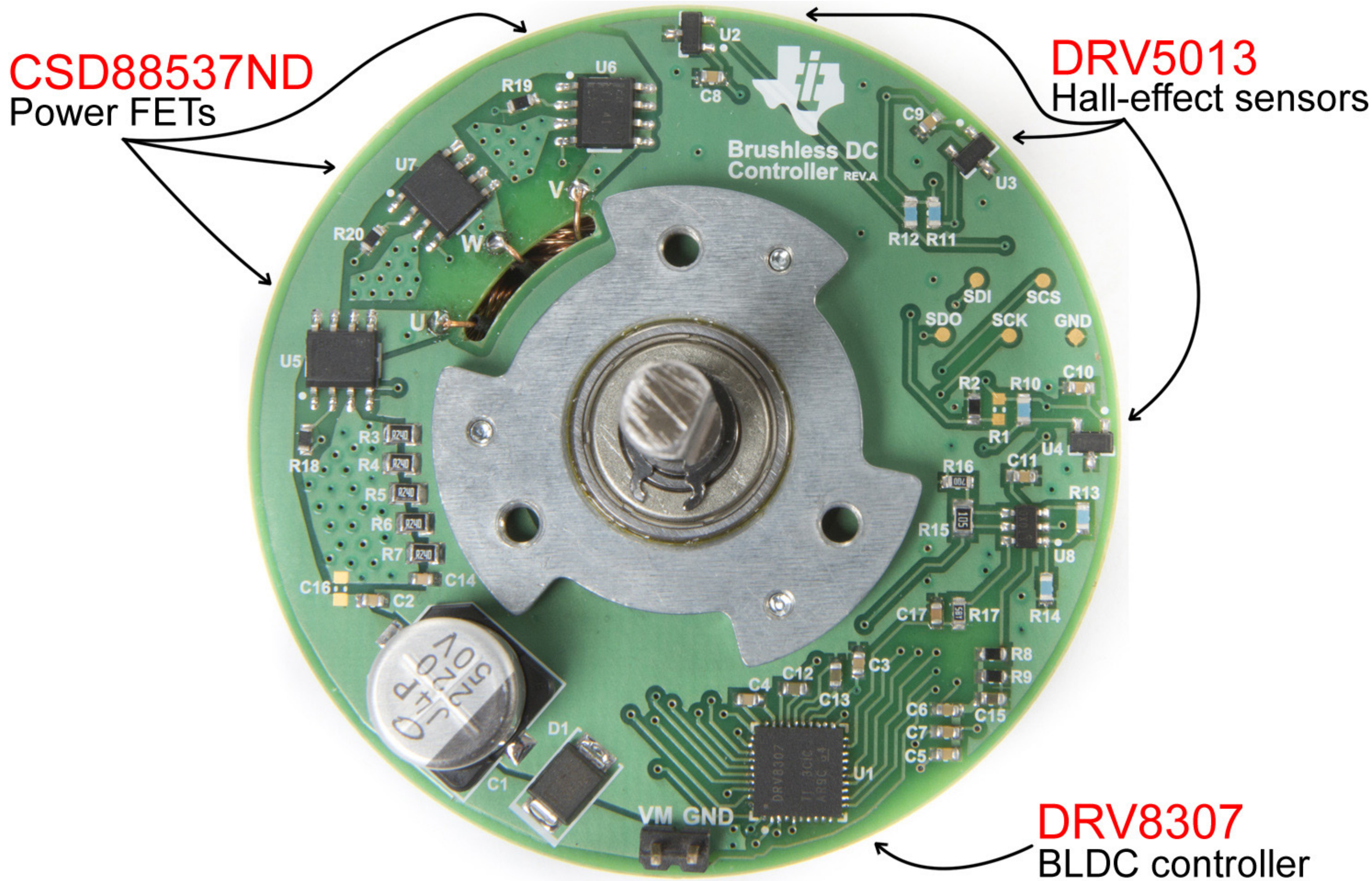
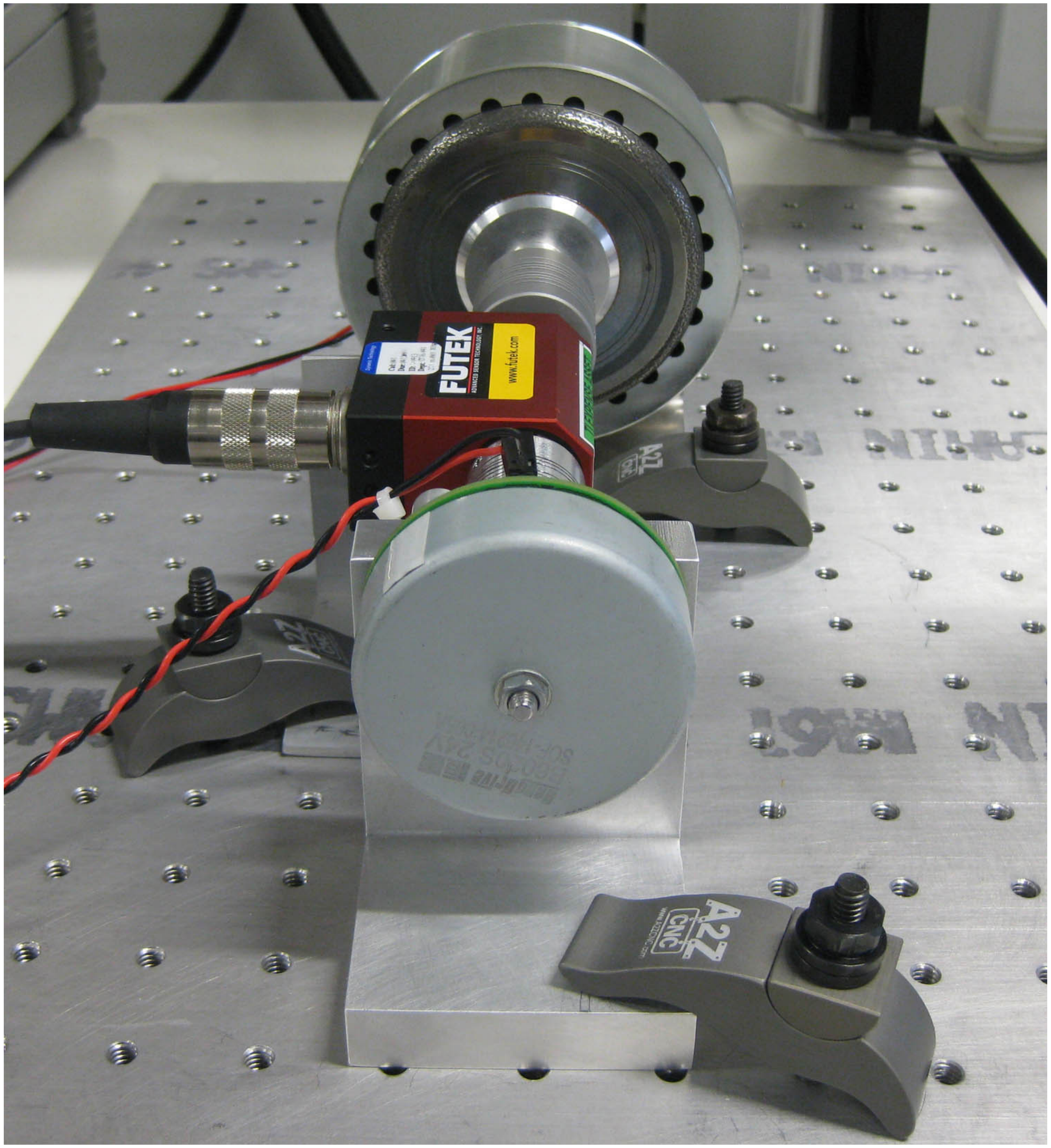
Texas Instruments

