

Abstract

This test report describes the results obtained from procedures undertaken to test the TIDA-00296/SAT0103 reference design, "BCM Load Driver".

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A. Load configuration

The load configuration used for the testing described in this report follows – loads were selected according to power requirements and subject to availability.

- TPS92630 – LED driver, 3 channels
 1. 30mA rated white LED (PCB mounted)
 2. 30mA rated white LED (PCB mounted)
 3. 30mA rated white LED (PCB mounted)
- TPL7407L – Low-side driver, 5 outputs
 1. Eiko 194 glovebox/taillight lamp
 2. Eiko 194 glovebox/taillight lamp
- LMD18400 – High-side driver, 4 outputs
 1. Automotive relay – power window actuator
 2. Automotive relay – power window actuator
 3. Automotive relay – windshield wiper actuator
 4. Automotive relay – windshield wiper actuator
- LM9061 – Pre-FET driver, 1 output
 1. Seat heater
- High-side driver, 1 output
 1. Automotive relay – HVAC blower
- TPIC44H01 – Pre-FET driver, 4 outputs
 1. Seat heater*
- High-side/low-side driver, 4 outputs
 1. Automotive relay – Door lock actuator

* Note the seat heater loads are direct driven, thus the heating element is powered directly from system input battery power. Due to the high current requirement of a seat heater at 12V, only one seat heater was used for overall system testing, driven by the LM9061.

B. Start-up and shut-down power sequence

The system power rails are shown during start up in Figure 1. The 12V plot is a direct battery connection, before system protection and step down is applied.

The 5V and 3.3V plots are taken from jumpers around the board and thus may be subject to negligible voltage drops from the power supply outputs. The system is fully loaded during these tests.

Figure 2 shows the shut-down power sequence when system input power is cut. The 3.3V rail shows a slow decay to steady state at 0V, which occurs off plot.

