This sensor-less drive design works on the principle of integrating the back-emf of the unexcited motor phase to determine commutation. To demonstrate the effectiveness of the sensor-less control scheme used in this design, the following parameters were verified in this test report. The first two were done with 3 different motors at different speeds at 24V.

- **Commutation accuracy**: This is a measure of how accurately phase voltage transitions match Hall signals transitions.
- **Flutter**: This is a measure of rotational speed jitter, and it measures the edge variation of a periodic signal generated by the motor. It is measured from Hall signals as the ratio of the max-to-min vs mean frequency of one Hall signal.
- **Power handling capacity**: This is performed at 48V, to test maximum power of the design.

![Figure 1: DRV8313 Reference design Circuit Card Assembly](image)
Figure 2: Motor Phase Voltage with respect to Hall-sensor for Test Motor-1

- Motor poles: 8
- Average speed during test: \(164.4 \times 120 / 8 = 2466 \text{rpm}\)\(^1\)
- % flutter as per Hall-A: \((164.7 - 164) / 164.4 * 100 = 0.43\%\)
- % flutter as per Hall-B: \((164.6 - 164.1) / 164.4 * 100 = 0.3\%\)
- Average flutter: 0.37 %

\(^1\) Speed in Rpm = (120*Hz/motor-pole)
Figure 3: Motor Phase Voltage with respect to Hall-sensor for Test Motor-2

- Motor poles-8
- Average speed during test: \(252.3 \times 120 / 8 = 3780\) rpm
- % flutter as per Hall-A: \((253.5 - 252.6) / 251.8 \times 100 = 0.67\%\)
- % flutter as per Hall-B: \((253.0 - 250.0) / 252 \times 100 = 0.79\%\)
- Average flutter: 0.73\%
Figure 4: Motor Phase Voltage with respect to Hall-sensor for Test Motor-3

- Motor poles: 8
- Average speed during test: \(100.35 \times 120 / 8 = 1505\) rpm
- \% flutter as per Hall-A: \((101.4 – 99.91) / 100.4 \times 100 = 1.48\%\)
- \% flutter as per Hall-B: \((100.9 - 100.1) / 100.3 \times 100 = 0.8\%\)
- Average flutter: 1.1 \%
Sensor-less 3-phase BLDC Drive, TIDA-00274

Figure 5: 3-Phase output voltages and phase current at 48Vdc/0.75Adc input

- Motor poles: 16
- Average speed during test: $36.3 \times 120 / 16 = 272$ rpm
- Motor phase current – 1.27Arms/1.9Apk
- Power Input = 36 watt
Figure 6: Thermal image at 48Vdc/0.75Adc, Pin = 36Watts
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