Title	*Fast Shutter Driver Test Procedure*
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Hardware Version	*PCB D1300780-v5 in Chassis D1400078*

1 Overview

This procedure along with test code found under E1400390 is used to verify proper operation of the D1400078 Ultra-fast Shutter Driver Chassis. This chassis operates at voltages up to 500VDC and portions of this procedure assume that the person performing the test be familiar with high voltage circuit testing, **The Test Technician or Engineer MUST be a LIGO approved Qualified Electrical Worker specifically authorized to work on energized equipment.** This procedure also assumes a considerable familiarity with Cypress PSoC programming and the fast shutter in general.

Table 1

Chassis Serial Number		
Date		
Tested By		
Overall Test Result	PASS	FAIL
	☐	☐

2 DC Measurements Section

2.1 Quiescent current draw

External to the chassis under test insert a Fluke Multi-meter in series with each power form and measure the power supply current. Record the results in the following table. Mark each measurement as Pass or Fail. The USB programming cable must not be actively plugged into the front panel of the chassis as this alters the current draw on the +18V supply. Remove meter and turn off HV after completion of the quiescent current measurements.

Table 2 Quiescent Current Draw

Quiescent Current Draw (mA)	Specified Value	Measured Value	Pass	Fail
+18V Supply	160mA +/- 20mA		☐	☐
-18V Supply	30mA +/- 20mA		☐	☐
+450V +/-5V on rear panel HV input with front panel HV switch ON	1.4mA+/-0.5mA		☐	☐

3 Test Procedure Using Test Code

Ensure the main drive cable is not attached to a fast shutter. Attach the20 ohm test load to main drive output. The test load has an integral short circuit between the coil integrity pins to bypass the *Open Load* interlock. Attach test board, D1400208, to front panel 9 pin D-sub and then turn on the LV supplies. Load the test code into the USB jack on the front panel using the PSoC programming software.

Table 3

Test	Specified Result	Measured Value	Pass	Fail
Using the *HV Enable* switch on the front panel verify the LED is functional by enabling and disabling	-	-	☐	☐
HV Enable OFF, then apply +450V +/-5V on rear panel HV input	LCD Capacitor Charge Voltage = 0 VDC		☐	☐
HV Enable ON, then OFF after measurement. Terminate step by pushing *SLOW UP* on test board	LCD Capacitor Charge Voltage = 433VDC +/-10VDC		☐	☐
Push *SLOW DOWN* on test board	LCD = OK		☐	☐
Push *FAST UP* on test board	LCD = OK		☐	☐
Simulate open coil by removing test load with integral short	*Fault* LED ON (Red), LCD = OK		☐	☐
STATUS LED Test. Terminate with *SLOW UP*	*STATUS* LED (Green) flashing		☐	☐
FAST UP LED Test. Terminate with *SLOW UP*	*FAST UP* LED (Green) flashing		☐	☐
HV READY LED Test. Terminate with *SLOW UP*	*HV READY* LED (Green) flashing		☐	☐
SLOW UP LED Test. Terminate with *SLOW UP*	*SLOW UP* LED (Green) flashing		☐	☐
SLOW DOWN LED Test. Terminate with *SLOW UP*	*SLOW DOWN* LED (Green) flashing		☐	☐

4 Test Procedure Using Normal Operational Code

During this portion of the test, the normal operating code is loaded into the shutter and a series of tests verifies the normal operation of the shutter circuitry when delivering high current, high voltage pulses to a 20 ohm resistive dummy load. The HV is initially de-energized in this test until specified under the test instructions. The test board D1400208 should still be attached to the front panel test port.