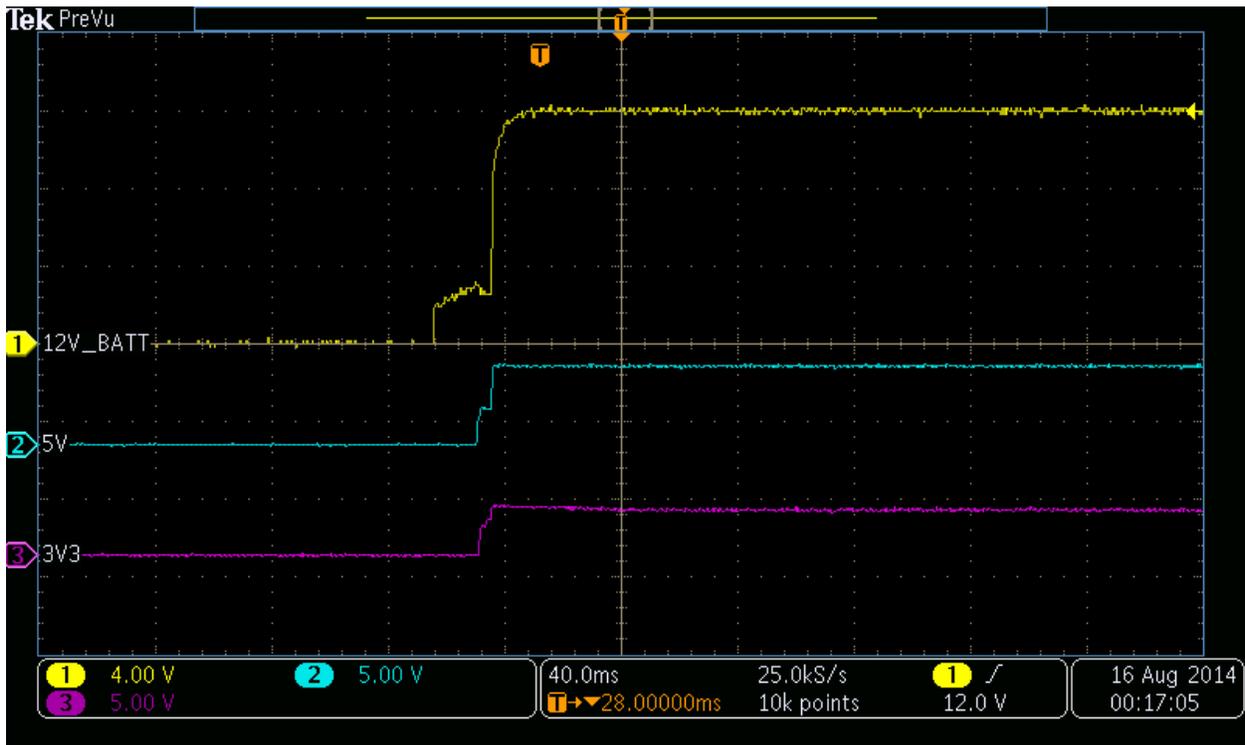


Figure 1 - Start-up sequence

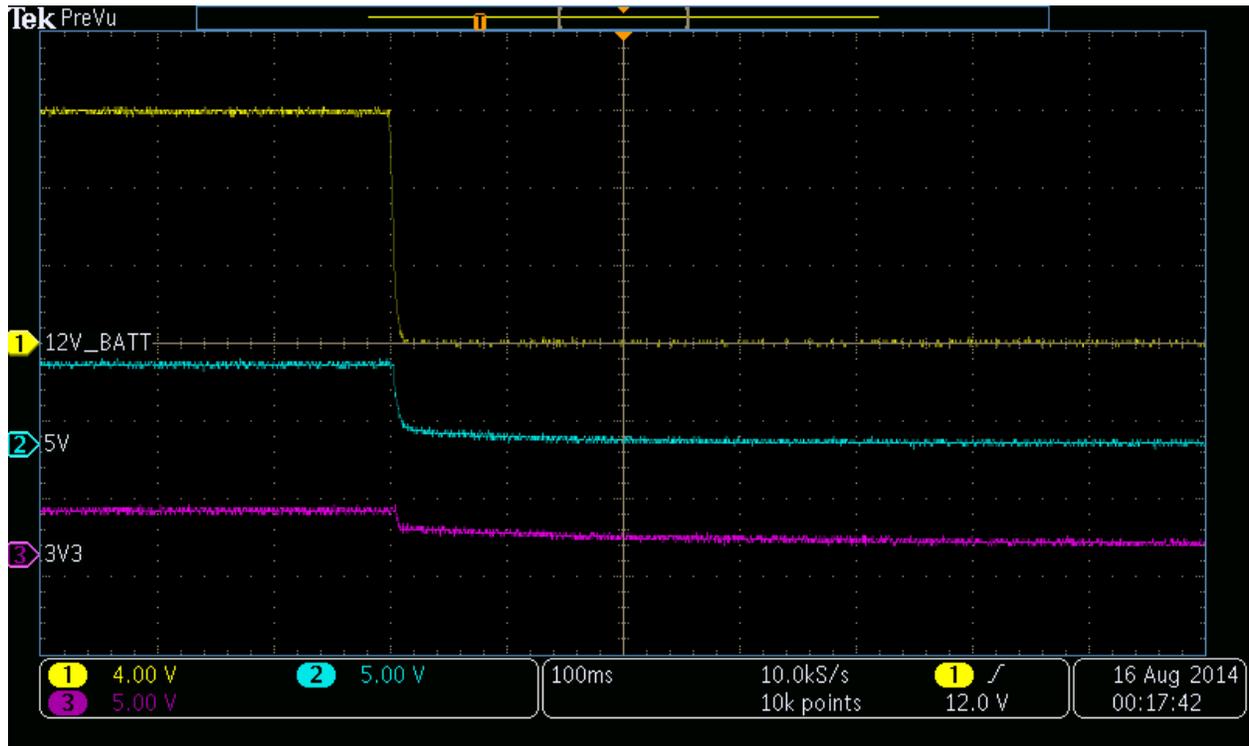


Figure 2 – Shut-down sequence

C. System current consumption

The current was tested at 11.5V, with the load drivers switching on/off to an approximate 50% duty cycle/1s period square wave, and with all illumination drivers remaining constantly on (TPL7407L and TPS92630).

