# *TI Designs: TIDA-00141*

## *Automotive Brushed Motor Drive for Flip Up Displays - Test Data*

This document shares the tests results of the logic board and the TPS65320-Q1 EVM with a MingHon BDC motor (FF-050SK-11170). The hardware on the logic board includes the DRV8832-Q1.

The data is structured into three main categories:

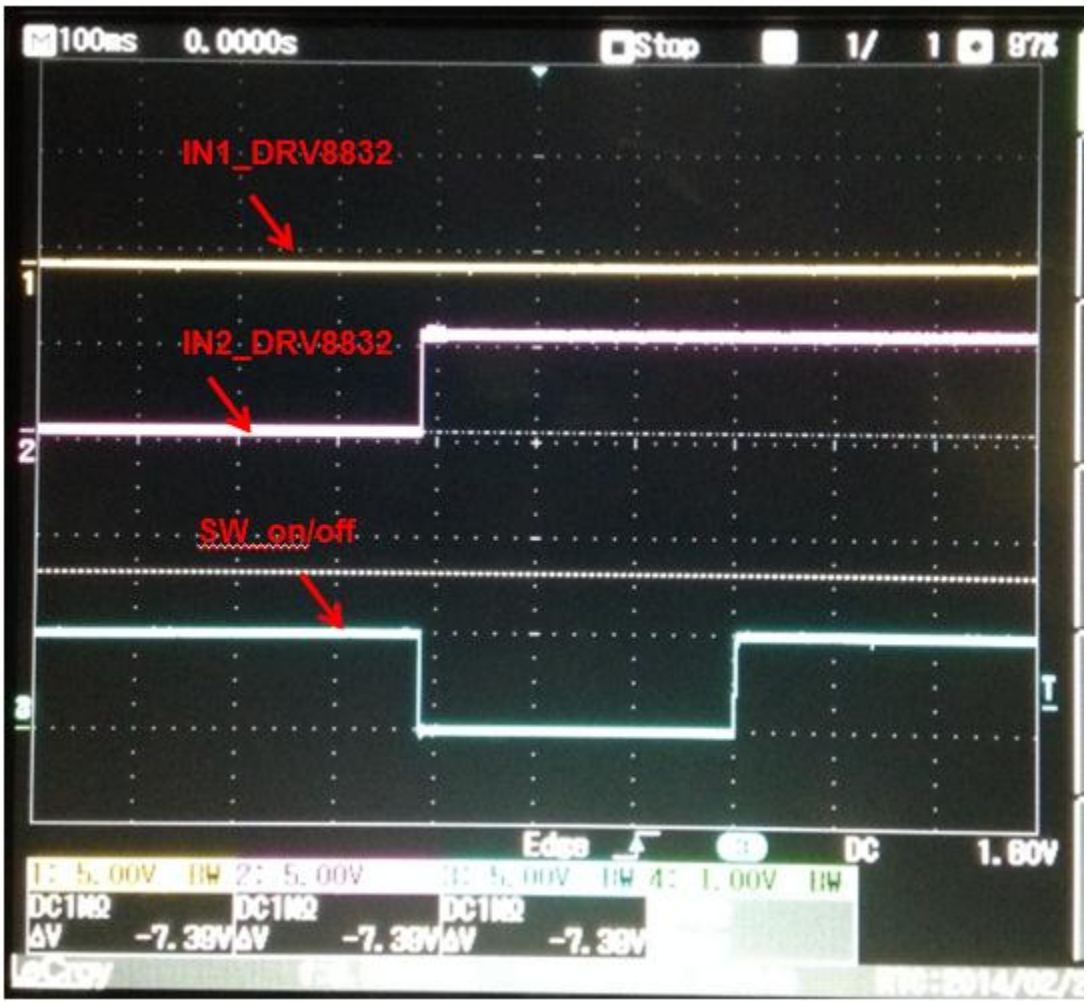
1. Single Motor Bi Directional Control
2. Fault detection
3. Thermal Image of Device Under Operation

**Section 1:**

Motor is connected between OUT1 and OUT2 (J11) of logic board. The data demonstrates the logic behavior at IN1 and IN2 of the DRV8832-Q1 when the motor is commanded to OPEN and CLOSE as per the following table. The duty cycle is not varied. (Speed is not varied).

The following table shows two scenarios where the flip up display is opening. In the first row, no limit switch is pressed. In the second row, the limit switch “Lim_C” is pressed.

| Switch action | Sw_on/of | nFault | CLK_U6 | Q_U6 | /Q_U6 | Q+_U6 | Q_U3 | Lim_O | Lim_C | IN1 | IN2 | Buck_EN | What do we need to do?(corresponds with Q_U6) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| sw pr | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | drive open |
| sw pr | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | drive open |




In the above figure, the signals illustrate the situation when the flip up display is commanded to OPEN. The user switch (SW_on/off) is pressed, IN1 is low, IN2 is high, and the flip up display opens. The oscilloscope is set to trigger off of the user switch (SW_on/off).