Table 4

Test	Specified Result	Measured Value	Pass	Fail
Load the regular Pulser code (not test code) under E1400390 then unplug the programming USB cable	-	-	☐	☐
Momentarily unplug the test board from the front panel and observe the *FAULT* LED is lit after ~5 seconds	*Fault* LED ON		☐	☐

Push *SLOW UP* on test board	Verify *SLOW UP* LED lit and +18V supply current increases by ~160mA		☐	☐
Push *SLOW DOWN* on test board	Verify a brief flash on *SLOW DOWN* LED		☐	☐
Attach Tektronix TCP202 clamp-on current probe around positive wire leading to 20 ohm resistive load. See Figure 2	-	-	-	-
Put *HV ENABLE* switch to *DISABLE* and apply 450VDC +/- 5VDC to HV power input on rear panel. *HV ENABLE* switch to *ENABLE*	Verify *HV READY* LED on after ~10 seconds and that the LCD reads 433VDC +/-10VDC		☐	☐
Set O-scope for single shot trigger off the rising edge of current pulse. Initiate a pulse by pushing *FAST UP* and compare the result to Figure 1	Verify the rising edge of the current pulse is 21.5A +/-1A and that the *SLOW UP* LED is on		☐	☐
Push *SLOW UP*	Verify the *SLOW UP* LED is not on		☐	☐
Put *HV ENABLE* switch to *DISABLE*	Verify the capacitor charge voltage on the LCD display decays to less than 50VDC in less than 10 seconds		☐	☐
Turn off HV and LV supplies	-	-		

Figure 1 shows a typical 21.5A leading edge current pulse corresponding to a capacitor voltage of 433VDC when fired into a 20 ohm resistive dummy load.

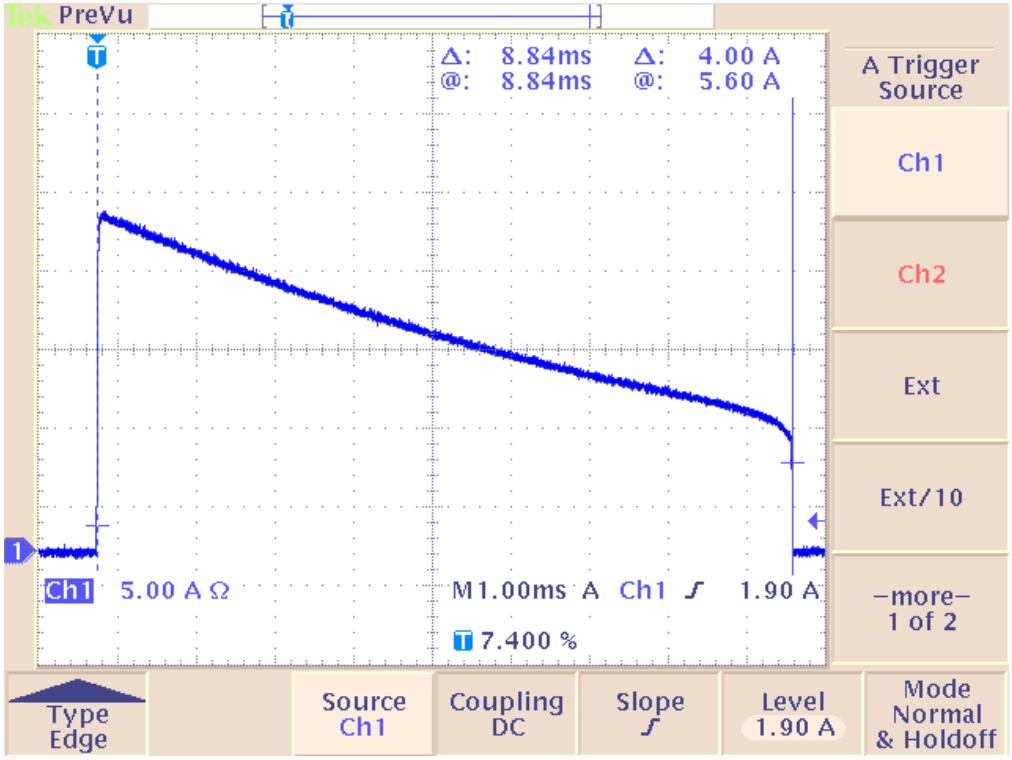

Figure 2 shows the dummy load with integral short, clamp-on current probe, and test board