It is seen from the Figure 3 waveform that the “off” state current consumption is approximately 500mA; this is due to the lamps (2*250mA) and LEDs remaining on during the drive duty cycle, and the load devices not engaging ‘sleep’ mode (if available) when the loads are switched off.

The maximum initial current draw for these conditions is approximately 4A at 11.5V, 5.8A at 18V and 6.6A at 20V.

The staggering before and after transitions seen in the waveform is due to the two door lock relays, driven by the high-side/low-side driver, receiving the I²C transmission (and with it an associated clocking delay for transmission time) before the rest of the system is switched.

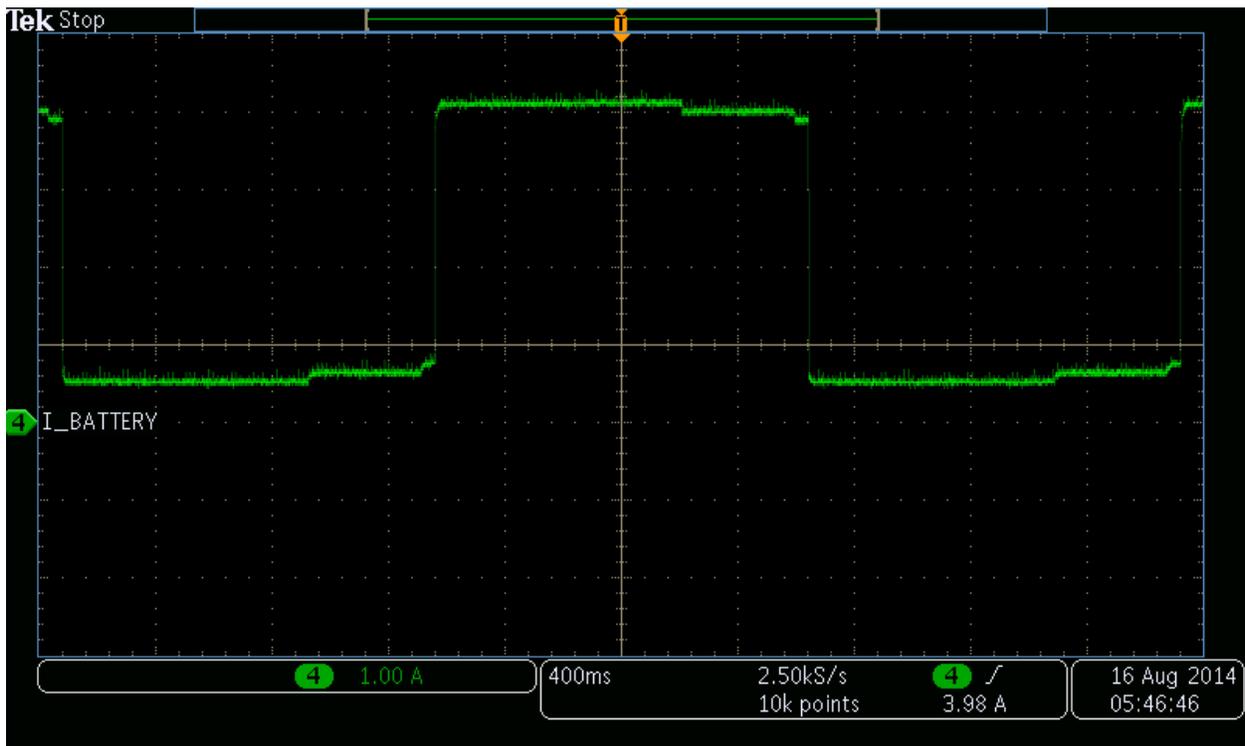


Figure 3 – System current consumption

D. TPL7407L drive test

The TPL7407L was driven on an approximate 1s period/50% duty cycle input, with the output plotted against the system power and shown in Figure 4. Note that this test was conducted on output channel 1; all other channels perform identical to this plot.

