



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8450
Report Number: 19807
Project No. 6433

TEST SPECIFICATIONS:

RTCA/DO-160G (December 8, 2010)

RADIO TECHNICAL COMMISSION FOR AERONAUTICS

ENVIRONMENTAL CONDITIONS

AND

TEST PROCEDURE FOR AIRBORNE EQUIPMENT

THE FOLLOWING **MEETS** SECTION 22 (PIN) TEST PROCEDURE OF THE ABOVE
TEST SPECIFICATION

Formal Name: Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3
Lightning Protection

Kind of Equipment: ARINC 429 Line Receiver

Test Configuration: Tabletop (Tested at 3.3 Vdc)

Model Number(s): HI-8450

Model(s) Tested: HI-8450

Serial Number(s): 1, 2, 3

Date of Tests: February 27, 2014

Test Conducted for: Holt Integrated Circuits, Inc.
23351 Madero
Mission Viejo, California 92691

NOTICE: "This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government". Please see the "Additional Description of Equipment Under Test" page listed inside of this report.

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United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2013-10-01 through 2014-09-30

Effective dates



For the National Institute of Standards and Technology

NVLAP-01C (REV. 2005-01-28)



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1.0 INTRODUCTION:

On February 27, 2014, a series of susceptibility tests were made to demonstrate that the Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection, Model Number(s) HI-8450, serial number 1, 2, 3, manufactured by Holt Integrated Circuits, Inc. was tested to the requirements of RTCA/DO-160G (December 8, 2010), Environmental conditions and Test Procedures for Airborne Equipment using the following test procedure(s): Section 22 (PIN).

2.0 TEST FACILITY:

D.L.S. Electronic Systems, Inc. is a full service EMC Testing Laboratory accredited to ISO Guide 17025. NVLAP Certificate and Scope can be viewed at <http://www.dlsemc.com/certificate>. Our facilities are registered with the FCC, Industry Canada, and VCCI. All tests were performed by personnel of D.L.S. Electronic Systems, Inc. at the following location(s):

Main Test Facility:
D.L.S. Electronic Systems, Inc.
1250 Peterson Drive
Wheeling, Illinois 60090

A list of the test equipment used, along with identification and calibration data, is included in the Table of each Appendix of this report. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.



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3.0 TEST SET-UP:

All susceptibility tests were performed at D.L.S. Electronic Systems, Inc. The Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection was placed on a copper bench measuring 24' long and 40" wide. The following describes the Lab that was used for testing:

LAB E 26' long x 16' wide x 16' high semi-ferrite lined enclosure.

*Electromagnetic field absorbers were strategically placed according to Figure 21-11 of the RTCA/DO-160 Standard. All lines leaving the room were filtered. The auxiliary equipment was located outside the main room.

The tests were run in the following lab:

LAB E Section 22, Lightning Inducted Transient Susceptibility



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4.0 OPERATING CONDITIONS OF TEST SAMPLE:

All test measurements were made at a laboratory temperature of **72° F** at **40%** humidity with the following mode of operation:

Power up the device with 3.3 V supply at VDD.

5.0 PERFORMANCE MONITORED:

The Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection performance was monitored as follows:

Any change to the initial supply current measurement after lightning injection will be categorized as out of specification. Current draw should be between 8-9mA.

6.0 DESCRIPTION OF TEST SAMPLE: (See also Paragraph 7.0)

6.1 DESCRIPTION

Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection.

6.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

Item 1 Board 2

Item 2 Board 3



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7.0 ADDITIONAL DESCRIPTION OF EQUIPMENT UNDER TEST:
(See also Paragraph 6.0)

There were no changes made during testing.

8.0 PHOTO ID INFORMATION:

The test set up can be seen in the accompanying photograph.

Item 0 Board 1

Item 1 Board 2

Item 2 Board 3



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9.0 PHOTO ID TAKEN DURING TESTING:

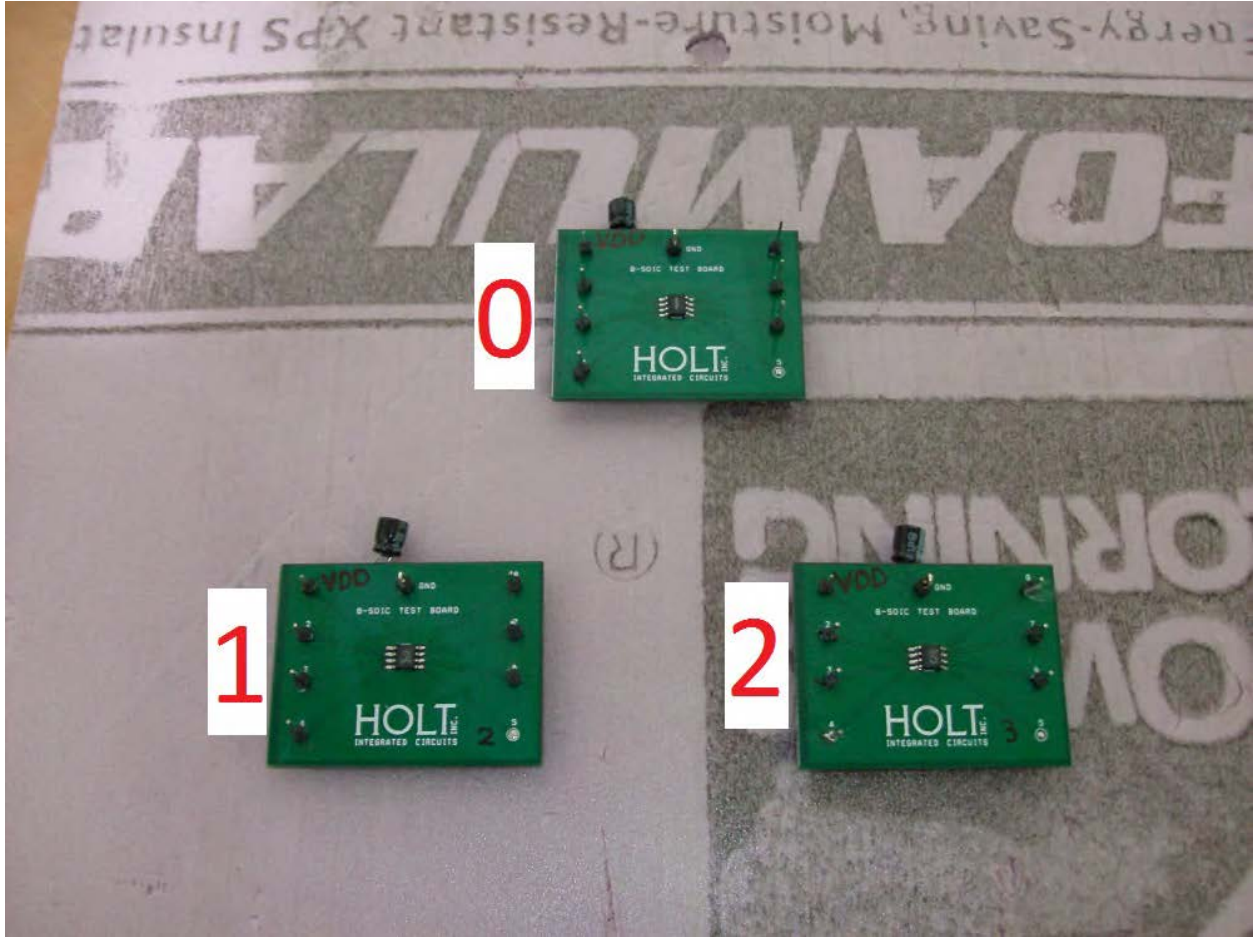


Photo ID



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10.0 REFERENCES:

1. Document No. RTCA/DO-160G, December 8, 2010
Prepared by: SC-135

11.0 TEST RESULTS:

The Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection was subject to the test procedure(s) Section 22 (PIN). A detailed explanation of how these tests and their measurements were made is shown in Appendix(es) A at the end of this report.

12.0 CONCLUSION OF SUSCEPTIBILITY TESTS:

The Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection, Model Number(s) HI-8450, **meets** Section 22 (PIN) RTCA/DO-160G (December 8, 2010), Environmental conditions and Test Procedures for Airborne Equipment. See the Appendix(es) A for a detailed explanation of the test results.



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Appendix A

APPENDIX A

RTCA/DO-160G

SECTION 22

PARAGRAPH 22.5

LIGHTNING INDUCED

TRANSIENT SUSCEPTIBILITY

PIN INJECTION



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1.0 PURPOSE OF THE TEST:

These tests verify the capability of the equipment to withstand effects of lightning induced electrical transients. The damage tolerance test was performed using the Pin Injection test method.

2.0 CATEGORIES, WAVEFORMS AND LEVELS:

Categories used are A3,B3 & Z3

Category designations for equipment consist of five characters appears as follows:

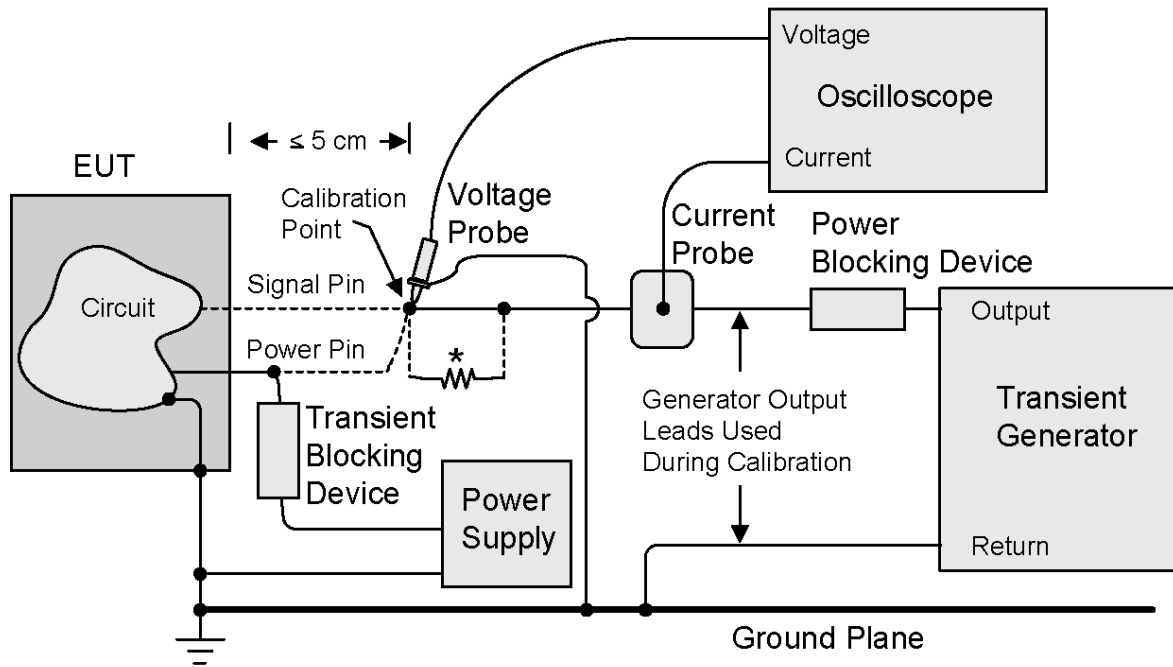
<u>3, 4, 5</u>	<u>3</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
Pin Test Waveform Set	Pin Test Level	Cable Bundle Single and Multiple Stroke Test Waveform Set	Cable Bundle Single and Multiple Stroke Test Level	Cable Bundle Multiple Burst Test Waveform Set	Cable Bundle Multiple Burst Test Level

X = Tests not performed

The equipment under test was tested to the levels and waveforms consistent with its expected use and aircraft installation. The Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection was subjected to Waveform(s) 3,4,5A,5B using Level(s) 3.

3.0 TEST SETUP AND APPARATUS:

A typical test setup is shown in Figure 22-13.



*Optional Remote Load Impedance
 See Paragraph 22.5.1.h

NOTES:

1. The notes from the calibration setup of Figure 22-10 apply.
2. Test setup and procedures are to be such that the required lightning transients appear differentially between the aircraft power and return/neutral lines. If power and return/neutral originate from a remote load, in the same cable bundle with signals, then the test setup should use an isolated power return to ensure the proper common-mode evaluation.
3. The power supply is not necessary for tests on un-powered equipment.
4. Test procedures assume lightning transients appear common-mode between all pins and case. If the expected installation utilizes local power and/or signal returns tied either internally or externally to case or aircraft structure, tests shall be performed with the return(s) tied to the case.
5. Return wire lengths shall be kept as short as possible.

Figure 22-13 Pin Injection Test Setup, Signal Pins & Power Pins – Direct Injection Method



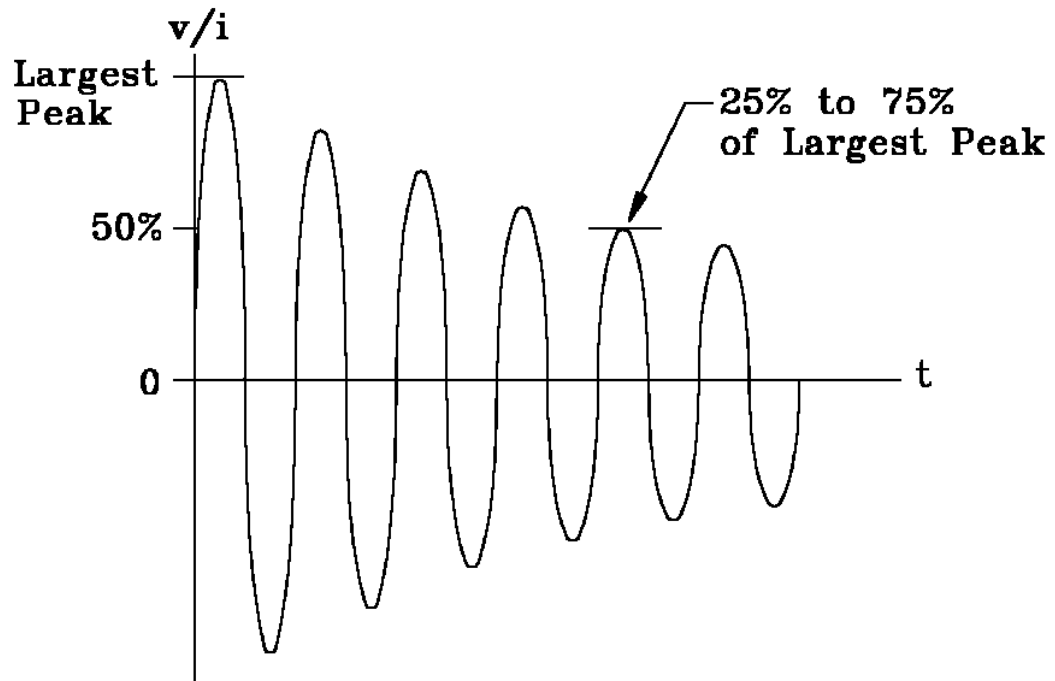
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3.0 TEST SETUP AND APPARATUS: (CON'T)

The transient generator used produced the Voltage/Current Waveform 3 shown in Figure 22-3 of the test specification. Any method of generating the spike may be used if the waveform complies with Figure 22-3. The generator was connected to the designated pin and case ground of the device under test by means of a short, low inductance lead.



NOTES:

1. Voltage and current are not required to be in phase.
2. The waveshape may have either a damped sine or cosine waveshape.

Figure 22-3 Voltage/Current Waveform 3



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3.0 TEST SETUP AND APPARATUS: (CON'T)

The transient generator used produced the Voltage Waveform 4 shown in [Figure 22-4](#) of the test specification. Any method of generating the spike may be used if the waveform complies with [Figure 22-4](#). The generator was connected to the designated pin and case ground of the device under test by means of a short, low inductance lead.