The following table shows two scenarios where the flip up display is closing. In the first row, no limit switch is pressed. In the second row, the limit switch “Lim_O” is pressed.

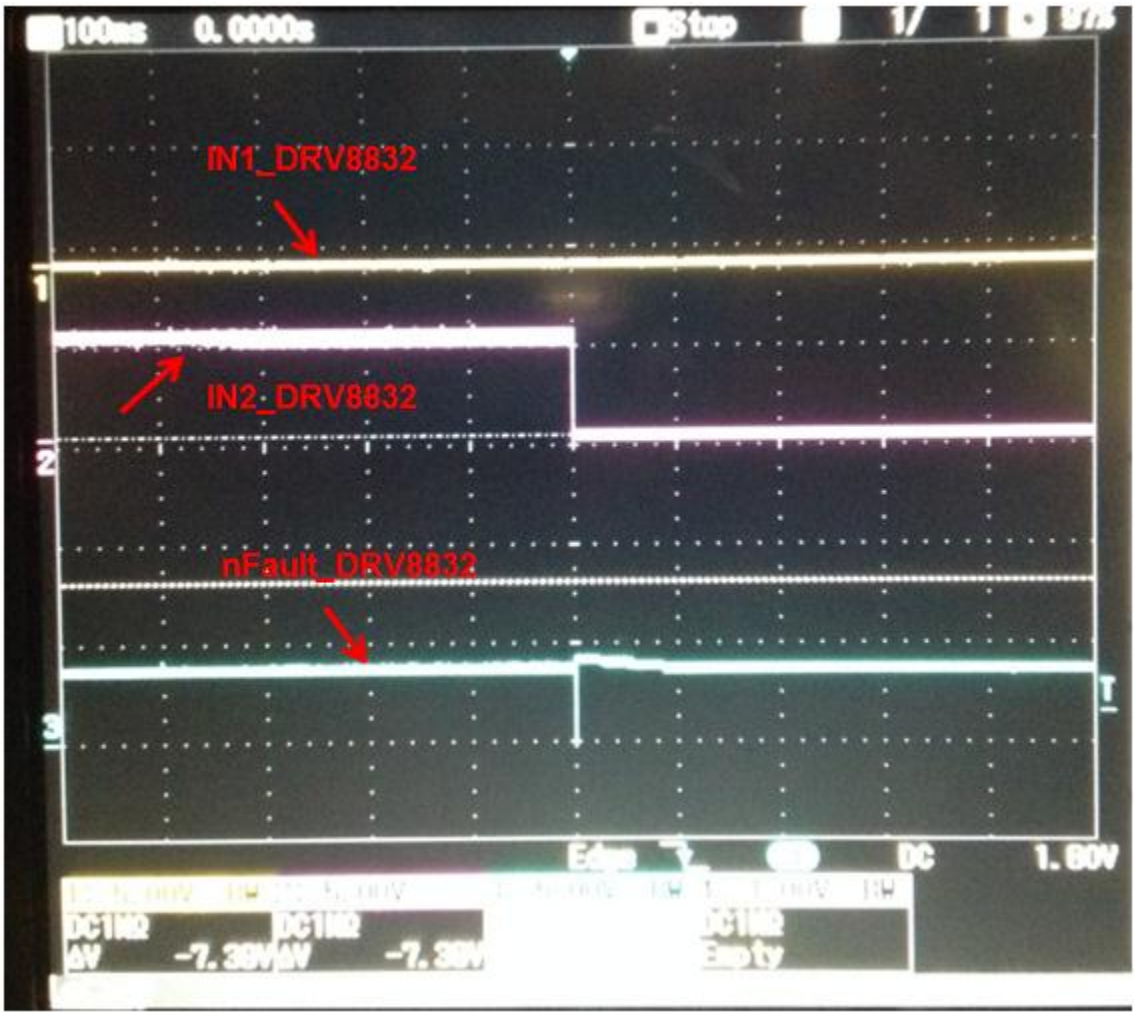
| Switch action | Sw_on/of | nFault | CLK_U6 | Q_U6 | /Q_U6 | Q+_U6 | Q_U3 | Lim_O | Lim_C | IN1 | IN2 | Buck_EN | What do we need to do?(corresponds with Q_U6) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| sw pr | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | drive close |
| sw pr | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | drive close |

In the above figure, the signals illustrate the situation when the flip up display is commanded to CLOSE. The user switch (SW_on/off) is pressed, IN1 is high, IN2 is low, and the flip up display closes. The oscilloscope  is set to trigger off of the user switch (SW_on/off).