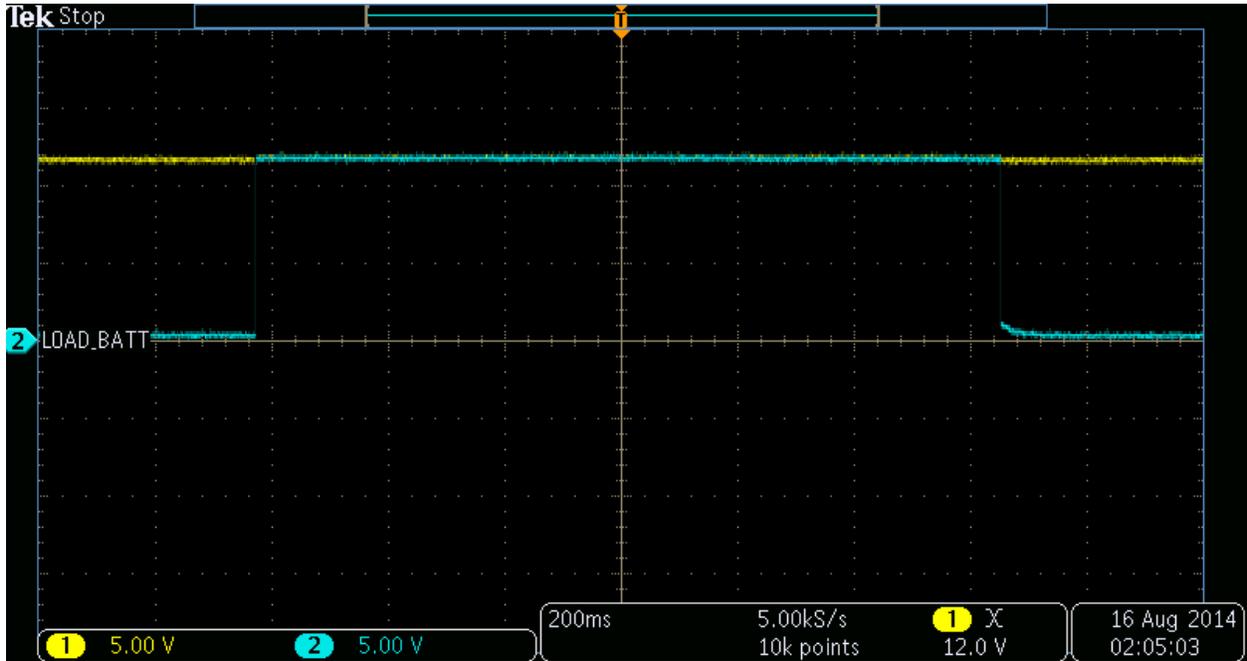


Figure 4 – TPL7407L drive test

E. LMD18400 drive test

The LMD18400 was driven on an approximate 1s period/50% duty cycle input, with the output plotted against the system power and shown in Figure 5. Note that this test was conducted on output channel 4; all other channels perform identical to this plot.