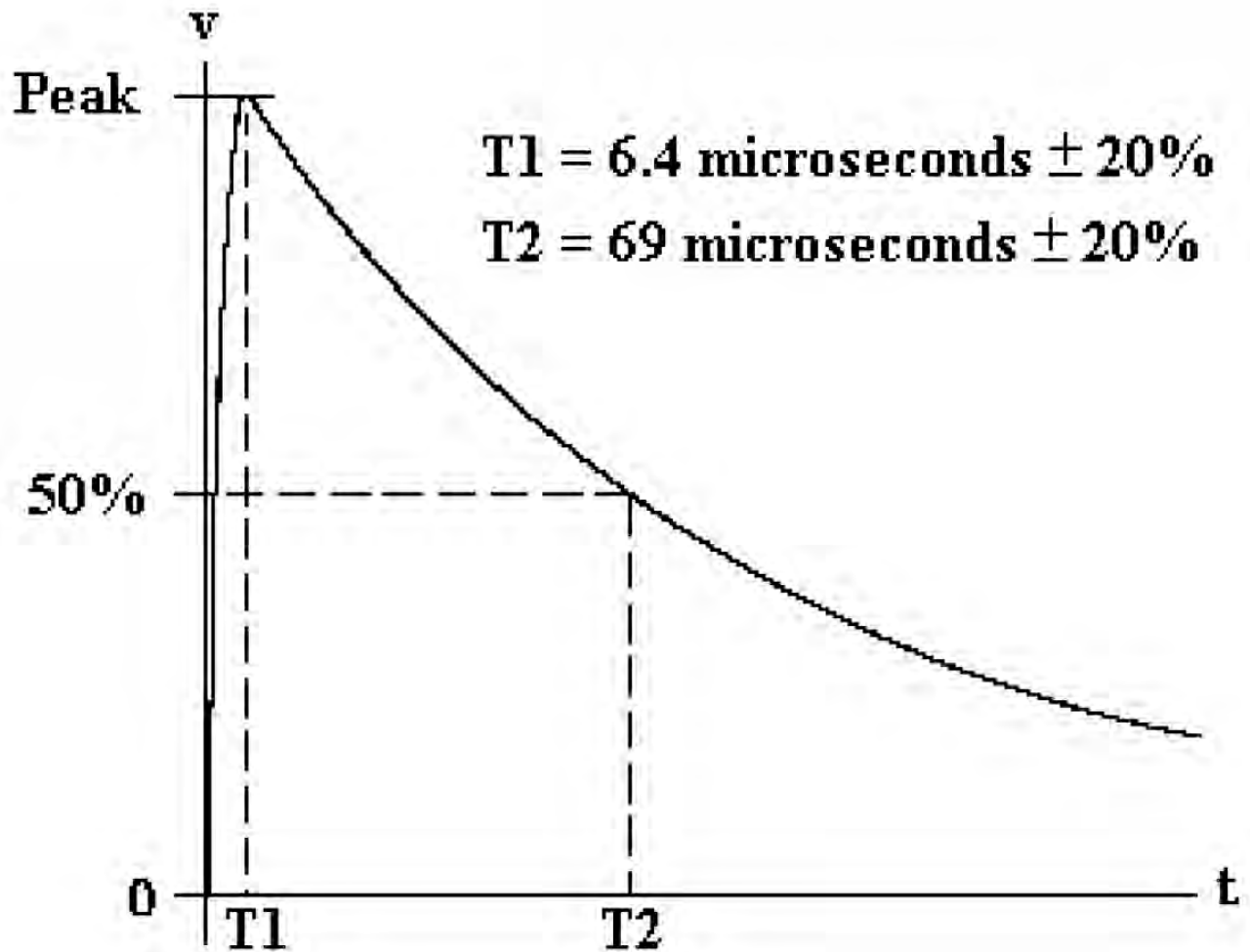


Figure 22-4 Voltage Waveform 4



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3.0 TEST SETUP AND APPARATUS: (CON'T)

The transient generator used produced the Current/Voltage Waveform 5 shown in Figure 22-5 of the test specification. Any method of generating the spike may be used if the waveform complies with Figure 22-5. The generator was connected to the designated pin and case ground of the device under test by means of a short, low inductance lead.

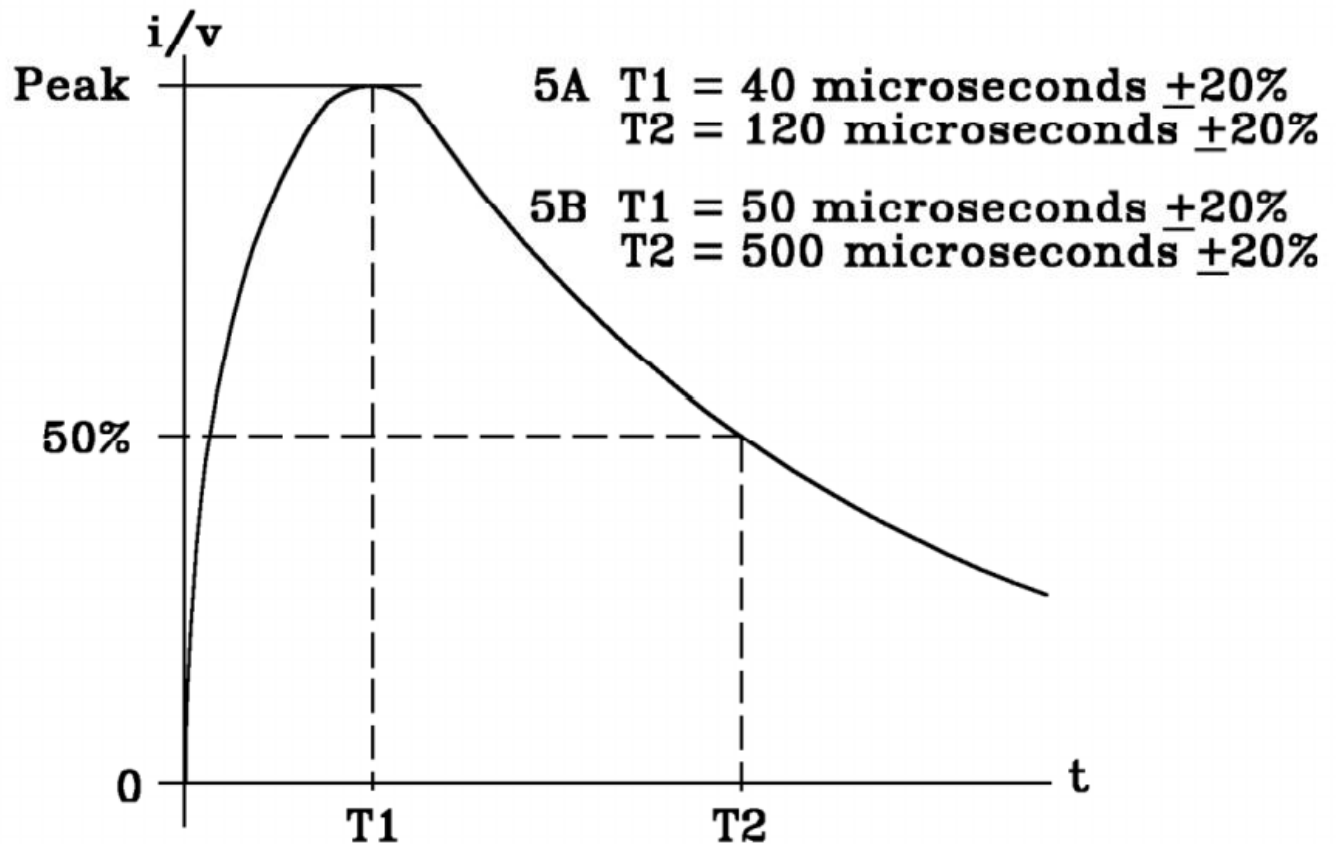


Figure 22-5 Current/Voltage Waveform 5



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4.0 TEST PROCEDURE:

Pin injection testing is a technique whereby the chosen transient waveform(s) is applied directly to each pin and case ground of the designated pins. Waveform 3 (1MHz damped sine), Waveform 4 (6.4 x 69us double exponential), 5A (T1 = 40 usec and T2 = 120 usec) and 5B (T1 = 50 usec and T2 = 500 usec) were each applied at level 3 positive and negative polarities, to the Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection pins called out in Table 22-1 & 22-2 of RTCA/DO-160F. The Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection was not powered up and none of the cables were connected throughout Pin Injection test.

For each waveform at each level, ten positive and ten negative discharges were applied at minimum intervals of 10 seconds. The actual waveshape applied to each pin was measured with a 1000x oscilloscope probe within 5cm of the pin. All waveshapes were recorded.



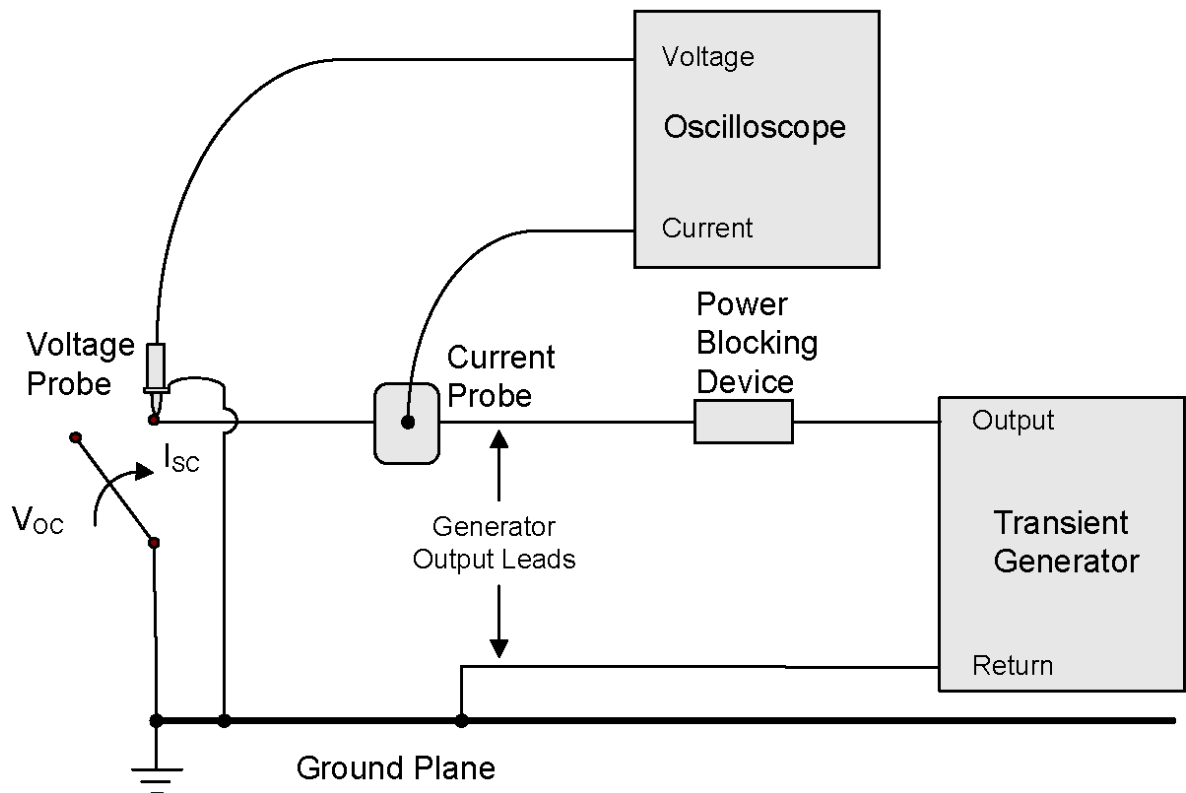
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4.0 TEST PROCEDURE:

The following test setup was used for calibration.



NOTES:

1. Tests of active ac power circuits may require transformer coupling of the applied transients to the power lines and transients should be synchronized to the peak of the ac waveform.
2. A power blocking device may be used to isolate voltages at the pins of the EUT from the low generator impedance and must be present during calibration since they may adversely affect the waveform calibration. Typical power blocking devices are bipolar suppression devices for Waveforms 4 and 5 or a series capacitor for Waveform 3. The bipolar suppression device is selected with a voltage rating close to the expected EUT operating voltage but may have a nominal value to allow testing with one calibrated setup. A voltage rating that represents a significant percentage of the applied transient will affect waveform calibration. The capacitor is selected to achieve the calibration current; too large a value may produce unwanted resonance during test.
3. The Power Blocking Device is not necessary for tests on un-powered equipment.

Figure 22-10 Pin Injection Calibration Setup, Signal Pins & Power Pins – Direct Injection Method



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5.0 LIMITS & RESULTS:

5.1 LIMITS:

The Waveform used for the test is taken from the following table:

Table 22-2 Generator Setting Levels for Pin Injection

Level	Waveforms		
	3/3	4/1	5A/5A
	Voc/Isc	Voc/Isc	Voc/Isc
1	100/4	50/10	50/50
2	250/10	125/25	125/125
3	600/24	300/60	300/300
4	1500/60	750/150	750/750
5	3200/128	1600/320	1600/1600

NOTES:

1. *Voc = Peak Open Circuit Voltage (Volts) available at the calibration point shown in Figure 22-10, Figure 22-11, or Figure 22-12.*
2. *Isc = Peak Short Circuit Current (Amps) available at the calibration point shown in Figure 22-10, Figure 22-11, or Figure 22-12.*
3. *Amplitude Tolerances +10%, -0%.*
4. *The ratio of Voc to Isc is the generator source impedance to be used during the calibration procedure.*
5. *Waveforms 3, 4 and 5A are identified in Figure 22-3, Figure 22-4 and Figure 22-5.*

a



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5.0 LIMITS & RESULTS (CON'T):

5.2 RESULTS:

The unit under test was powered up and monitored for susceptibility during testing. The actual waveshapes were applied to the pins and recorded. On any given pin, the waveshape did not significantly vary between the first and tenth discharges. At regular intervals and after all events, the generators' open circuit calibration waveshape and source impedance were re-verified. In all cases, the generator maintained its' performance. There were no events noted during testing, indicating possible damage to circuitry through these pins. The post operation was verified and the Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection passed the requirements of Section 22 (Pin Injection).



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5.0 LIMITS & RESULTS (CON'T):

5.2 RESULTS:

The Single / Quad ARINC 429 Line Receivers with Integrated DO-160G Level 3 Lightning Protection **meets** the following conditions:

Lab used: E

Summary:

Board 1 was tested to Category A3, Board 2 to Category B3, Board 3 to Category Z3. Category Z3 consisted of WF3 and WF5B.

Input 1A and 1B was tested on each board. The pretest resistance measurement of 19kOhms did not change after the lightning pin injection was performed.

There were no issues were observed during this test. See the data sheets at the end of this appendix for the test results.