Brushless DC Motor, TI Design

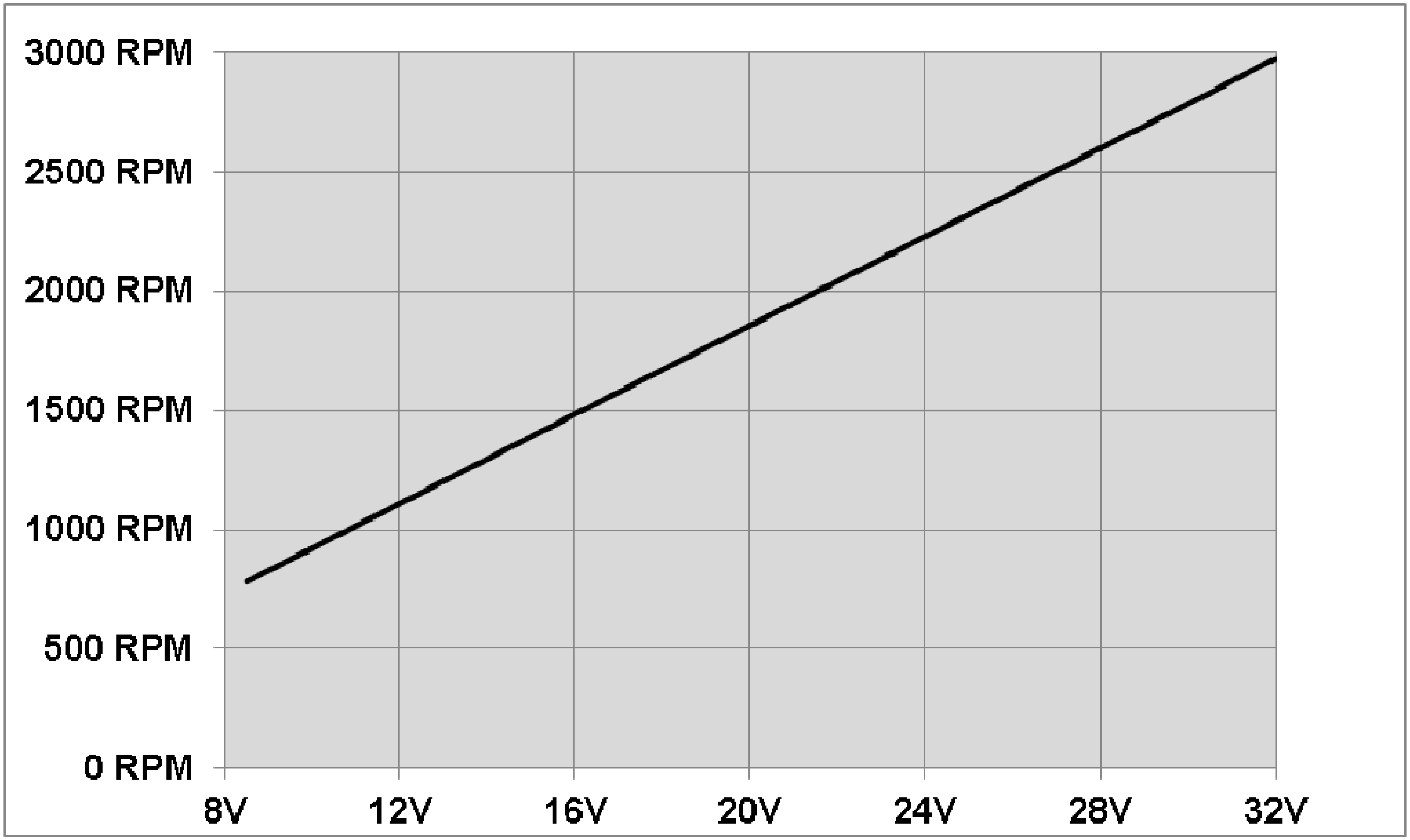
This design has a simple power connector that accepts 8.5V to 32V. The speed input to the DRV8307 is set by resistors R13 and R14, and they are set for a constant 79% duty cycle. Motor current is limited to 5.2A using the DRV8307 $V_{LIMITER}$ feature.