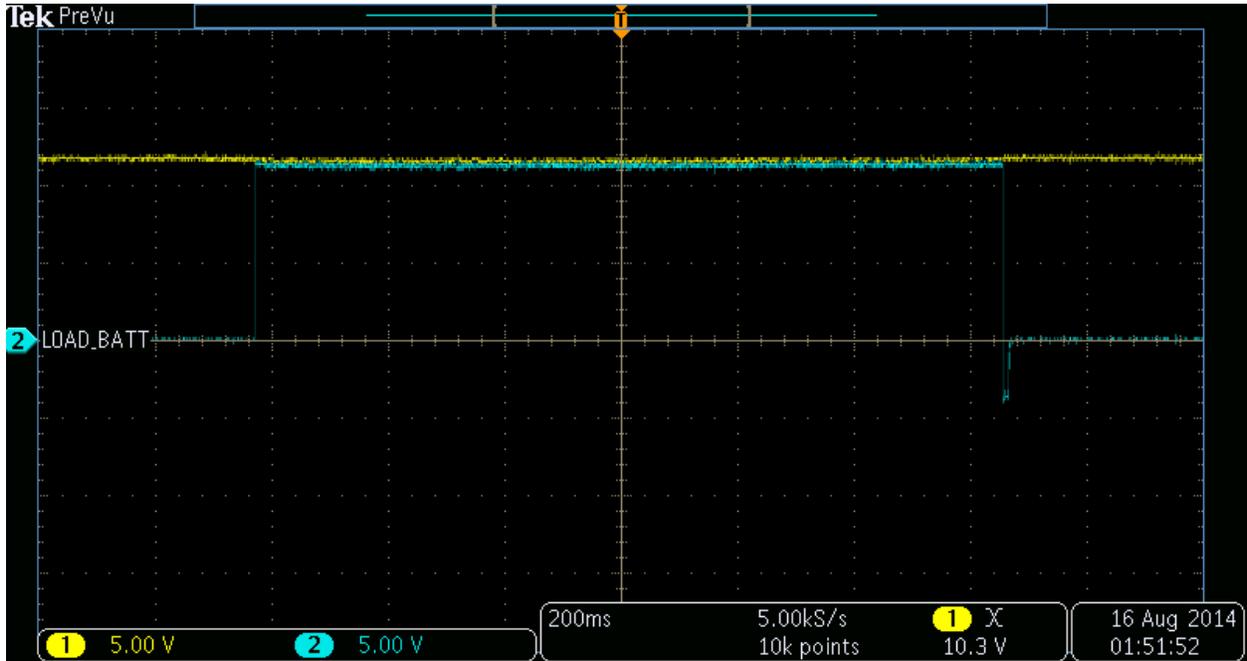


Figure 5 – LMD18400 drive test

F. LM9061 drive test

The LM9061 was driven on an approximate 1s period/50% duty cycle input, with the output plotted against the system power and shown in Figure 6.

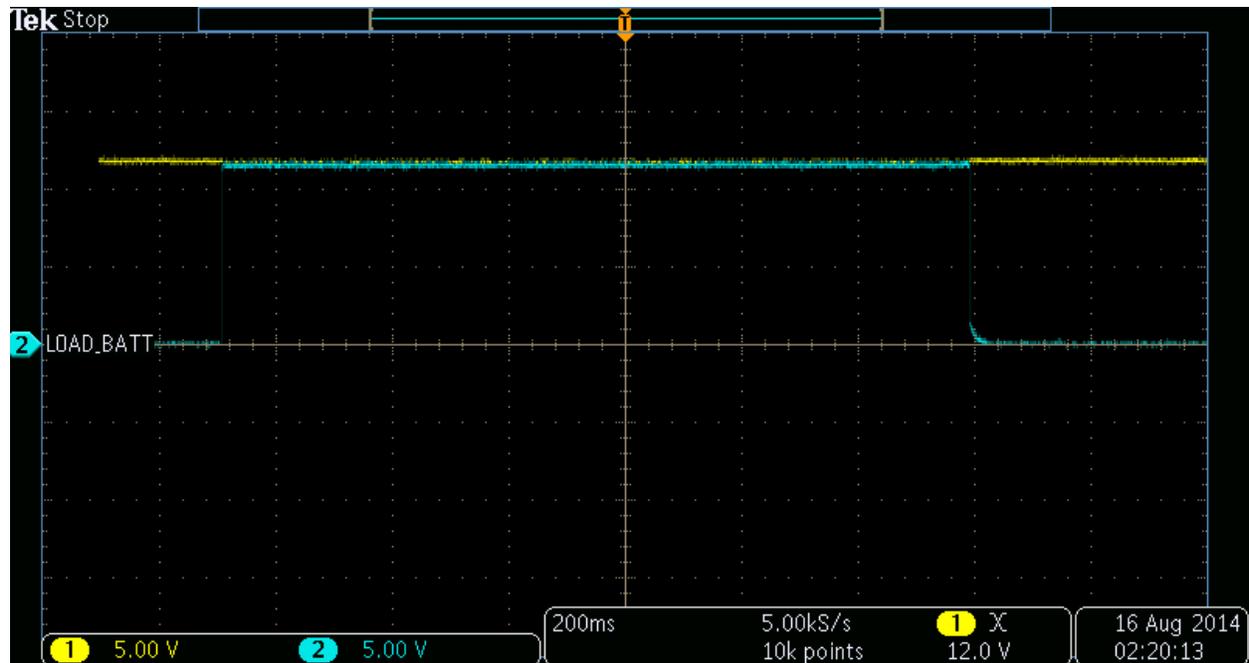


Figure 6 – LM9061 drive test

G. High side drive test

The device was driven on an approximate 1s period/50% duty cycle input, with the output plotted against the system power and shown in Figure 7.