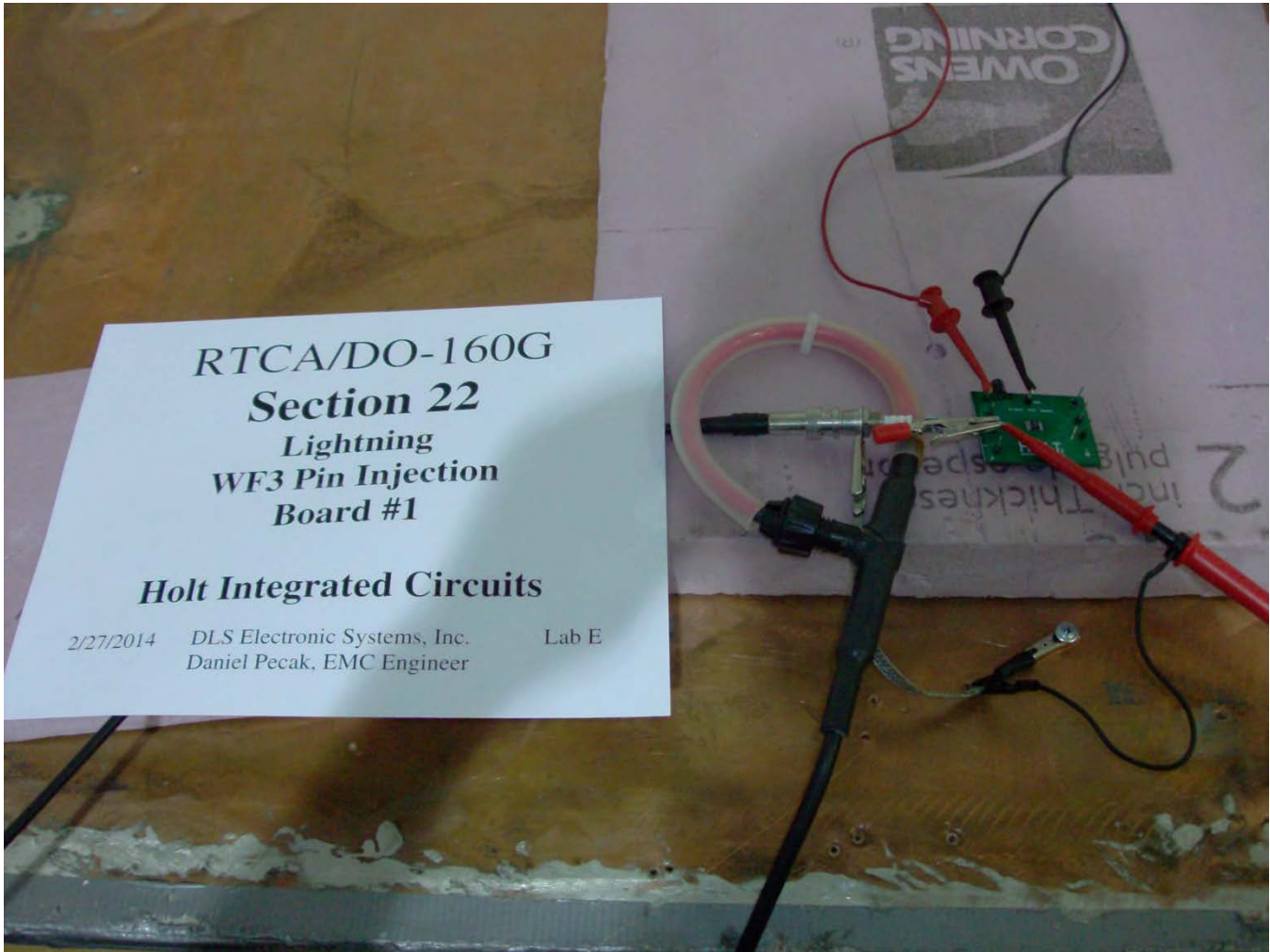


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Appendix A

6.0 PHOTOS TAKEN DURING TESTING



Section 22 Pin Injection - WF3 Board 1

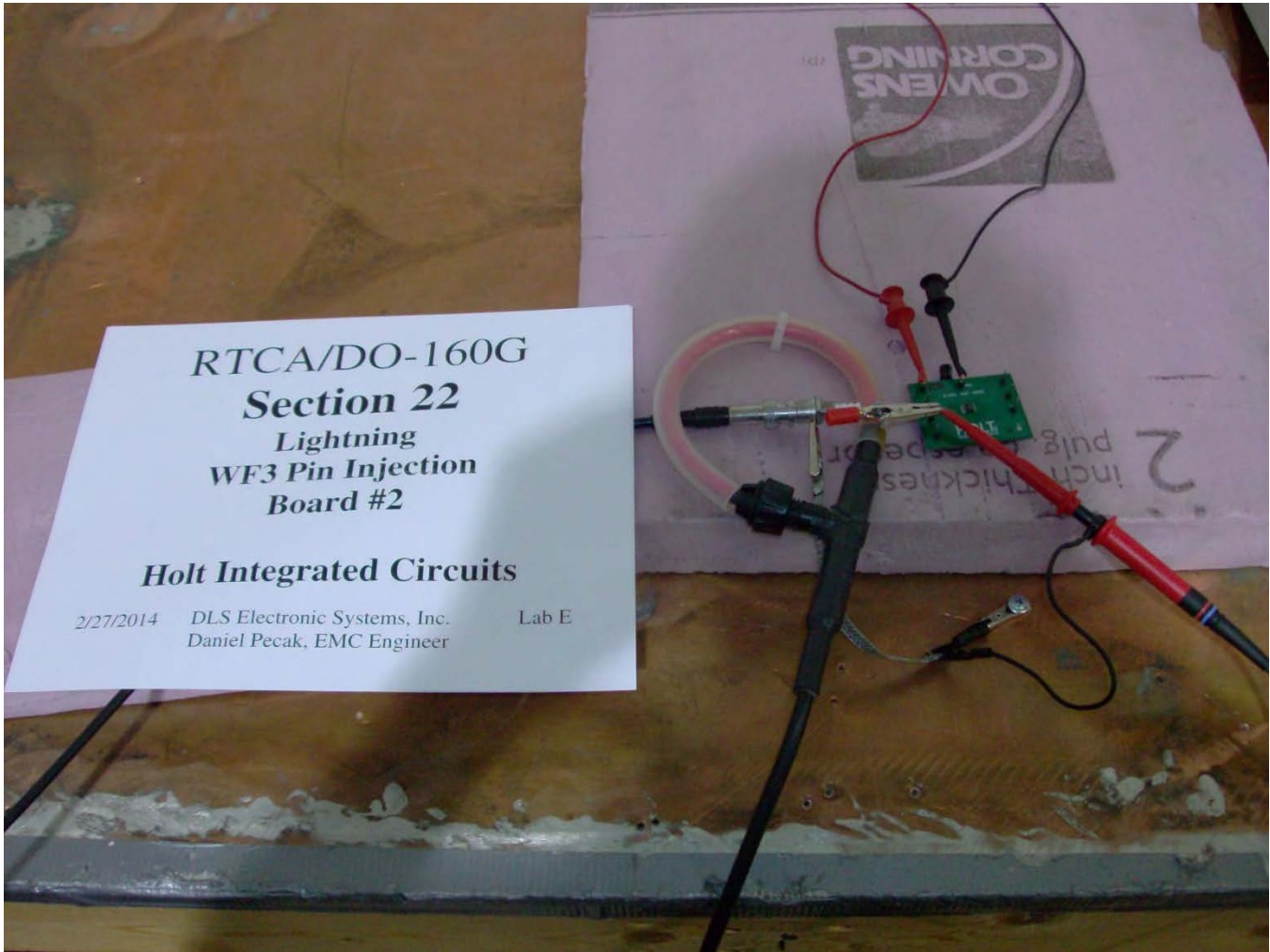


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Section 22 Pin Injection - WF3 Board 2

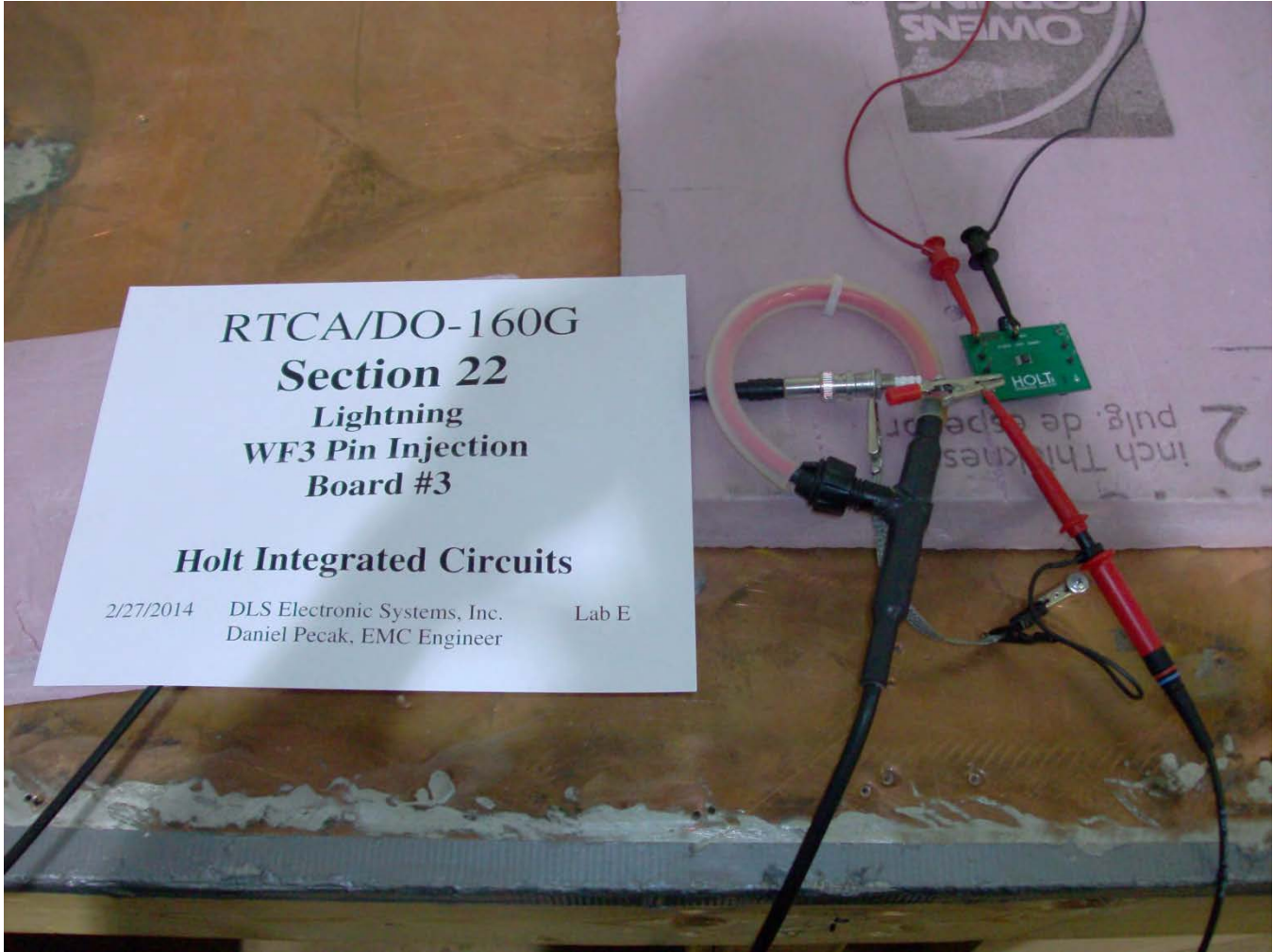


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Section 22 Pin Injection - WF3 Board 3



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Section 22 Pin Injection - WF4 Board 1

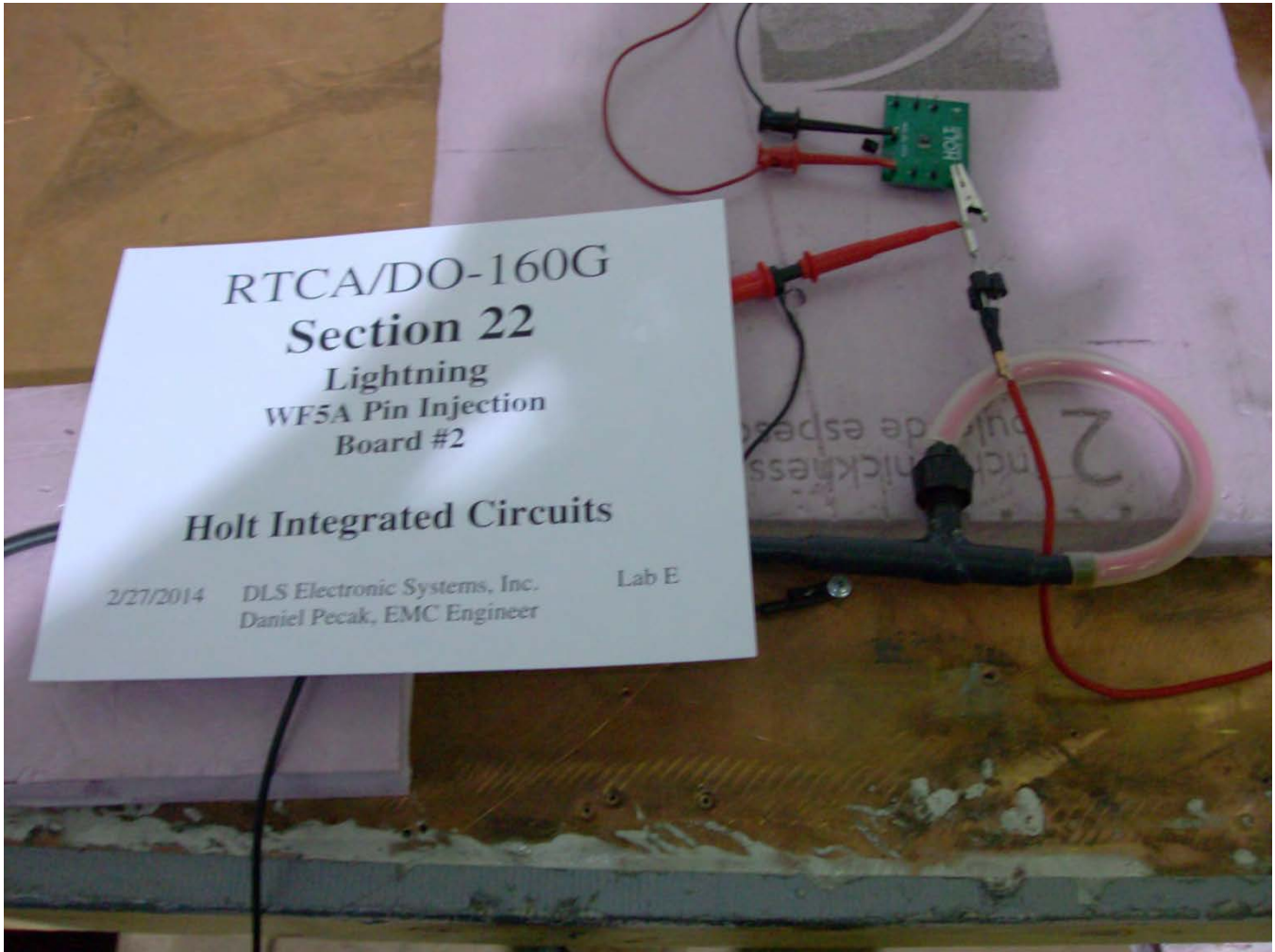


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Appendix A

6.0 PHOTOS TAKEN DURING TESTING



Section 22 Pin Injection - WF5A Board 2

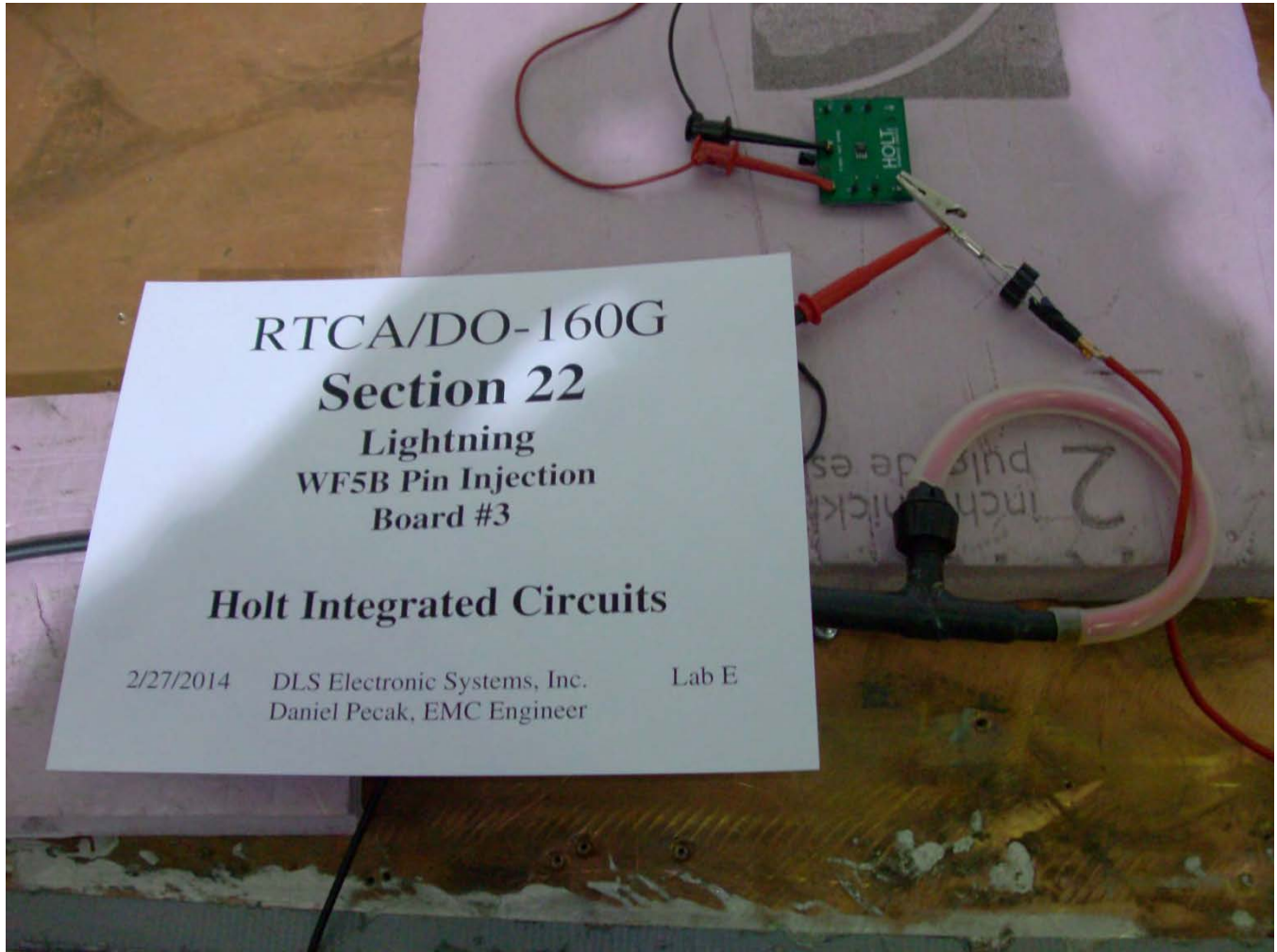


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Section 22 Pin Injection - WF5B Board 3



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Section 22 Pin Injection - WF3 SC Calibration



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6.0 PHOTOS TAKEN DURING TESTING



Section 22 Pin Injection - WF3 OC Calibration



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6.0 PHOTOS TAKEN DURING TESTING



Section 22 Pin Injection - WF4, WF5A & WF5B SC Calibration



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Section 22 Pin Injection - WF4, WF5A & WF5B OC Calibration



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SECTION 22

TEST INSTRUMENTATION

Lightning Induced Transient Susceptibility

TABLE 1

Equipment	Manufacturer	Model Number	Serial Number	Range	Cal. On	Cal. Due
Oscilloscope	LeCroy	WavePro 7200A	LCRY0705N13389	2 GHz 20GS/s	06/04/2013	06/04/2014
Current Probe	PEM	CWT 6R	6997-8287	16 MHz	11/4/2013	11/4/2014

All primary equipment is calibrated against known reference standards with a verified traceable path NIST.