Test Setup

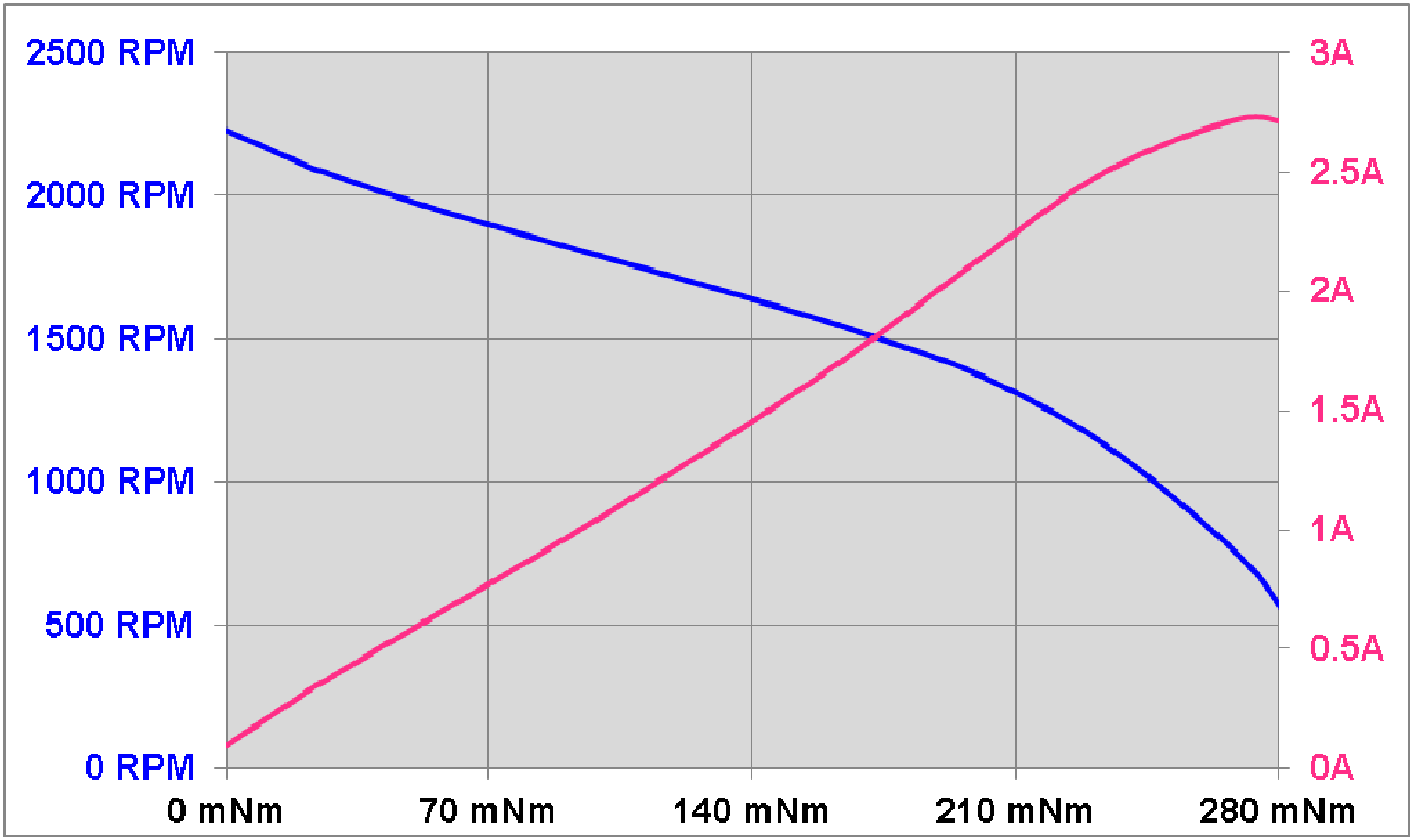


RPM vs Voltage (no load)