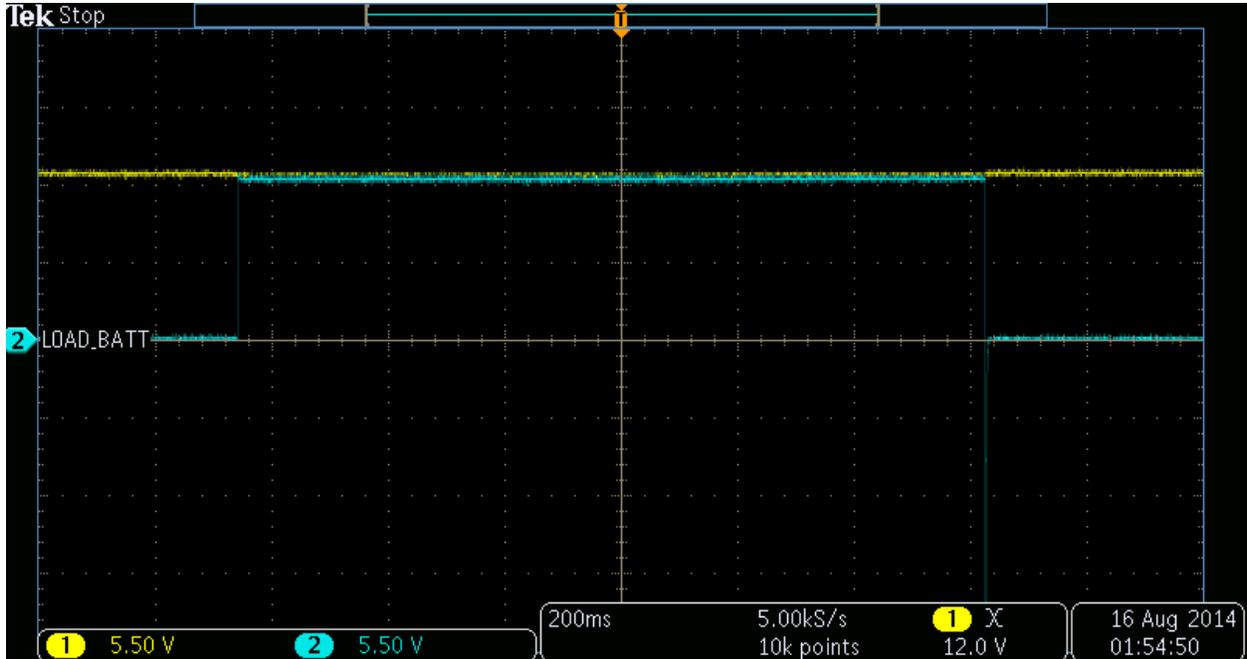


Figure 7 – High side drive test

H. TPIC44H01 drive test

The TPIC44H01 was driven on an approximate 1s period/50% duty cycle input, with the output plotted against the system power and shown in Figure 8. Note that this test was conducted on the first FET output; all other channels perform identical to this plot.