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SECTION 22

TEST EQUIPMENT

Lightning Induced Transient Susceptibility

TABLE 2

Equipment	Manufacturer	Model Number	Serial Number	Range
Transient Generator	EMC Partner	MIG0600MS	DLS#795	N/A
Transient Generator	EMC Partner	MIG-OS-MB	DLS#796	N/A

NOTE: The above test equipment is verified upon use.



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Appendix A

PIN INJECTION TEST DATA SHEETS

WF3

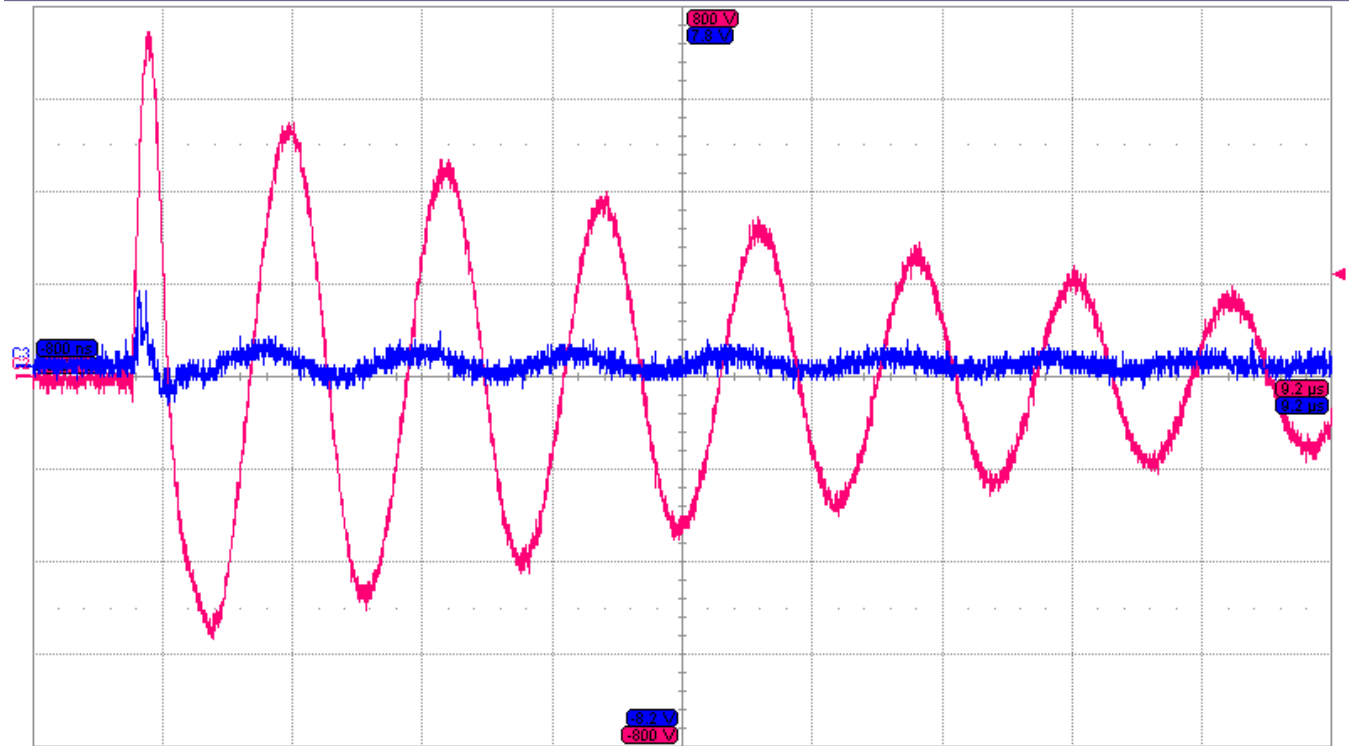
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 10:50:30 AM

Pin WF3 Test Pos - Board 1 - Input 1A



Holt Integrated Electronics
 Board 1
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	742 V	1.66 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	2.00 V/div	200 V/div	200 mV/div
0.0 V offset	200 mV offset		

TELEDYNE LECROY	Timebase	-4.20 μ s	Trigger	C2
	1.00 μ s/div	Stop	220 V	
	5.00 kS	500 MS/s	Edge	Positive

2/27/2014 10:50:40 AM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

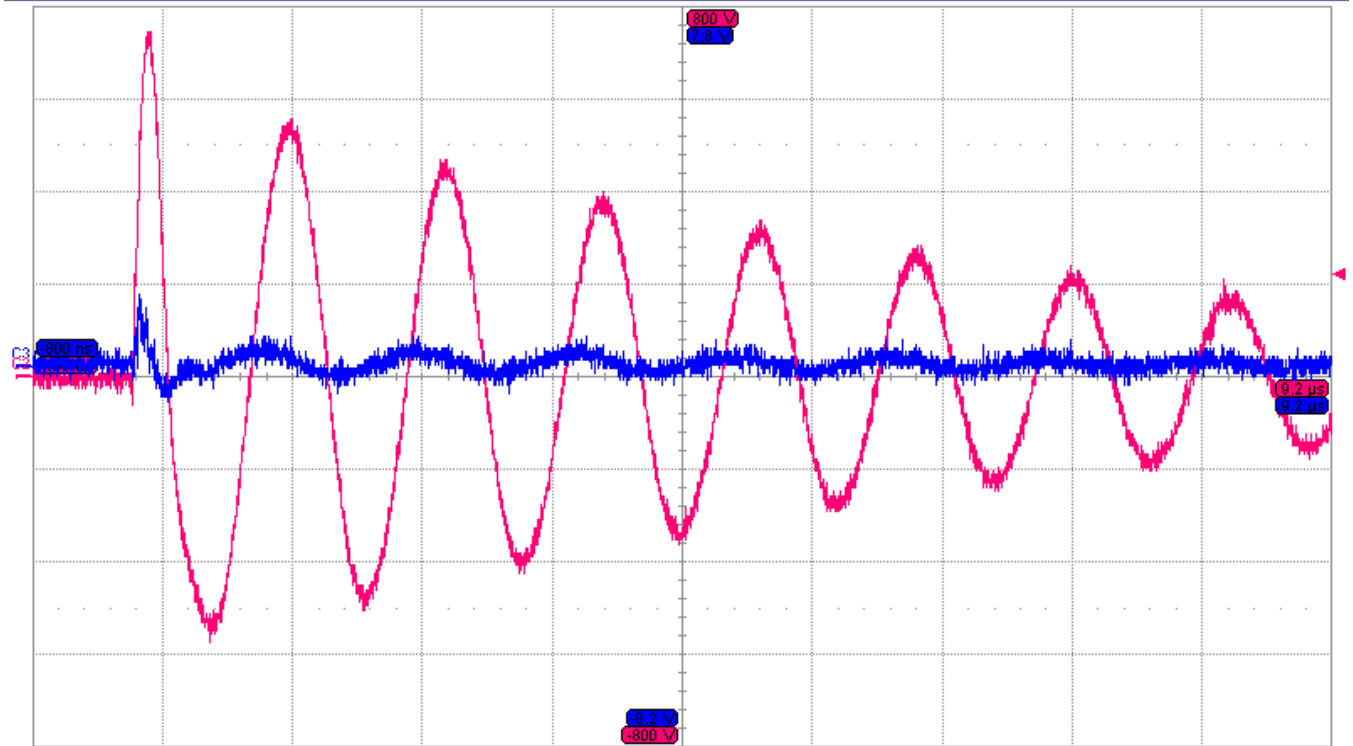
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 10:39:28 AM

Pin WF3 Test Pos - Board 1 - Input 1B



Holt Integrated Electronics
 Board 1
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure

value	P1:max(C2)	P2:min(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
status	742 V	-730 mV						

C2 DC1M C3 DC1M
 200 V/div 2.00 V/div
 0.0 V offset 200 mV offset

Timebase -4.20 μs Trigger C2
 1.00 μs/div Stop 220 V
 5.00 kS 500 MS/s Edge Positive

TELEDYNE LECROY 2/27/2014 10:39:41 AM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Vertical Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

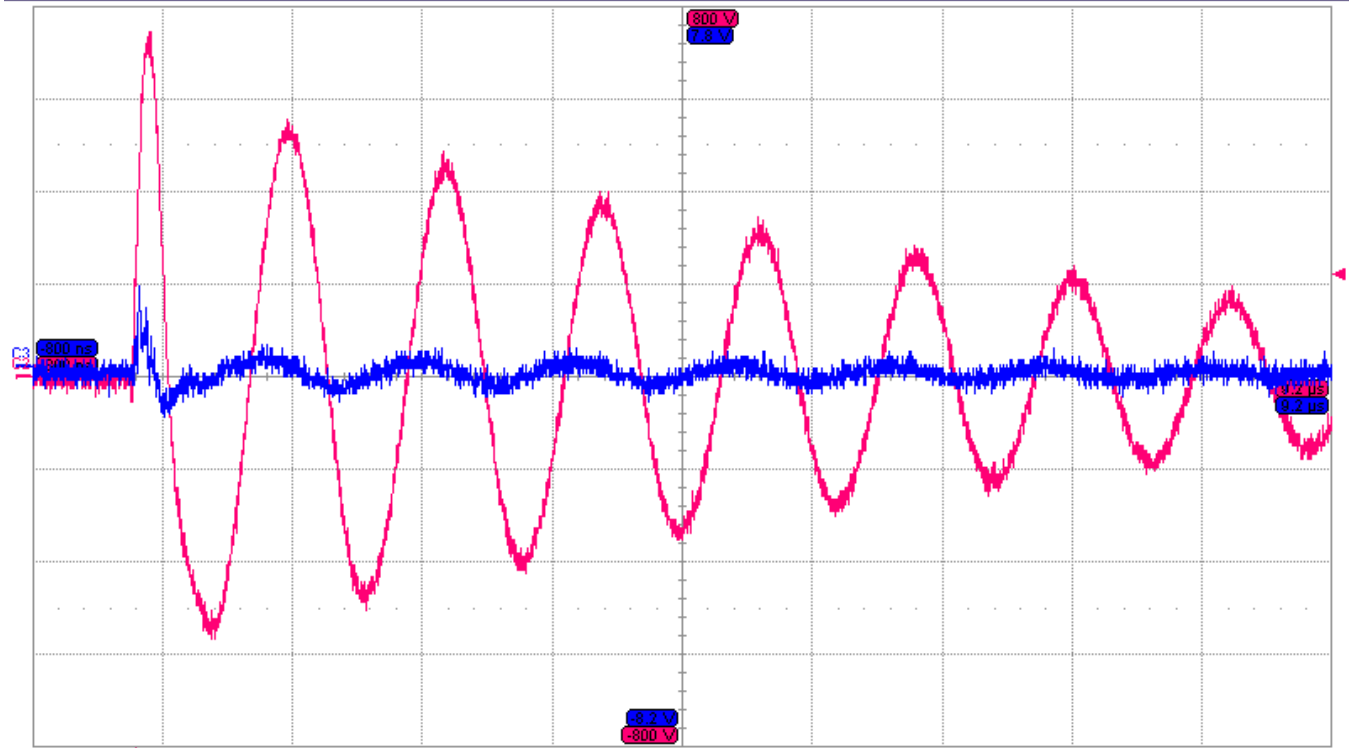
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 11:20:07 AM

Pin WF3 Test Pos - Board 2 - Input 1A



Holt Integrated Electronics
 Board 2
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	742 V	1.74 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	2.00 V/div	200 V/div	200 mV/div
0.0 V offset	200 mV offset		

TELEDYNE LECROY	Timebase	-4.20 μs	Trigger	C2
	1.00 μs/div	500 MS/s	Stop	220 V
	5.00 kS		Edge	Positive

2/27/2014 11:20:17 AM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

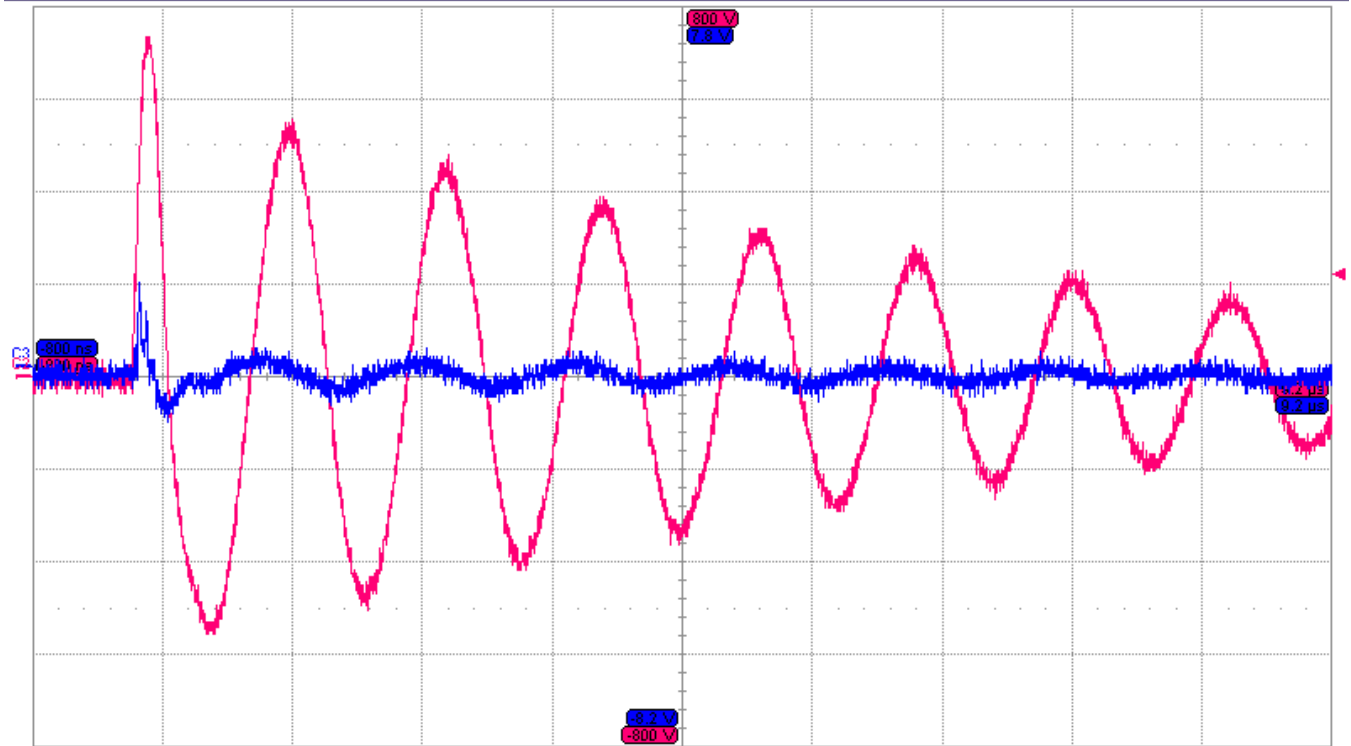
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 12:58:49 PM

Pin WF3 Test Pos - Board 2 - Input 1B



Holt Integrated Electronics
 Board 2
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	734 V	1.83 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	2.00 V/div	200 V/div	200 mV/div
0.0 V offset	200 mV offset		

TELEDYNE LECROY	Timebase	-4.20 μ s	Trigger	C2
	1.00 μ s/div	500 MS/s	Stop	220 V
	5.00 kS		Edge	Positive