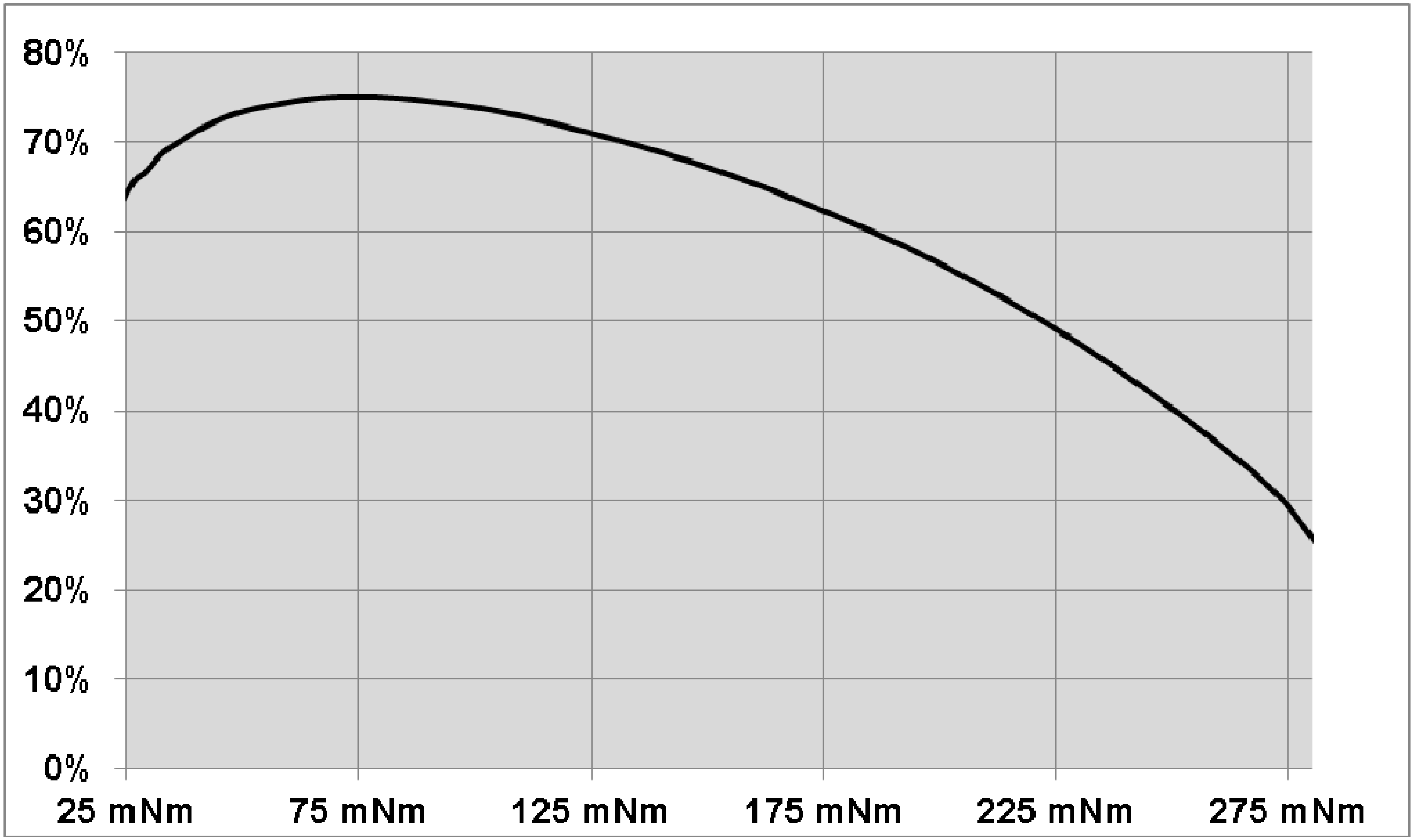
Subsequent data was taken with 24V applied.

