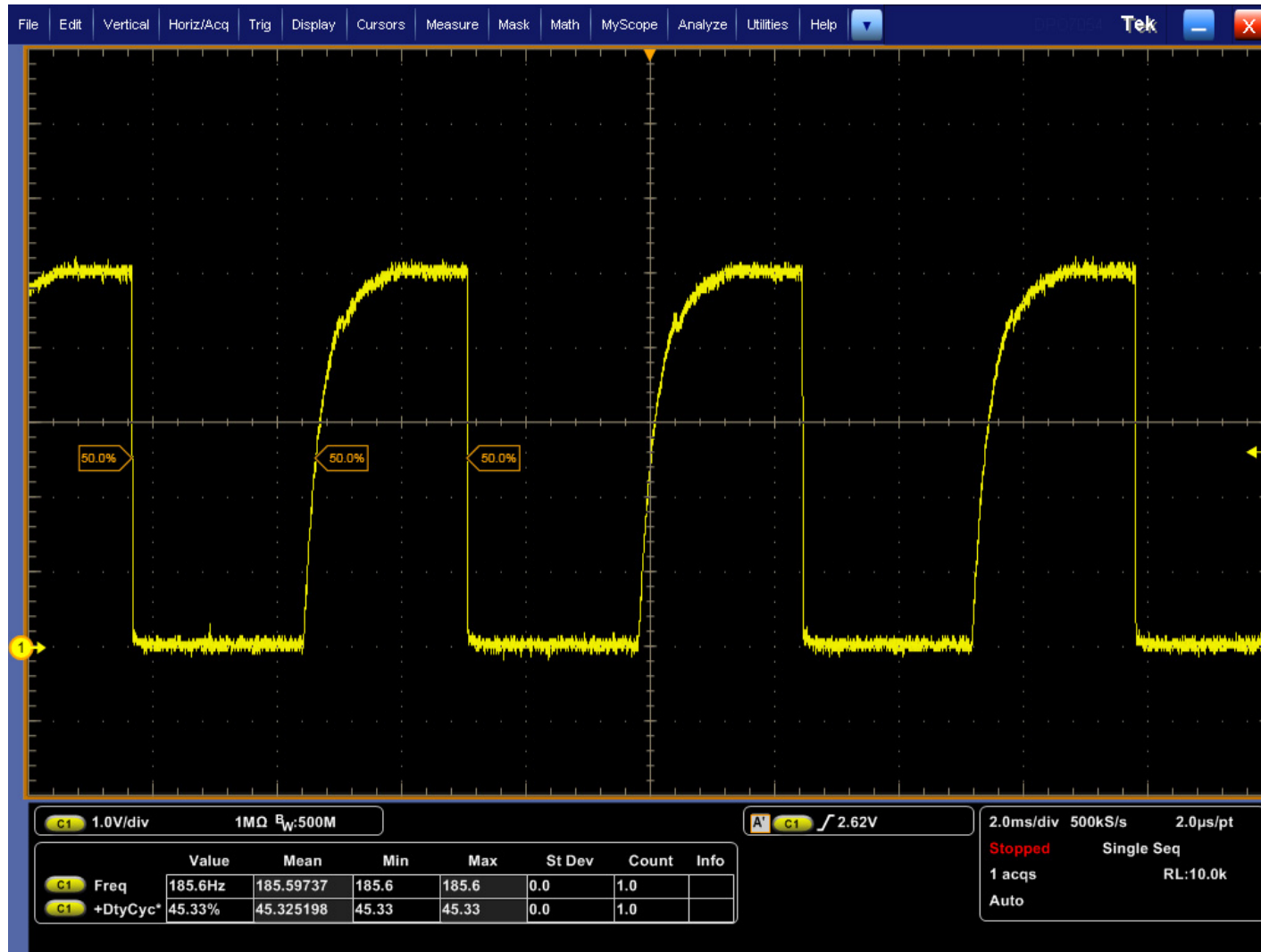
Flutter is a measure of rotational speed jitter, and it measures the edge variation of a periodic signal generated by the motor. It is most accurately measured from a serpentine board trace that senses magnetic reluctance, but in this case a Hall signal was used. The DRV8307 commutates based on 1 Hall sensor, and that improves flutter.

### Input clock to the DRV8307



This is the duty cycle speed input to the DRV8307 pin “PWM”.

### Hall-effect sensor signal



The motor has 10 permanent magnet poles, so there are 5 Hall cycles per revolution.  $185.6\text{Hz} / 5 * 60 = 2227\text{ RPM}$ .

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2021, Texas Instruments Incorporated