2/27/2014 12:59:01 PM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

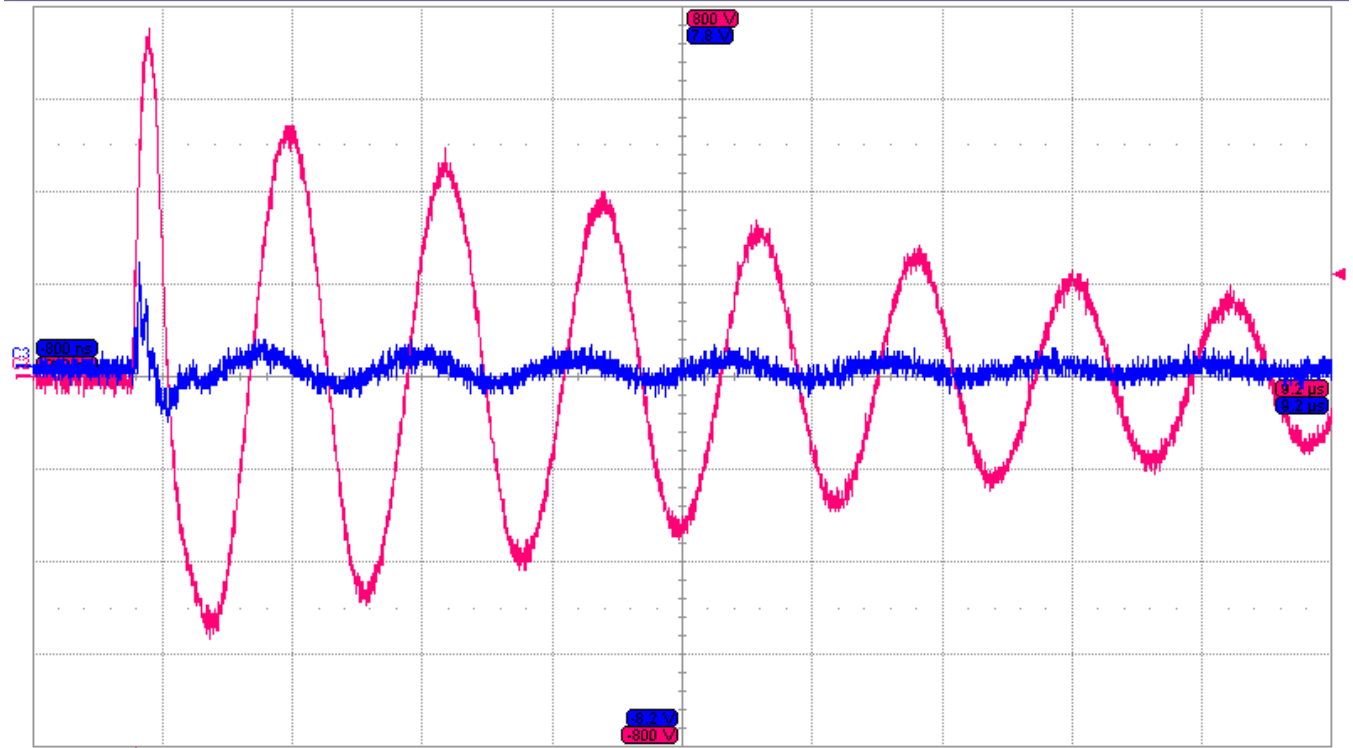
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 DSO S/N:
 User: labadmin
 Time: 2/27/2014 1:16:25 PM

Pin WF3 Test Pos - Board 3 - Input 1A



Holt Integrated Electronics
 Board 3
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	751 V	2.27 V						
status	✓	✓						

C2	C3
DCIM	DCIM
200 V/div	2.00 V/div
0.0 V offset	200 mV offset

TELEDYNE LECROY

Timebase	-4.20 μ s	Trigger	C2
	1.00 μ s/div	Stop	220 V
5.00 kS	500 MS/s	Edge	Positive

2/27/2014 1:16:36 PM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

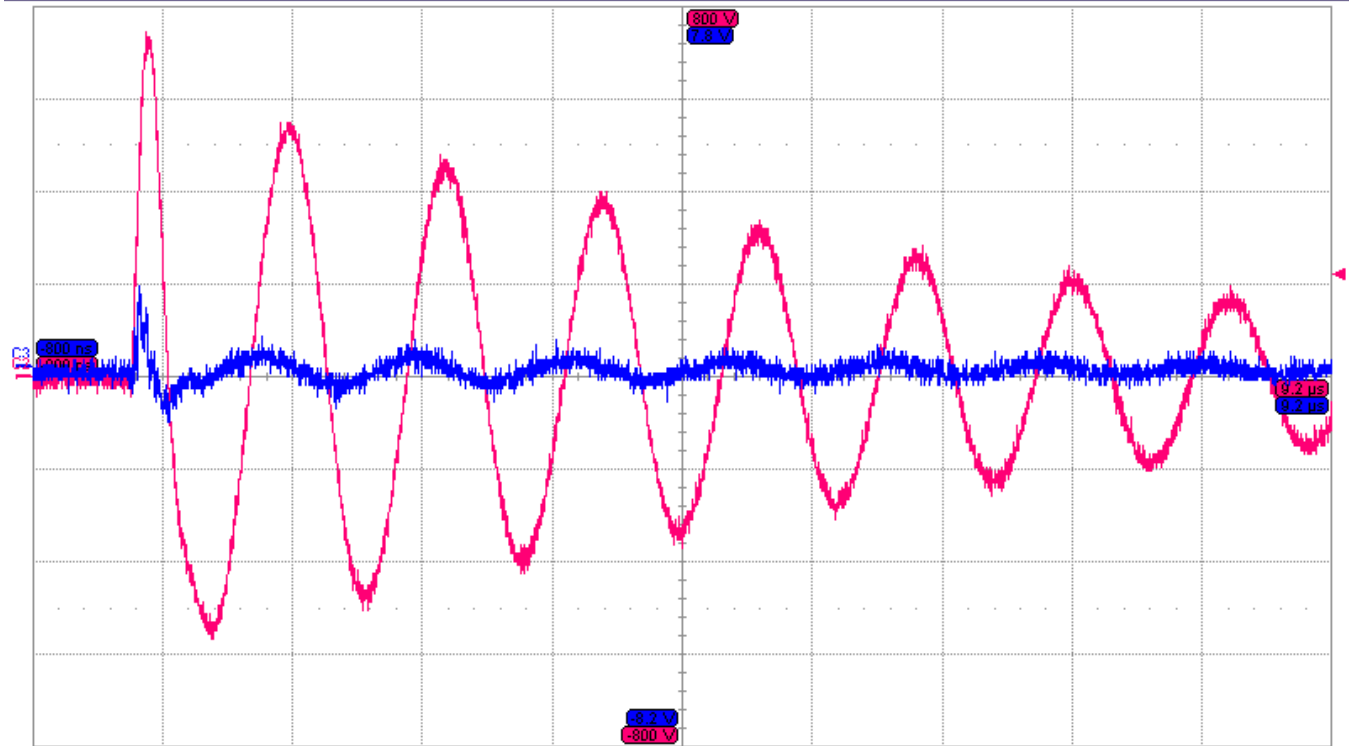
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 1:06:52 PM

Pin WF3 Test Pos - Board 3 - Input 1B



Holt Integrated Electronics
 Board 3
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status

P1:max(C2)	742 V	P2:max(C3)	1.74 V	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
------------	-------	------------	--------	------------	------------	--------	--------	--------	--------

C2 200 V/div 0.0 V offset DC1M
 C3 2.00 V/div 200 mV offset DC1M

TELEDYNE LECROY

Timebase -4.20 μ s 5.00 kS
 Trigger Stop 220 V Edge Positive

2/27/2014 1:07:09 PM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

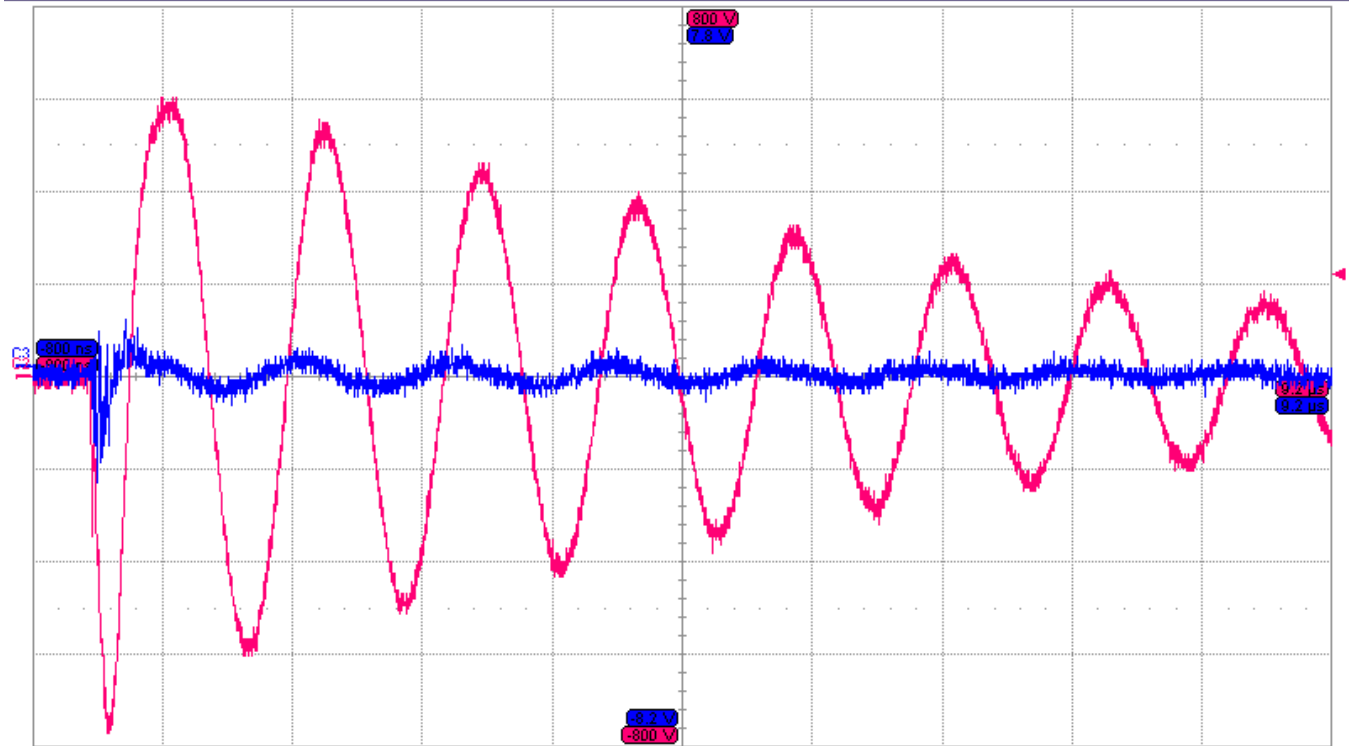
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 DSO S/N:
 User: labadmin
 Time: 2/27/2014 10:45:21 AM

Pin WF3 Test Neg - Board 1 - Input 1A



Holt Integrated Electronics
 Board 1
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-769 V	-2.50 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	2.00 V/div	200 V/div	200 mV/div
0.0 V offset	200 mV offset		

Timebase	-4.20 μs	Trigger	C2
	1.00 μs/div	Stop	220 V
5.00 kS	500 MS/s	Edge	Positive

TELEDYNE LECROY 2/27/2014 10:45:30 AM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

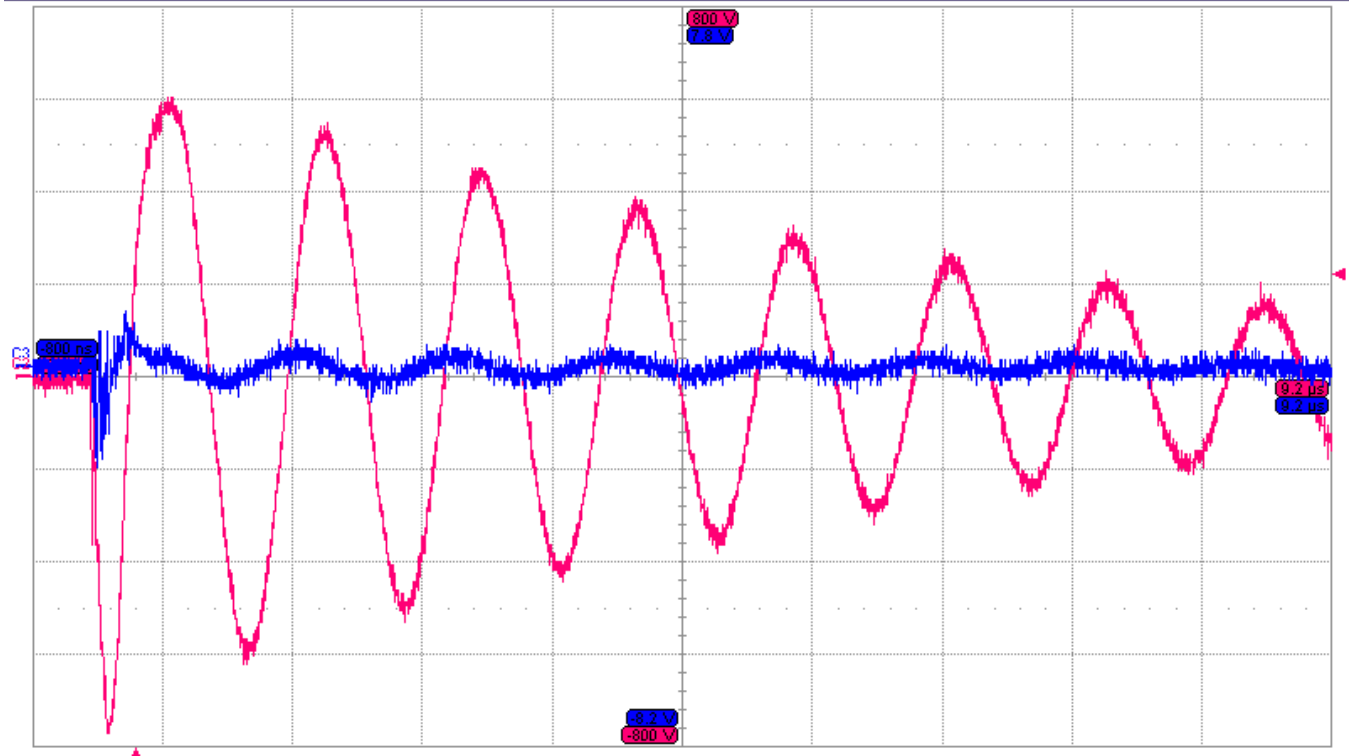
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 DSO S/N:
 User: labadmin
 Time: 2/27/2014 10:40:51 AM

Pin WF3 Test Neg - Board 1 - Input 1B



Holt Integrated Electronics
 Board 1
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-769 V	-2.14 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	2.00 V/div	200 V/div	200 mV/div
0.0 V offset	200 mV offset		

TELEDYNE LECROY	
------------------------	--

Timebase	-4.20 μs	Trigger	C2
5.00 kS	1.00 μs/div	Stop	220 V
	500 MS/s	Edge	Positive

2/27/2014 10:41:00 AM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

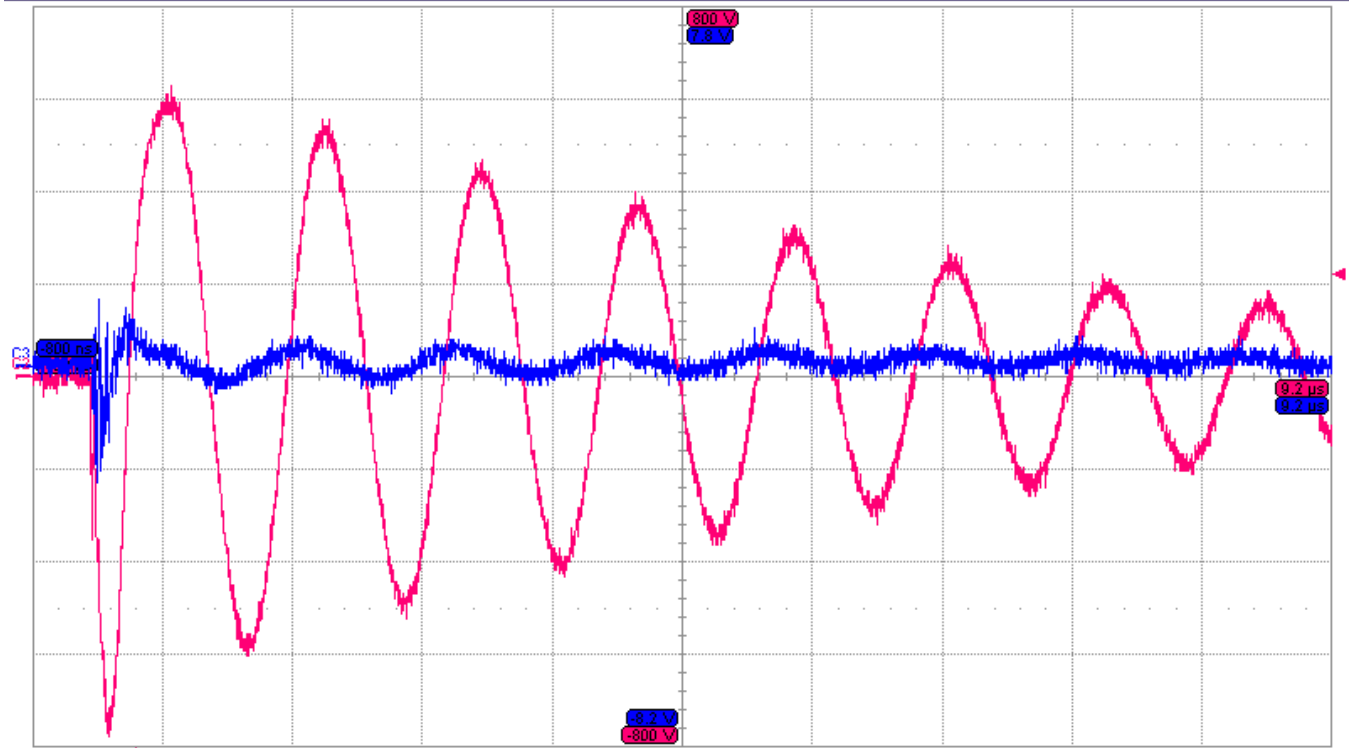
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 12:50:51 PM