RPM and Supply Current vs Torque



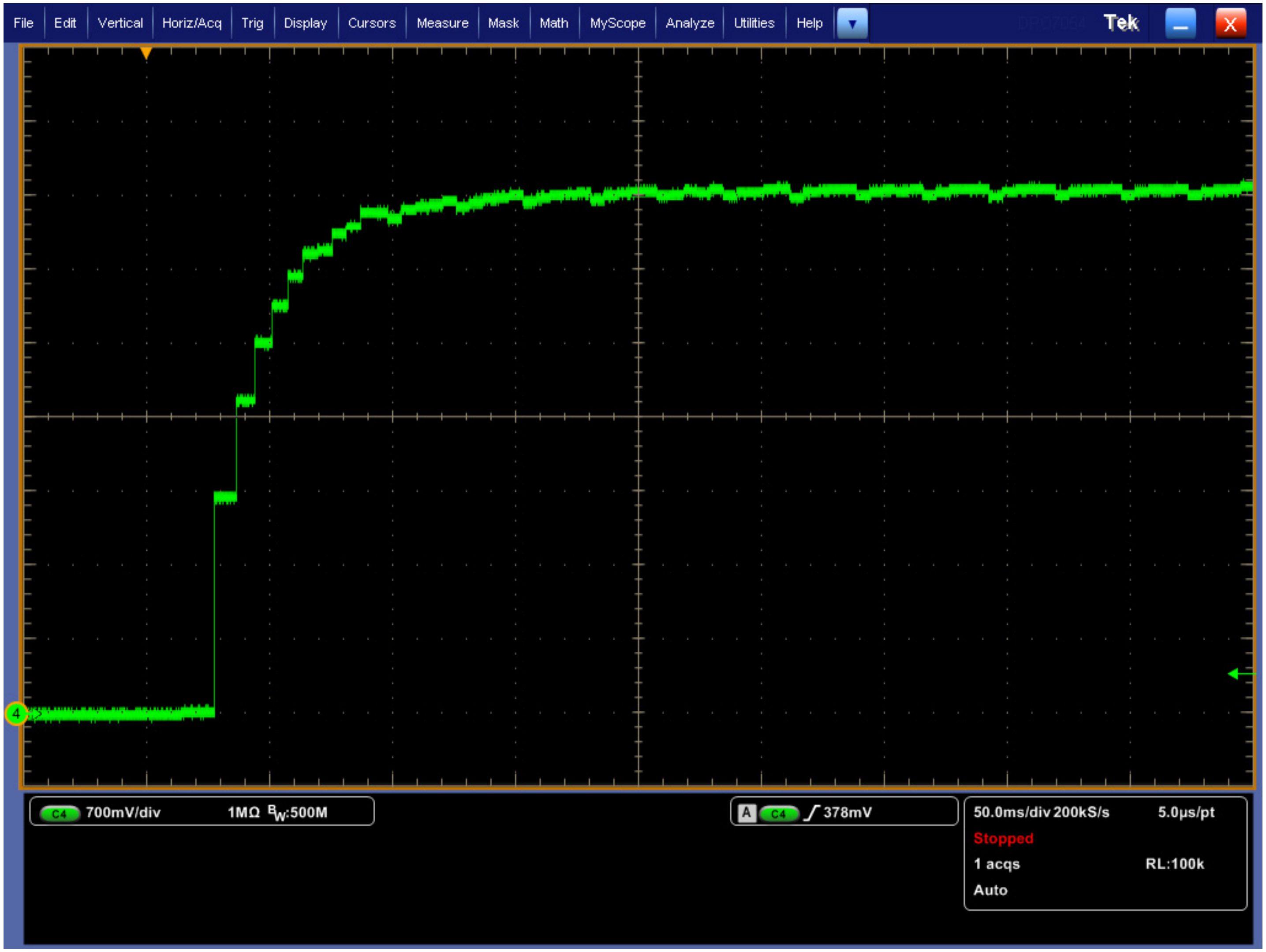
Maximum motor power is 28.8W, at 201 mNm (28.5 oz-in).

Power Efficiency vs Torque



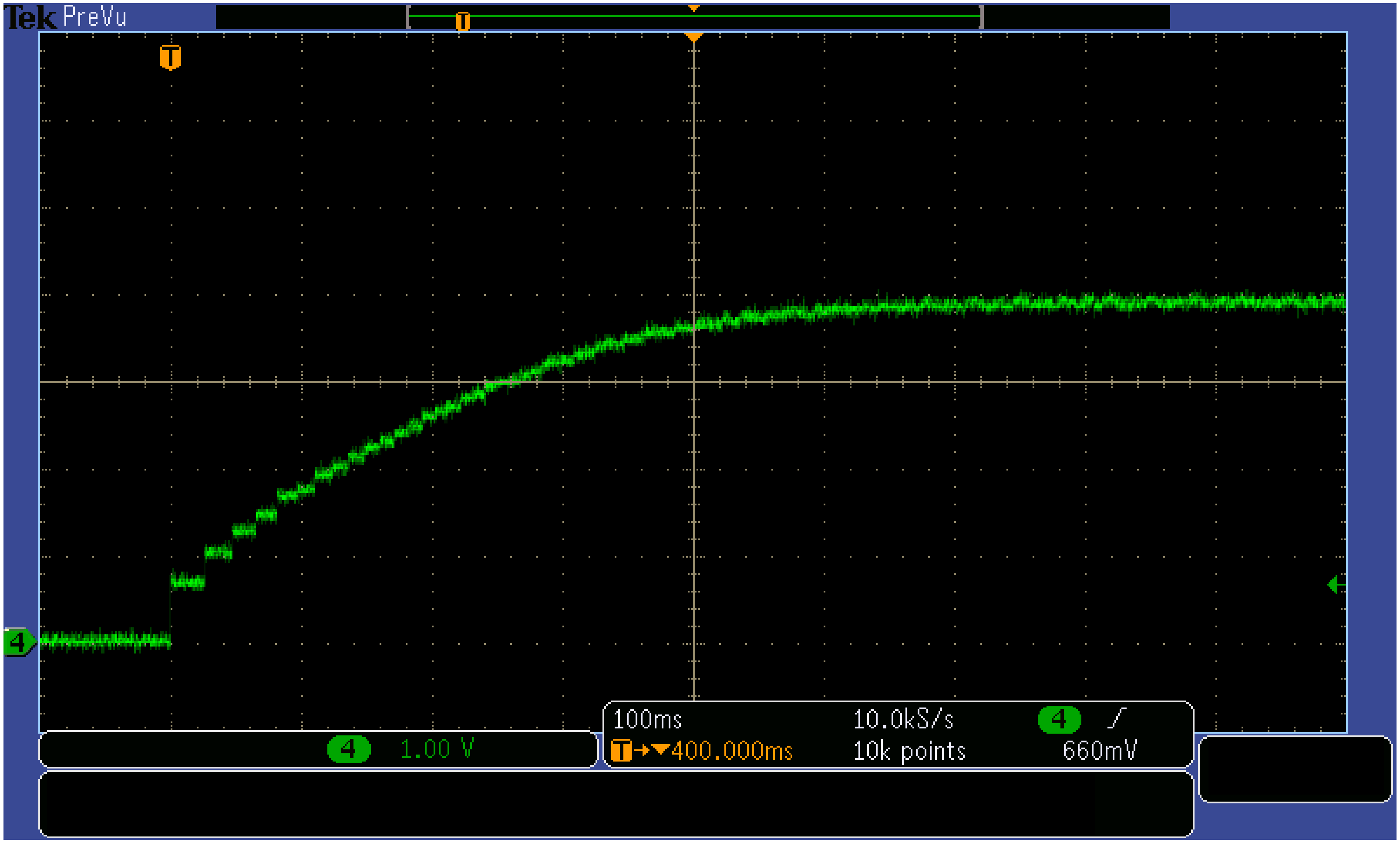
Power Efficiency = Motor Power / Supply Power = (Torque * Speed) / (Voltage * Current).