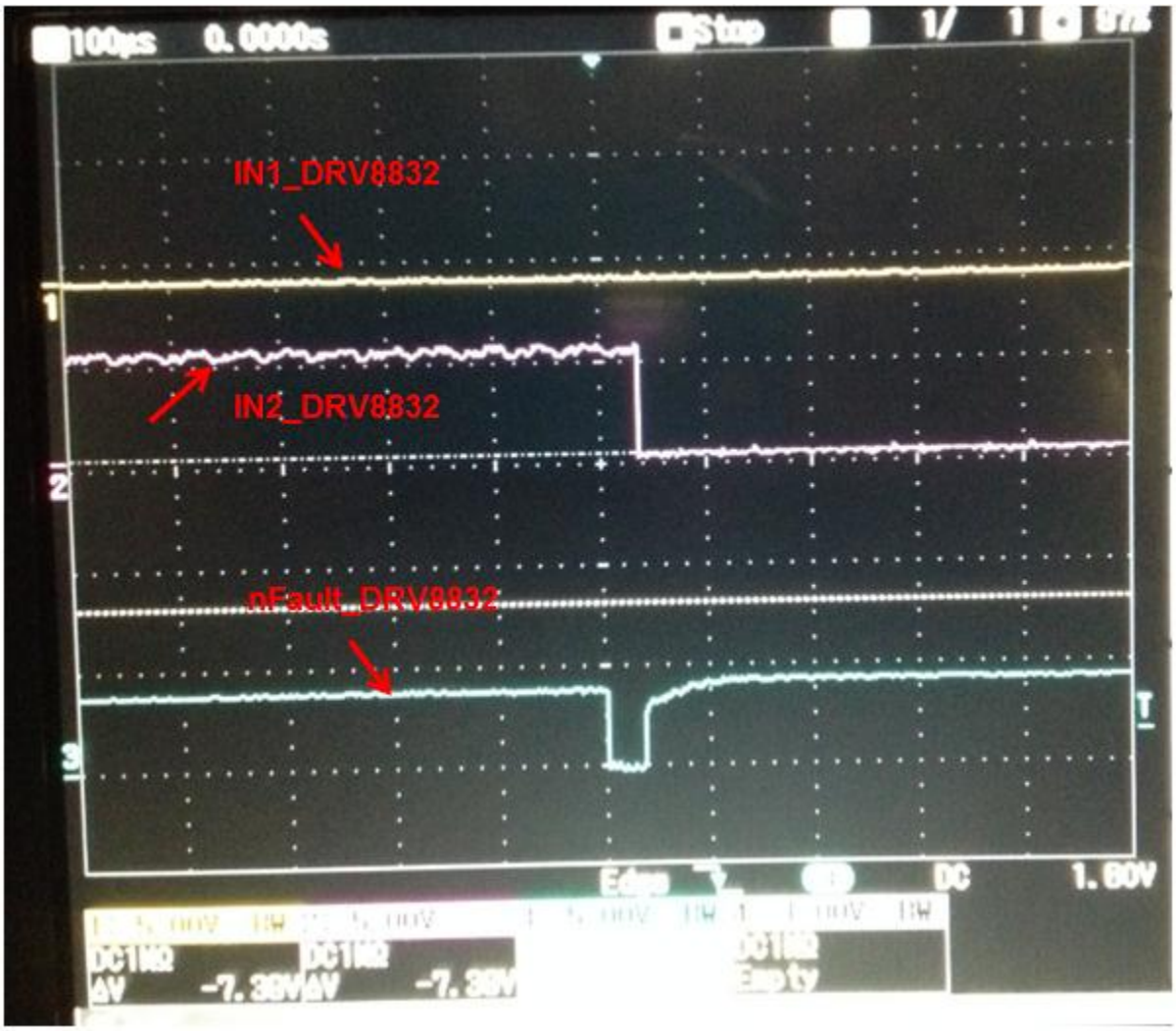
**Section 2:**

The following table shows a fault condition. If nFault is 0, the motor stops (IN1=0, IN2=0).

| Switch action | Sw_on/of | nFault | CLK_U6 | Q_U6 | /Q_U6 | Q+_U6 | Q_U3 | Lim_O | Lim_C | IN1 | IN2 | Buck_EN | What do we need to do?(corresponds with Q_U6) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| x | x | 0 | x | x | x | x | x | x | x | 0 | 0 | 0 | DRV8832 fault - turns off |