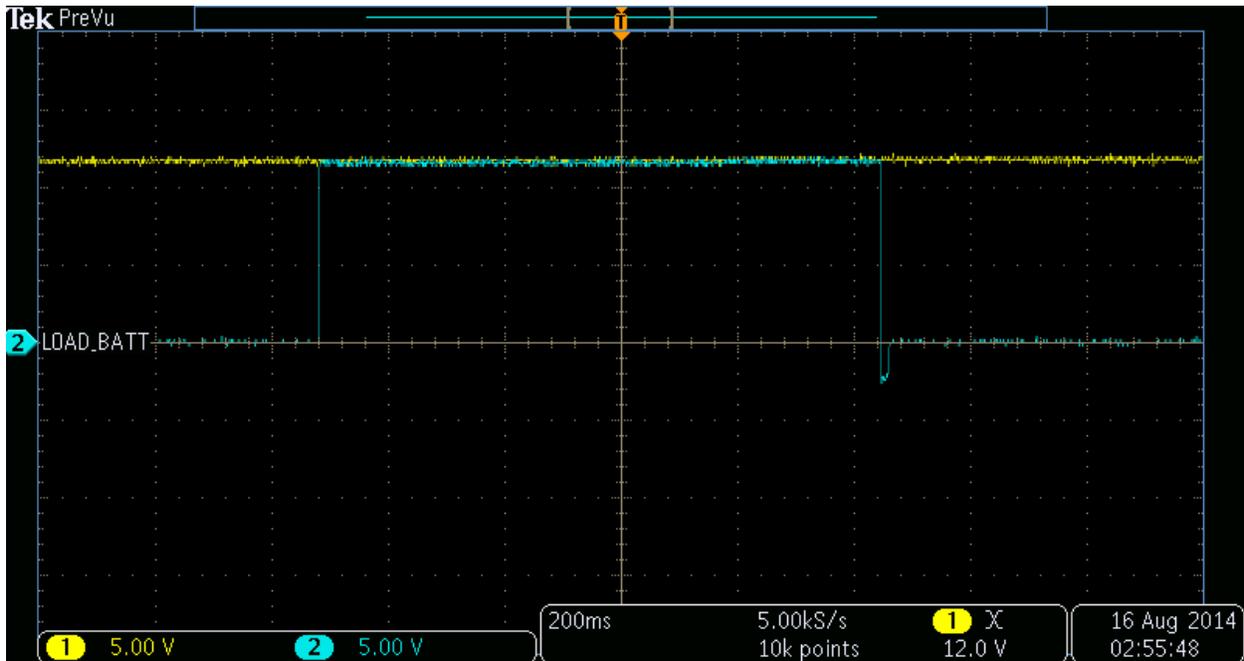


Figure 8 – TPIC44H01 drive test

I. High side/low side drive test

The device was driven on an approximate 1s period/50% duty cycle input, with both high-side and low-side outputs plotted respectively against the system power and shown in Figure 9 and 10 respectively. Note that this test was doncuted on the first channel of both high and low sides; all other channels perform identical to this plot.