Spin-up Profile with No Load



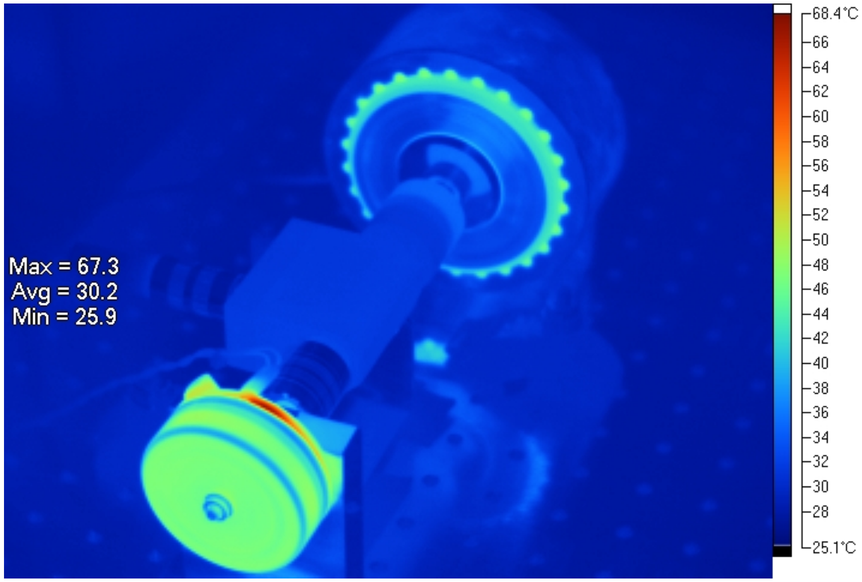
Motor speed was measured from the frequency of one Hall signal, and converted to this analog waveform. Spin-up time was 60ms. The steady-state value represents 2227 RPM.