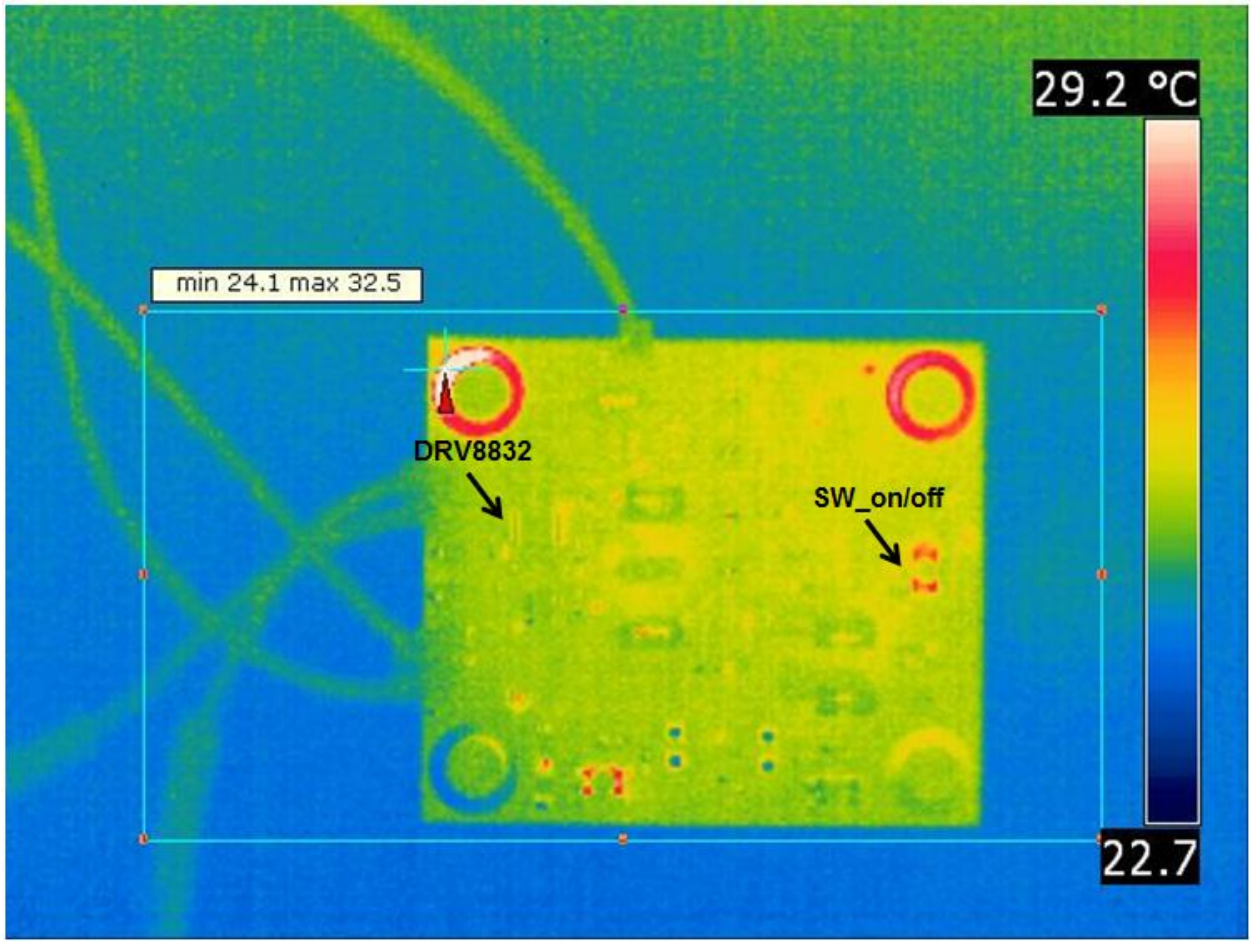



In the above figure, the signals illustrate the situation when a fault occurs. A fault occurs when an overcurrent is reached. In this case, an obstacle (the user's hand) was put in front of the display as it was moving. The flip up display was opening (IN1=0, IN2=1), a fault occurred, then the display stopped moving (IN1=0, IN2=0). The oscilloscope is set to trigger off of the nFault signal.




The above figure is the same scope shot as the previous figure. This time, the signals are zoomed in to further emphasize the nFault signal.

**Section 3:**




The above thermal image was taken with a FLIR thermal camera. The flip up display was repeatedly opened and closed for 15 minutes before the thermal image was taken. The figure above shows most of the heat (red) dissipated through the ground pads in the corners. This is because the two red ground pads are closest to the DRV8832-Q1 and the user switch. The DRV8832-Q1 is the only component on the board to dissipate a significant amount of heat and the user switch is heated up through the user's touch.

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