Pin WF3 Test Neg - Board 2 - Input 1A



Holt Integrated Electronics
 Board 2
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-778 V	-2.50 V						
status	✓	✓						

C2	DCIM	C3	DCIM
200 V/div	2.00 V/div	200 V/div	200 mV/div
0.0 V offset	200 mV offset		

TELEDYNE LECROY	Timebase	-4.20 µs	Trigger	C2
	1.00 µs/div	500 MS/s	Stop	220 V
	5.00 kS		Edge	Positive

2/27/2014 12:50:59 PM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

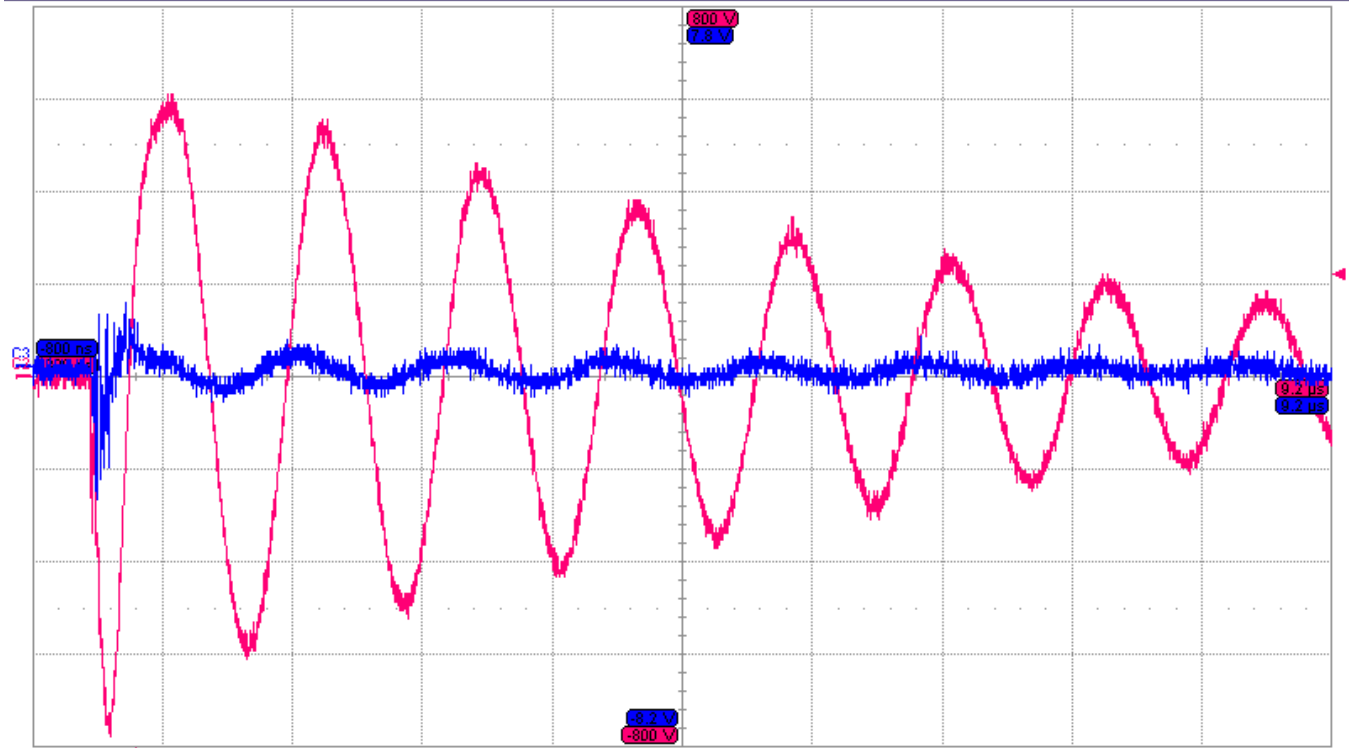
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 12:53:08 PM

Pin WF3 Test Neg - Board 2 - Input 1B



Holt Integrated Electronics
 Board 2
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-778 V	-2.85 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	2.00 V/div	200 V/div	200 mV/div
0.0 V offset	200 mV offset		

TELEDYNE LECROY	Timebase	-4.20 μs	Trigger	C2
	1.00 μs/div	500 MS/s	Stop	220 V
	5.00 kS		Edge	Positive

2/27/2014 12:53:16 PM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

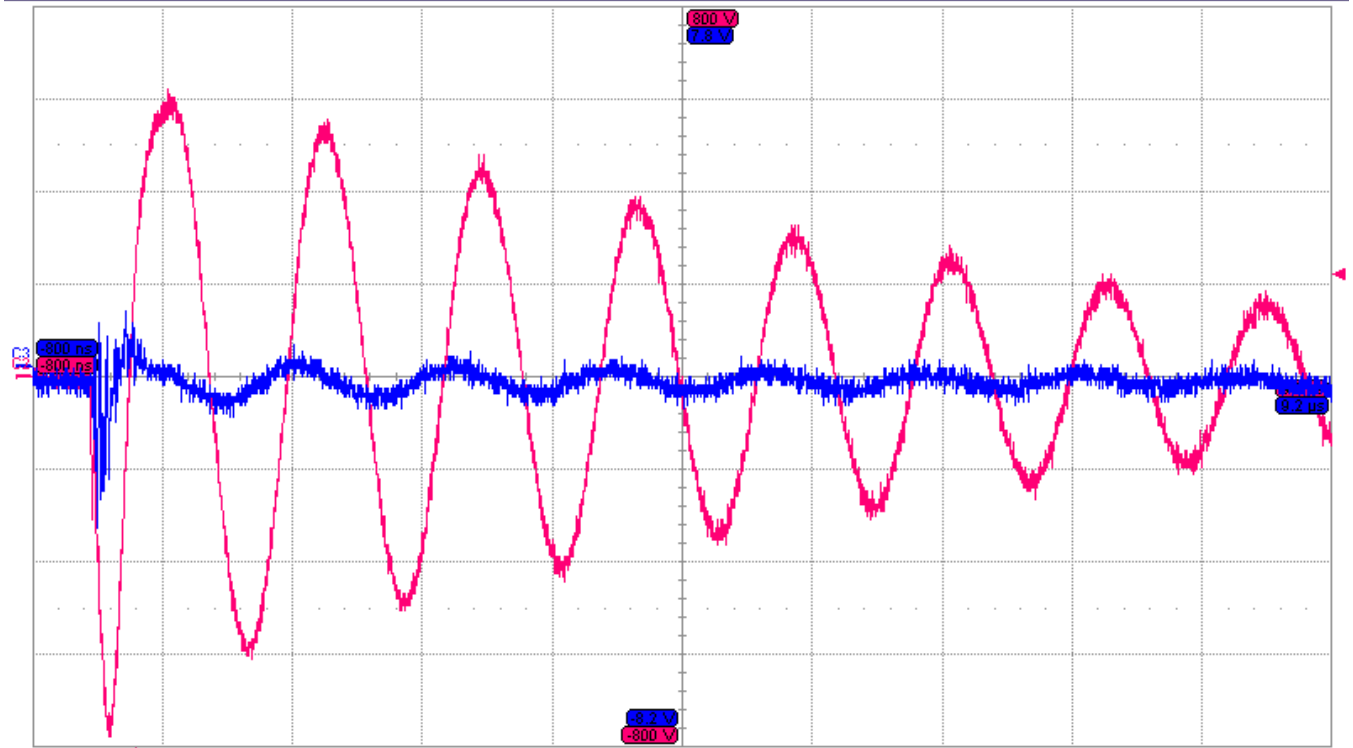
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 DSO S/N:
 User: labadmin
 Time: 2/27/2014 1:14:20 PM

Pin WF3 Test Neg - Board 3 - Input 1A



Holt Integrated Electronics
 Board 3
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure

Measure	value	status
P1:min(C2)	-778 V	✓
P2:min(C3)	-3.47 V	✓
P3:max(F3)		
P4:max(F4)		
P5:---		
P6:---		
P7:---		
P8:---		

Channel Settings:

Channel	Scale	Offset	DCIM
C2	200 V/div	0.0 V offset	DC1M
C3	2.00 V/div	200 mV offset	DC1M

Timebase: -4.20 μs
Trigger: C2, Stop, 220 V, Edge, Positive
 5.00 kS, 500 MS/s

TELEDYNE LECROY
 2/27/2014 1:14:28 PM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

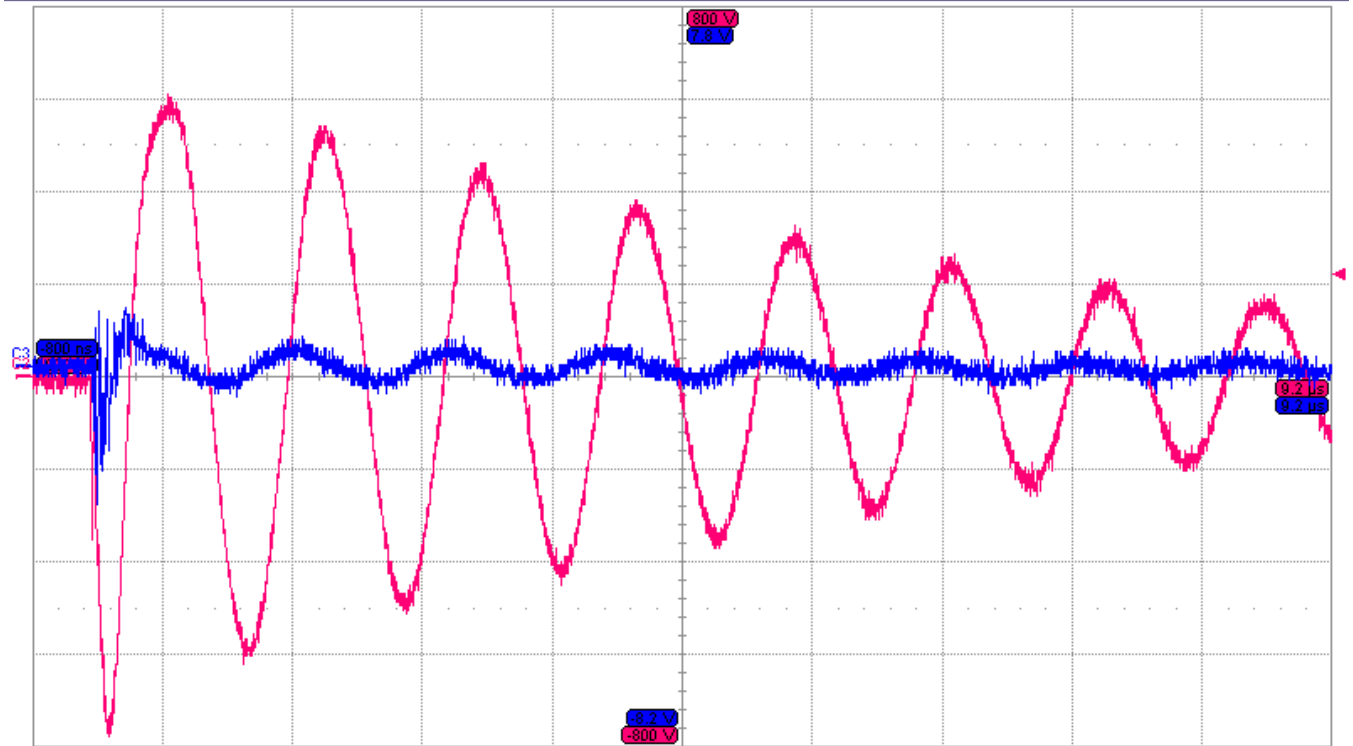
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
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 Time: 2/27/2014 1:08:51 PM

Pin WF3 Test Neg - Board 3 - Input 1B



Holt Integrated Electronics
 Board 3
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status

P1:min(C2)	-778 V	P2:min(C3)	-2.94 V	P3:max(F3)		P4:max(F4)		P5:---	P6:---	P7:---	P8:---
------------	--------	------------	---------	------------	--	------------	--	--------	--------	--------	--------

C2 200 V/div 0.0 V offset
 C3 2.00 V/div 200 mV offset

Timebase -4.20 μ s 5.00 kS
 Trigger Stop Edge Positive

TELEDYNE LECROY

2/27/2014 1:08:59 PM

Channel Status

	C2	C3
V / Div	200 V	2.00 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8450
Report Number: 19807
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

PIN INJECTION TEST DATA SHEETS

WF4

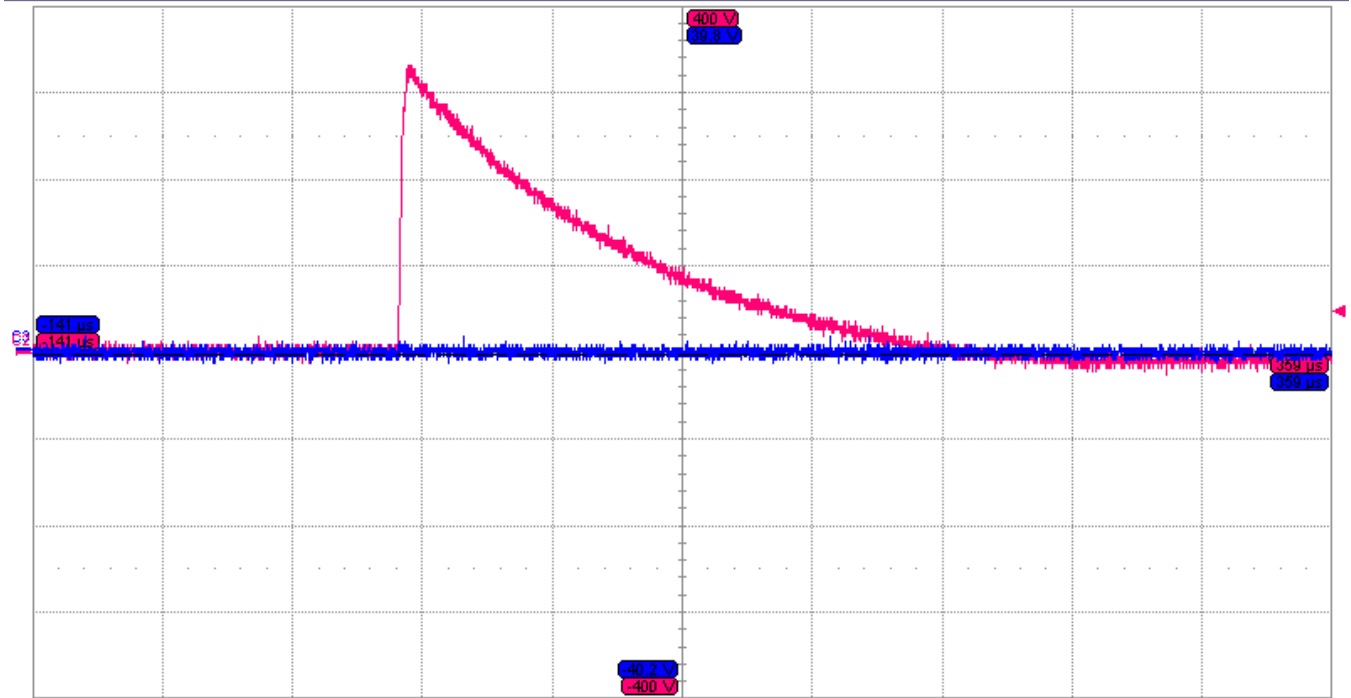
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:17:01 PM

Pin WF4 Test Pos - Board 1 - Input 1A



Holt Integrated Electronics
 Board 1
 Pin Inj. WF4 (Direct Injection)
 Level 3 - 300V/60A
 Gen 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	331 V	1.6 V						
status	✓	✓						

C2	C3
100 V/div	10.0 V/div
0.0 V offset	200 mV offset
---	---
-2 V	-400 mV
-2 V	-400 mV