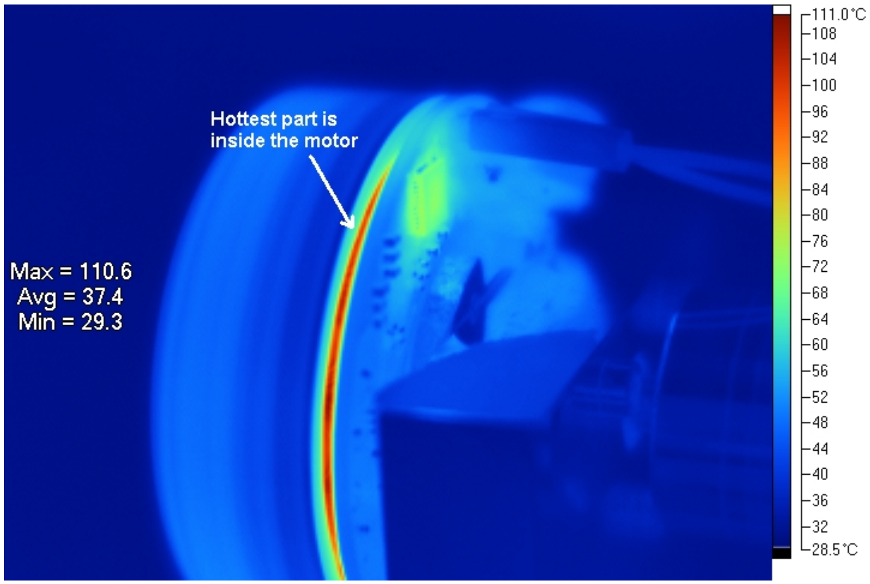
Spin-up Profile with 105 mNm Load

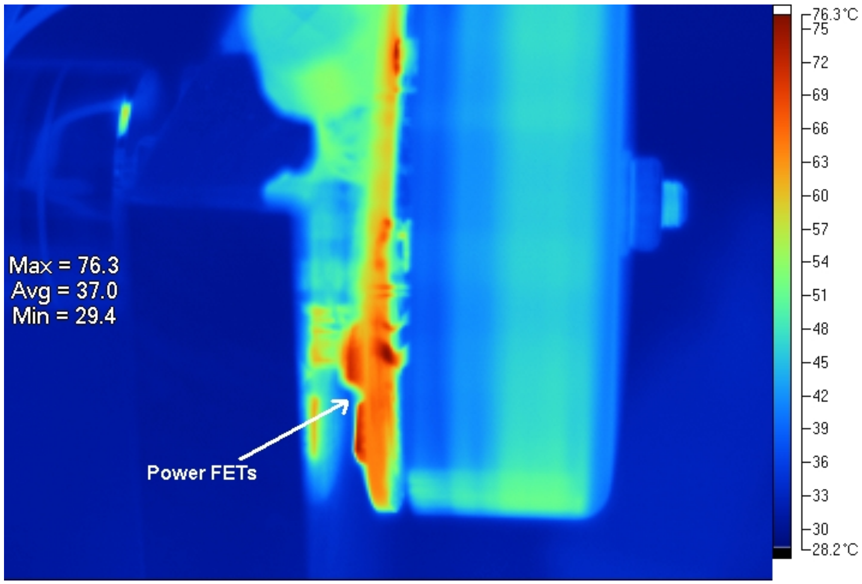


Motor speed was measured from the frequency of one Hall signal, and converted to this analog waveform. Spin-up time was 500ms. The steady-state value represents 1767 RPM.