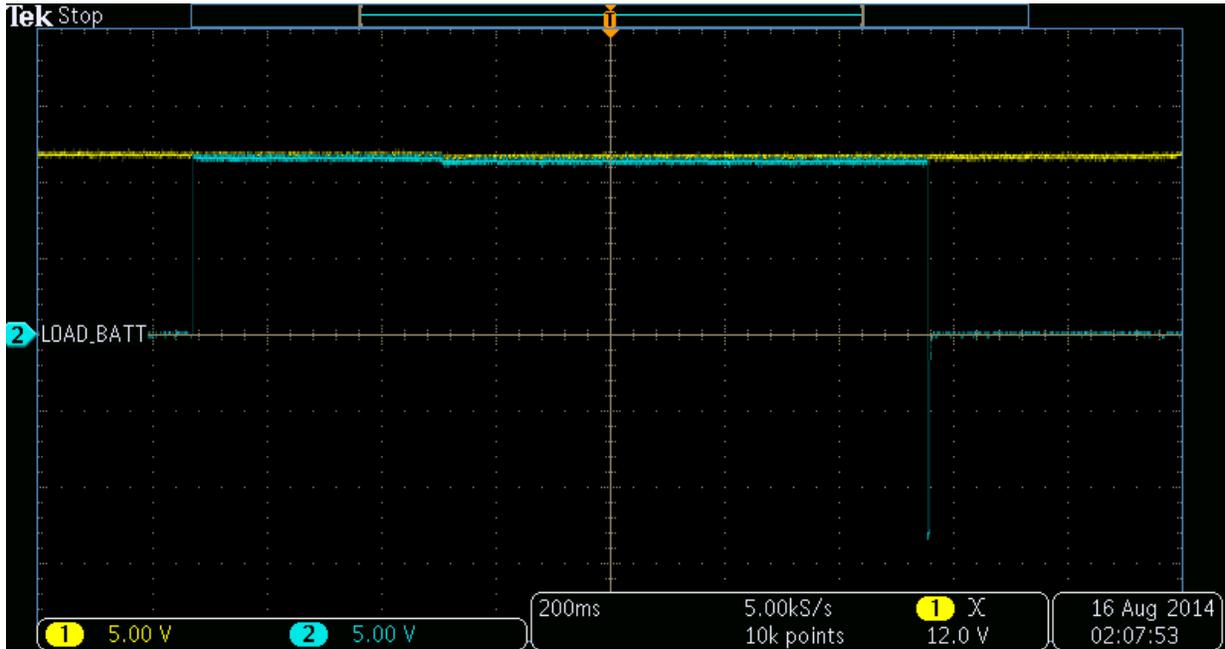


Figure 9 –High-side drive test

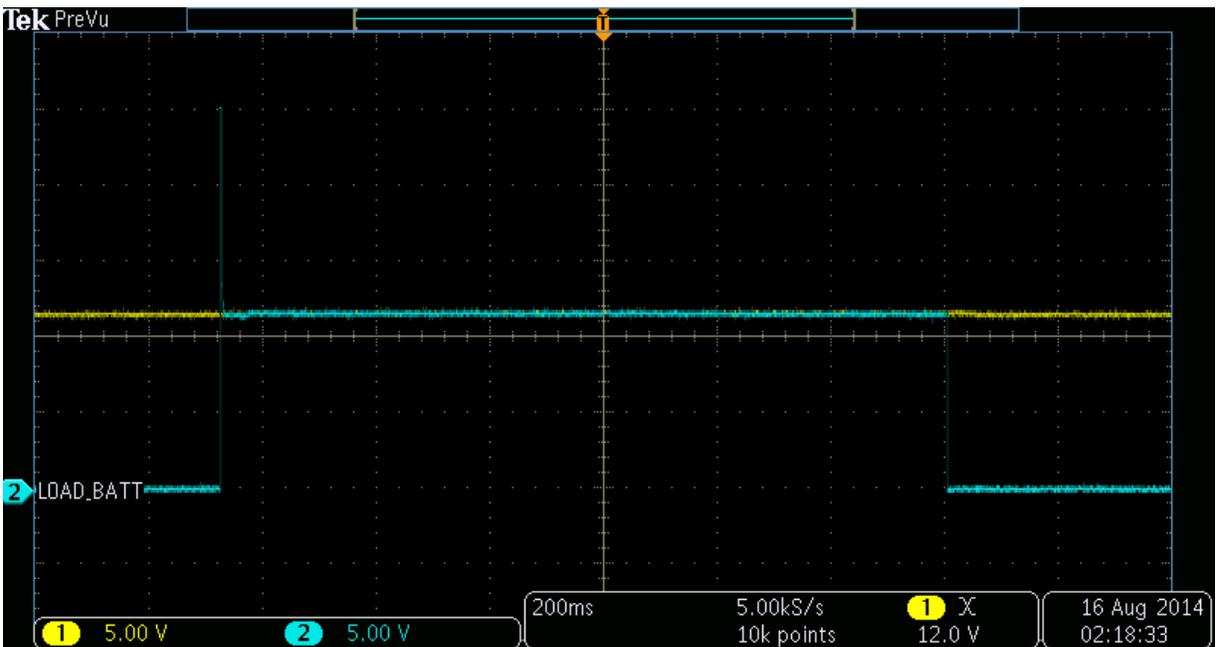


Figure 10 –Low-side drive test

J. Thermal Imaging

Thermal images of the reference design are seen in Figures 11 and 12. Images were captured at regular 12V operation and maximum stress 20V operation.

Note at 20V, the seat heater load draws just enough current to trigger the designed LM9061 over-current protection threshold of 5.5A, disabling the load until the seat heater cools down enough to draw lesser current momentarily.



Figure 11 – PCB thermal image @ 12V



Figure 12 – PCB thermal image @ 20V

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