Timebase	Trigger
-109 μs	Stop
50.0 μs/div	47 V
5.00 kS	10 MS/s
	Edge
	Positive

X1= 42.2 μs ΔX= -43.8 μs
 X2= -1.6 μs 1/ΔX= -22.83 kHz
 2/27/2014 3:17:10 PM

TELEDYNE LECROY

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

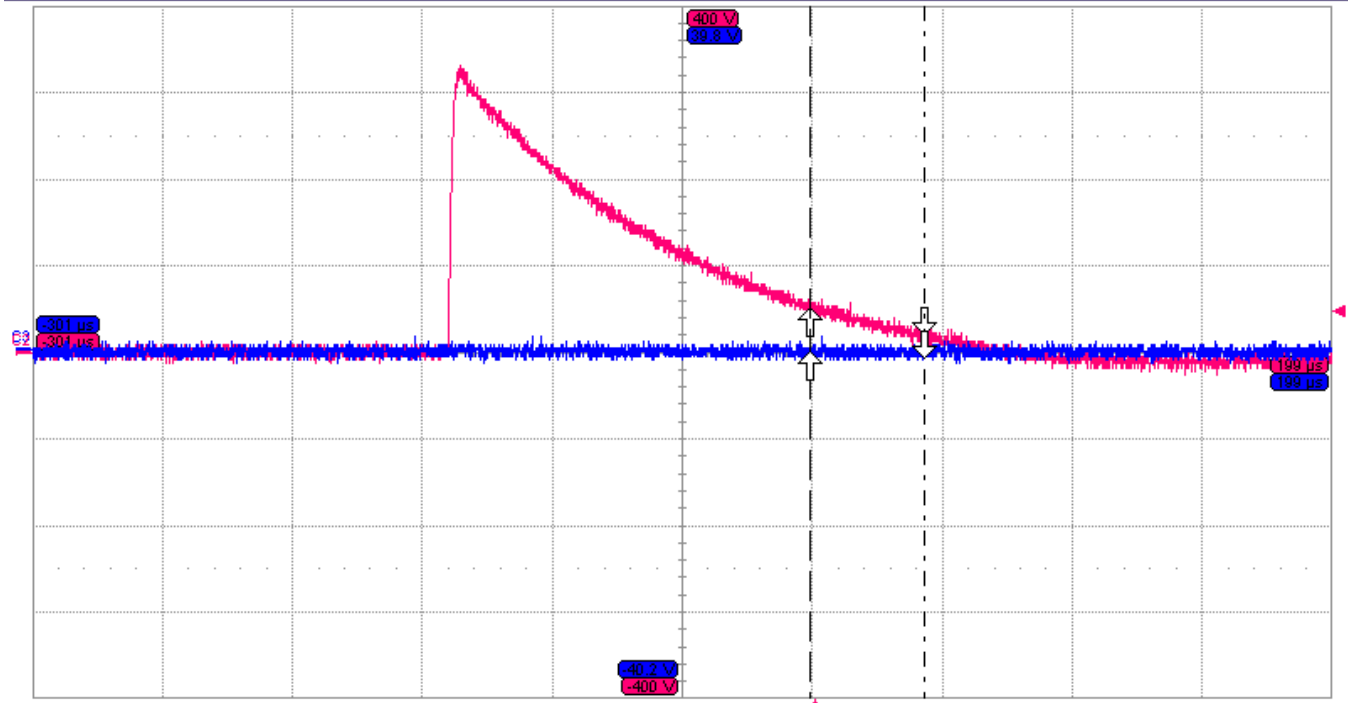
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:09:56 PM

Pin WF4 Test Pos - Board 1 - Input 1B



Holt Integrated Electronics
 Board 1
 Pin Inj. WF4 (Direct Injection)
 Level 3 - 300V/60A
 Gen 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	331 V	1.6 V						
status	✓	✓						

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
↓ 22.4 V		↓ -640 mV	
↑ 48.6 V		↑ -230 mV	

Timebase	51 μ s	Trigger	C2
	50.0 μ s/div	Stop	47 V
5.00 kS	10 MS/s	Edge	Negative
X1=	42.2 μ s	Δ X=	-43.8 μ s
X2=	-1.6 μ s	1/ Δ X=	-22.83 kHz

TELEDYNE LECROY

2/27/2014 3:10:23 PM

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

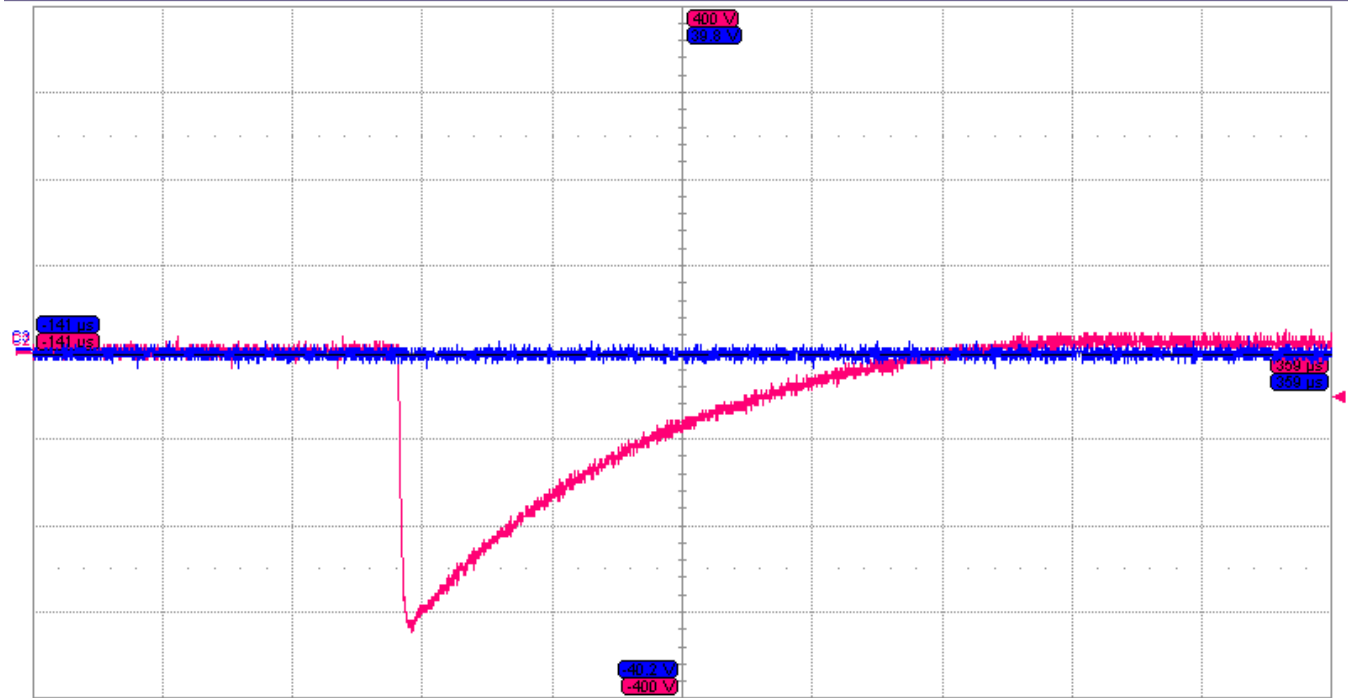
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:14:27 PM

Pin WF4 Test Neg - Board 1 - Input 1A



Holt Integrated Electronics
 Board 1
 Pin Inj. WF4 (Direct Injection)
 Level 3 - 300V/60A
 Gen 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-323 V	-2.0 V						
status	✓	✓						

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
----	-2 V	----	-400 mV
----	-2 V	----	-400 mV

Timebase	-109 μ s	Trigger	C2
	50.0 μ s/div	Stop	-52 V
5.00 kS	10 MS/s	Edge	Negative
X1=	42.2 μ s	Δ X=	-43.8 μ s
X2=	-1.6 μ s	1/ Δ X=	-22.83 kHz

TELEDYNE LECROY

2/27/2014 3:14:38 PM

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

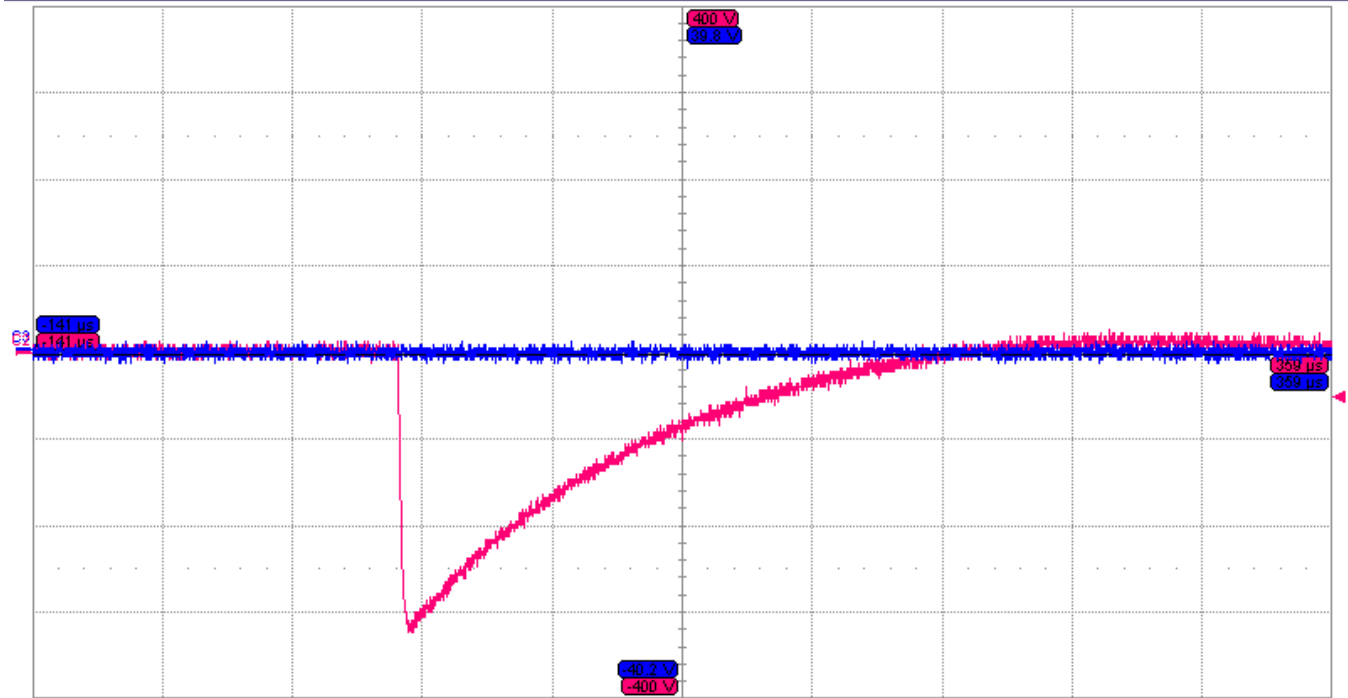
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:12:05 PM

Pin WF4 Test Neg - Board 1 - Input 1B



Holt Integrated Electronics
 Board 1
 Pin Inj. WF4 (Direct Injection)
 Level 3 - 300V/60A
 Gen 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:min(C2) P2:min(F3) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---
 value -323 V -2.0 V
 status ✓ ✓

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
----	-2 V	----	-400 mV
----	-2 V	----	-400 mV

Timebase	-109 μ s	Trigger	C2
	50.0 μ s/div	Stop	-52 V
	5.00 kS	Edge	Negative

TELEDYNE LECROY

2/27/2014 3:12:15 PM

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8450
Report Number: 19807
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

PIN INJECTION TEST DATA SHEETS

WF5A

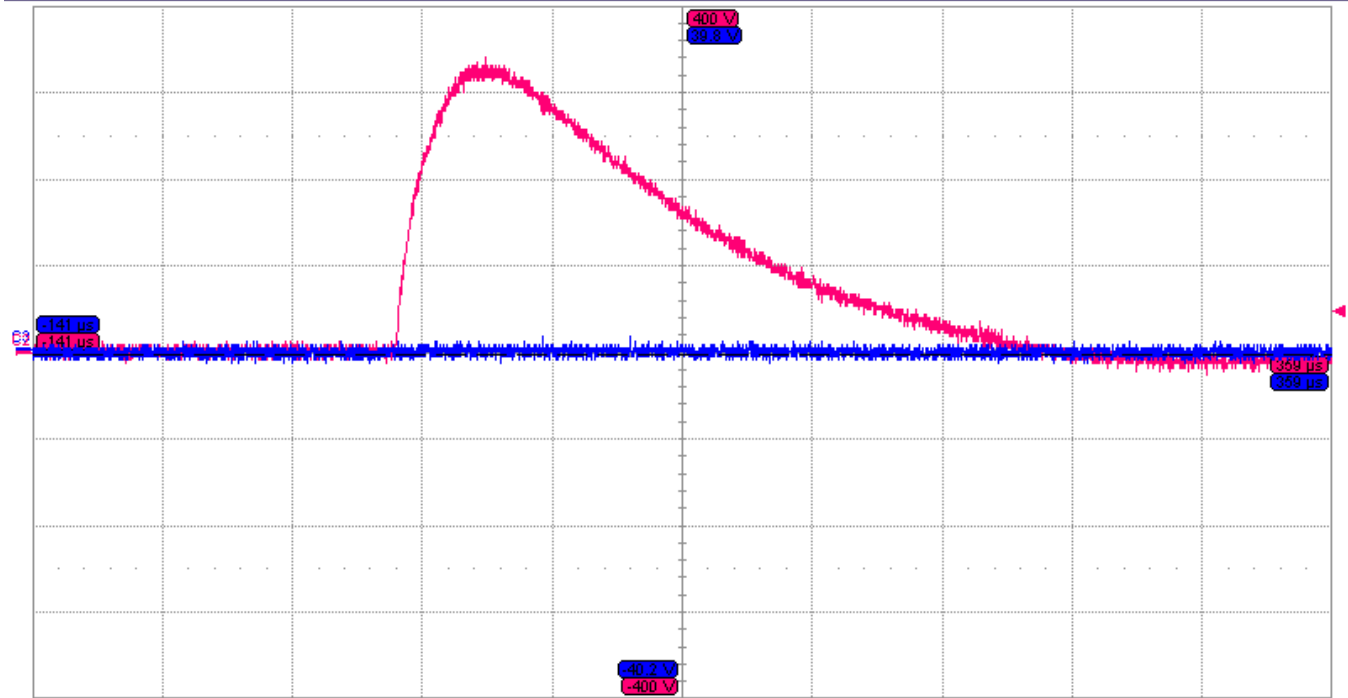
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:26:37 PM

Pin WF5A Test Pos - Board 1 - Input 1A



Holt Integrated Electronics
 Board 2
 Pin Inj. WF5A (Direct Injection)
 Level 3 - 300V/300A
 Gen 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C2) P2:max(F3) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---
 value 340 V 1.6 V
 status ✓ ✓

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
----	-2 V	----	-400 mV
----	-2 V	----	-400 mV

Timebase	-109 μ s	Trigger	C2
	50.0 μ s/div	Stop	47 V
	5.00 kS	Edge	Positive

X1= 42.2 μ s Δ X= -43.8 μ s
 X2= -1.6 μ s 1/ Δ X= -22.83 kHz
 2/27/2014 3:26:47 PM

TELEDYNE LECROY

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Vertical	DC1M Ω	DC1M Ω
Coupling	Full	Full
BW	1.000e+3	200.000
Probe	1 #	1 #
Sweeps		

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

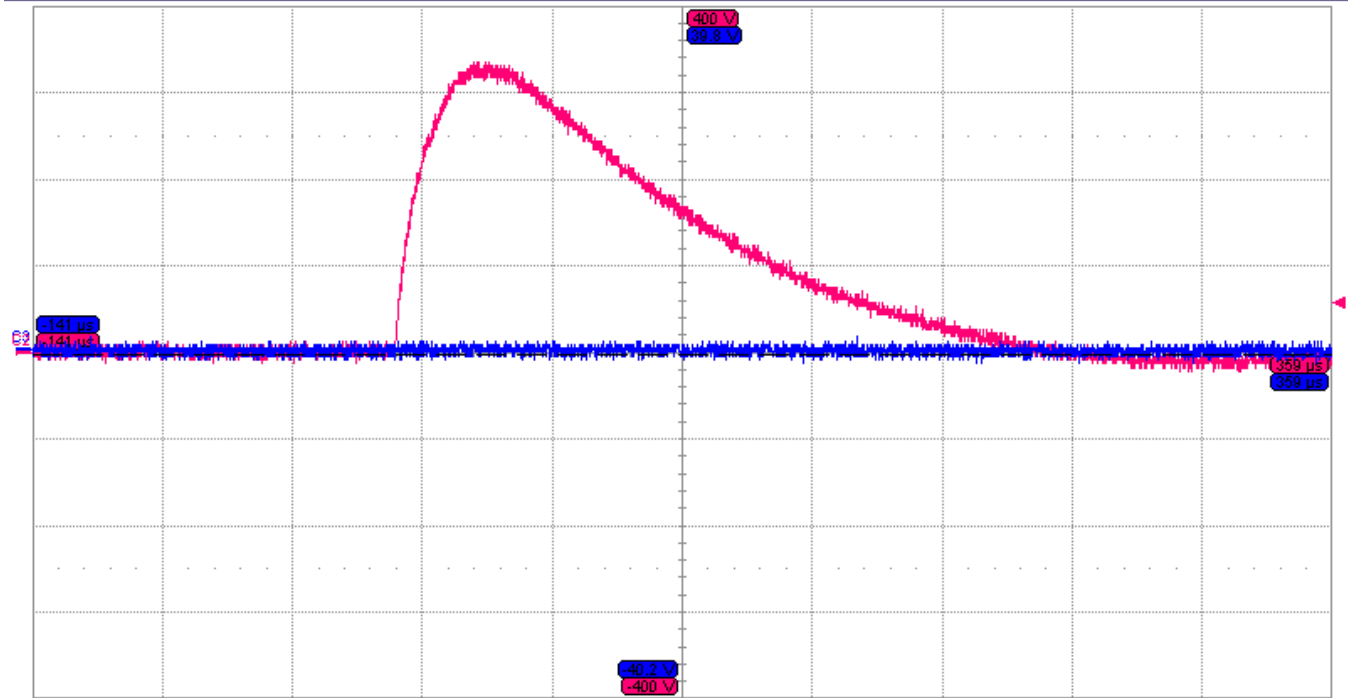
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:35:34 PM