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





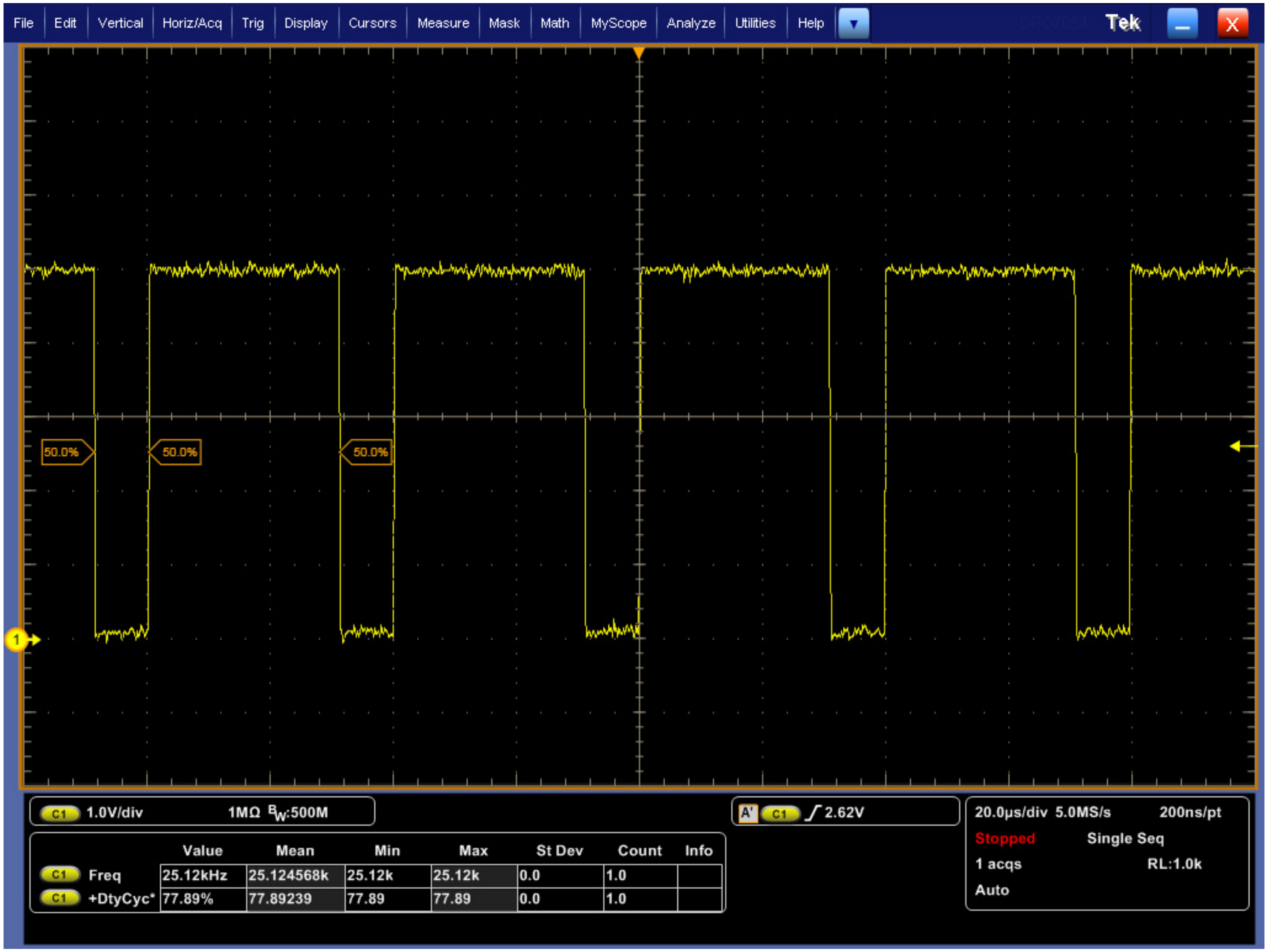


Flutter with No Load (measured from a Hall signal)

0.37%

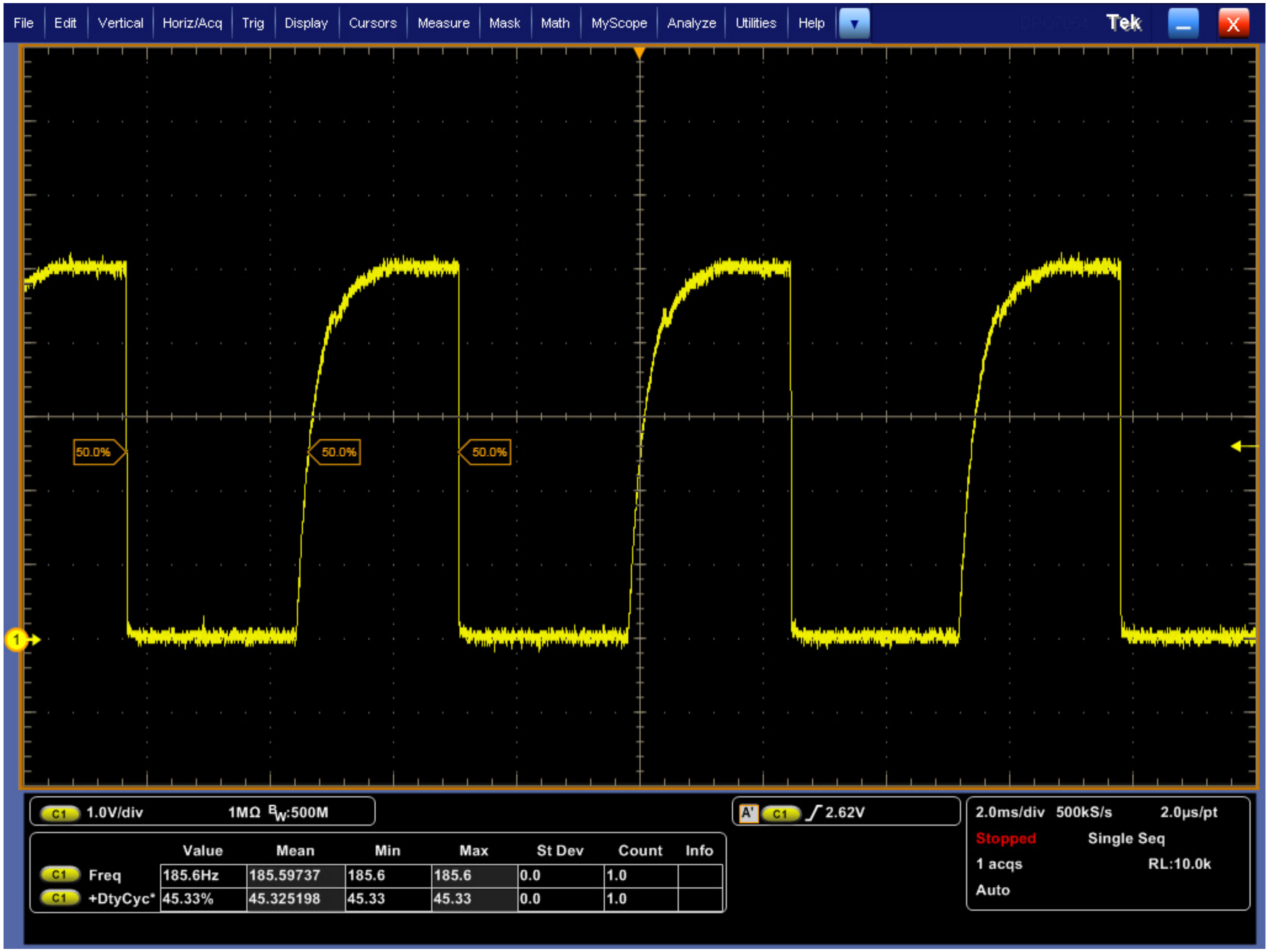
Flutter is a measure of rotational speed jitter, and it measures the edge variation of a periodic signal generated by the motor. It is most accurately measured from a serpentine board trace that senses magnetic reluctance, but in this case a Hall signal was used. The DRV8307 commutates based on 1 Hall 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. 185.6Hz / 5 * 60 = 2227 RPM.