Pin WF5A Test Pos - Board 2 - Input 1B



Holt Integrated Electronics
 Board 2
 Pin Inj. WF5A (Direct Injection)
 Level 3 - 300V/300A
 Gen 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	336 V	1.6 V						
status	✓	✓						

C2	C3
100 V/div	10.0 V/div
0.0 V offset	200 mV offset
----	----
-2 V	-400 mV
----	----
-2 V	-400 mV

Timebase	Trigger
-109 μ s	Stop
50.0 μ s/div	58 V
5.00 kS	Edge
	Positive

X1= 42.2 μ s Δ X= -43.8 μ s
 X2= -1.6 μ s 1/ Δ X= -22.83 kHz
 2/27/2014 3:35:43 PM

TELEDYNE LECROY

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

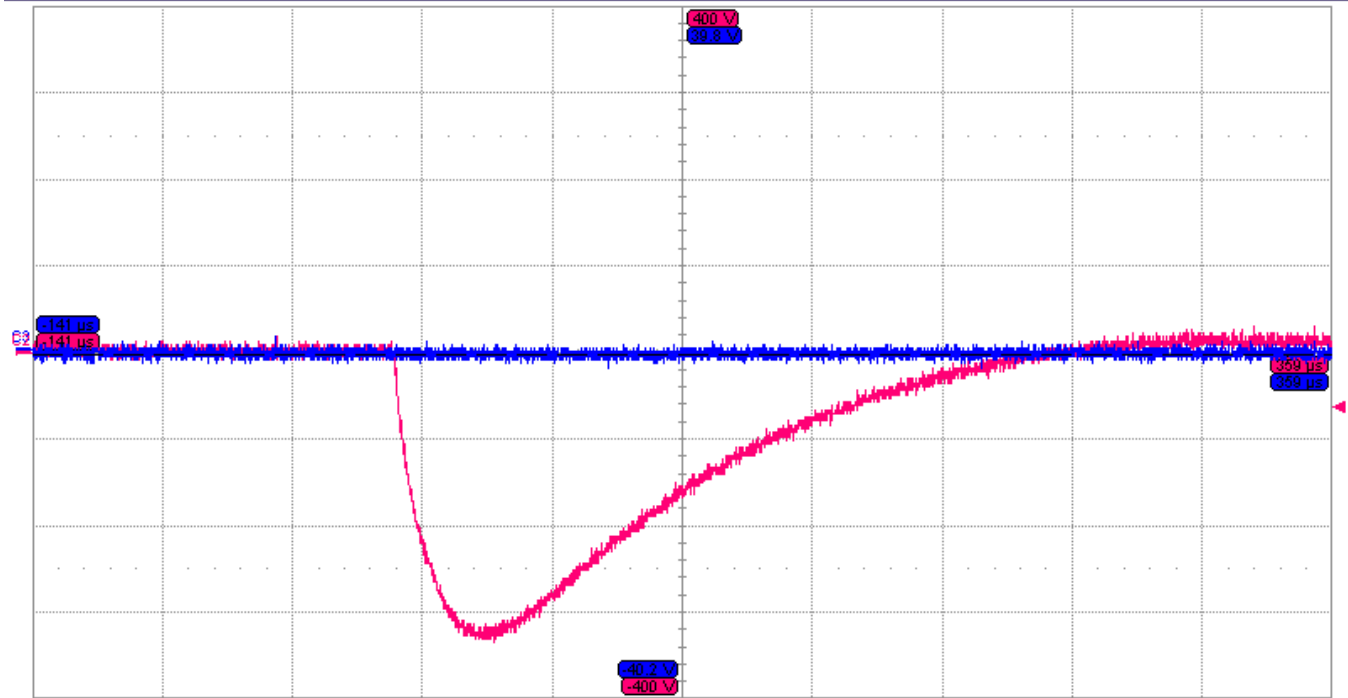
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:28:46 PM

Pin WF5A Test Neg - Board 2 - Input 1A



Holt Integrated Electronics
 Board 2
 Pin Inj. WF5A (Direct Injection)
 Level 3 - 300V/300A
 Gen 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:min(C2) P2:min(F3) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---
 value -336 V -2.0 V
 status ✓ ✓

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
----	-2 V	----	-400 mV
----	-2 V	----	-400 mV

Timebase	-109 μs	Trigger	C2
	50.0 μs/div	Stop	-63 V
	5.00 kS	Edge	Negative

X1= 42.2 μs ΔX= -43.8 μs
 X2= -1.6 μs 1/ΔX= -22.83 kHz
 2/27/2014 3:28:57 PM

TELEDYNE LECROY

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

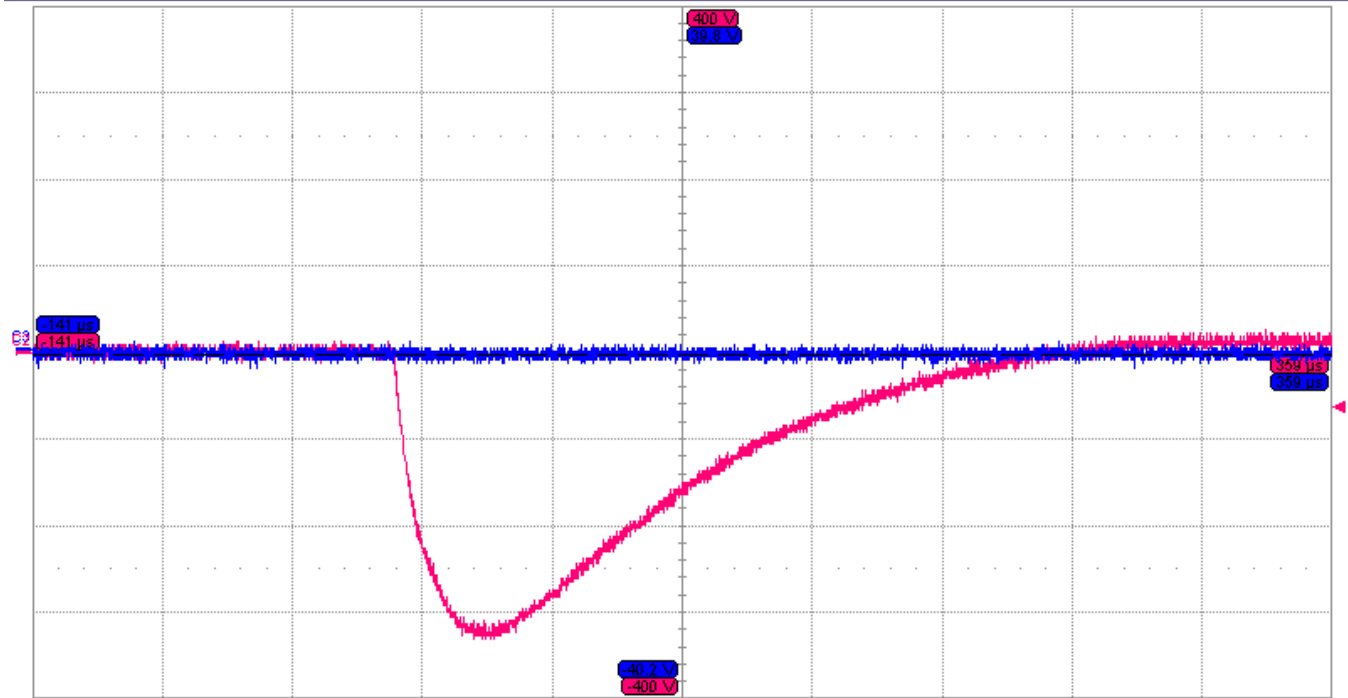
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:30:34 PM

Pin WF5A Test Neg - Board 2 - Input 1B



Holt Integrated Electronics
 Board 2
 Pin Inj. WF5A (Direct Injection)
 Level 3 - 300V/300A
 Gen 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-331 V	-2.0 V						
status	✓	✓						

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
----	-2 V	----	-400 mV
----	-2 V	----	-400 mV

Timebase	-109 μs	Trigger	C2
	50.0 μs/div	Stop	-63 V
5.00 kS	10 MS/s	Edge	Negative
X1=	42.2 μs	ΔX=	-43.8 μs
X2=	-1.6 μs	1/ΔX=	-22.83 kHz

TELEDYNE LECROY

2/27/2014 3:30:43 PM

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8450
Report Number: 19807
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

PIN INJECTION TEST DATA SHEETS

WF5B

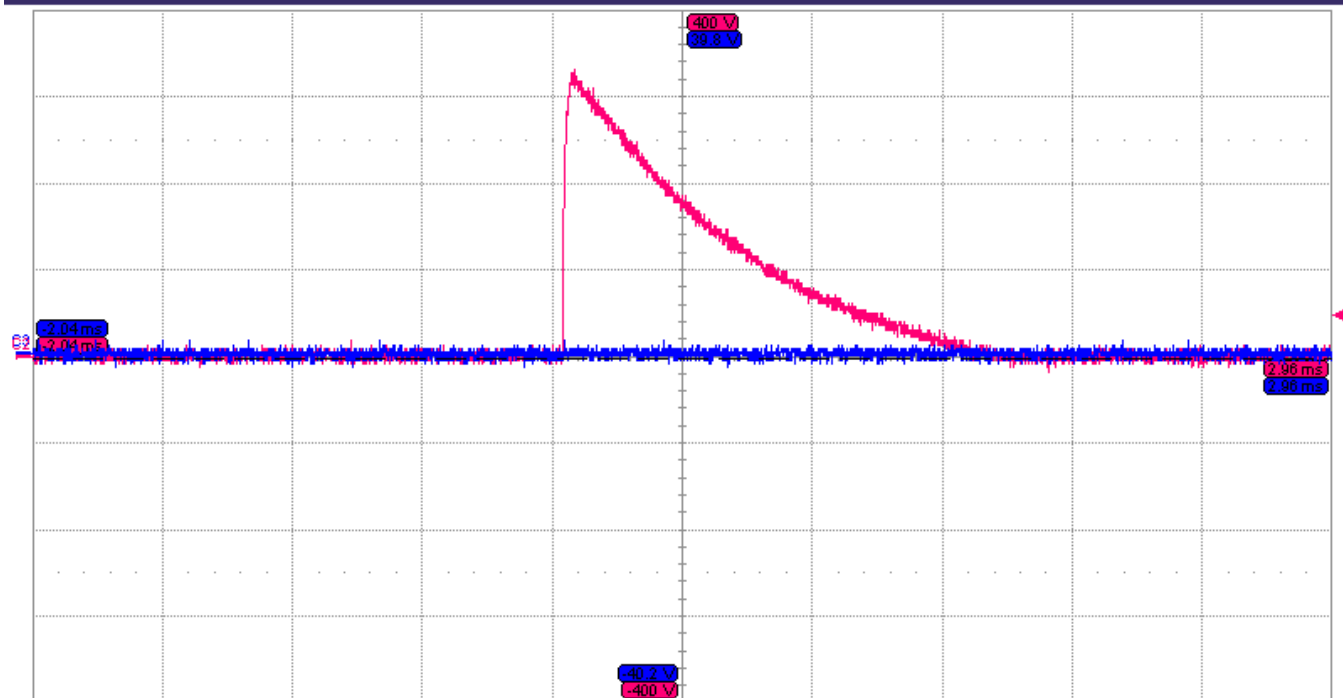
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:54:26 PM

Pin WF5B Test Pos - Board 3 - Input 1A



Holt Integrated Electronics
 Board 3
 Pin Inj. WF5B (Direct Injection)
 Level 3 - 300V/300A
 Gen 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	331 V	1.6 V						
status	✓	✓						

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
----	-2 V	----	-400 mV
----	-2 V	----	-400 mV

Timebase	-460 μ s	Trigger	C2
	500 μ s/div	Stop	47 V
5.00 kS	1.0 MS/s	Edge	Positive
X1=	42.2 μ s	Δ X=	-43.8 μ s
X2=	-1.6 μ s	1/ Δ X=	-22.83 kHz

2/27/2014 3:54:34 PM

TELEDYNE LECROY

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

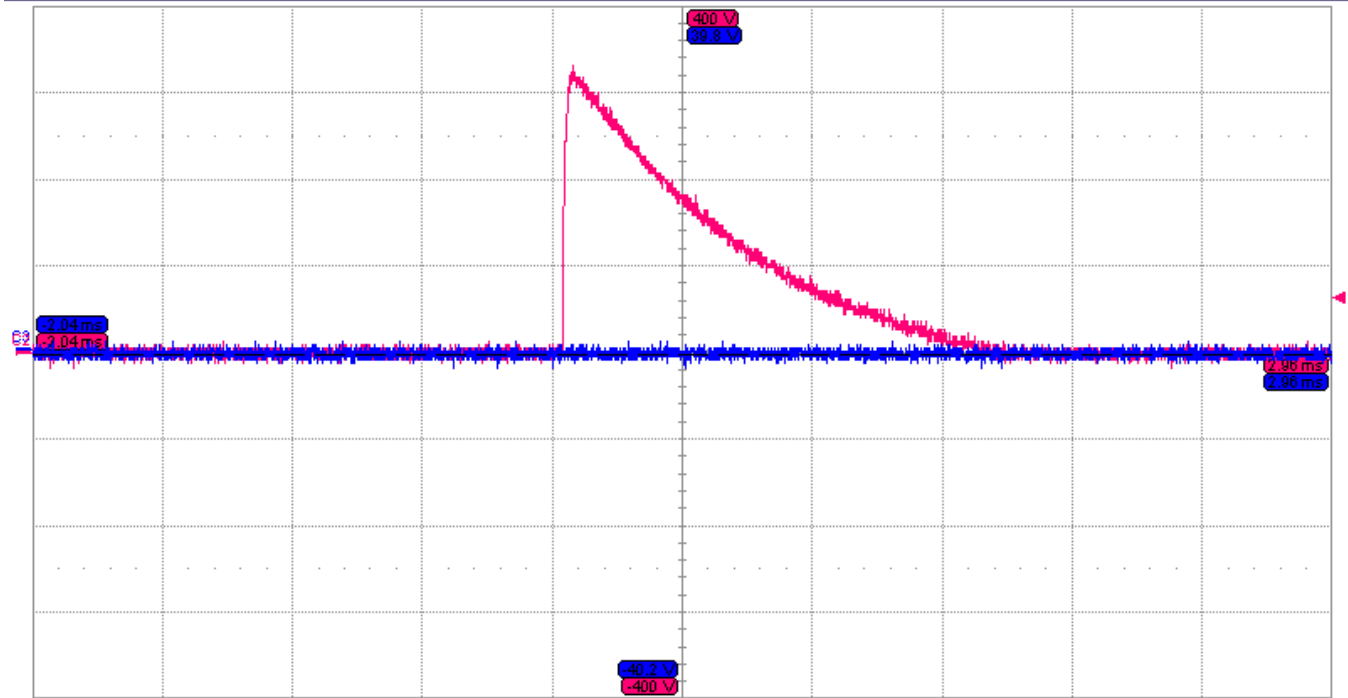
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:41:50 PM

Pin WF5B Test Pos - Board 3 - Input 1B



Holt Integrated Electronics
 Board 3
 Pin Inj. WF5B (Direct Injection)
 Level 3 - 300V/300A
 Gen 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	331 V	1.1 V						
status	✓	✓						

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
----	-2 V	----	-400 mV
----	-2 V	----	-400 mV

TELEDYNE LECROY

Timebase	-460 μ s	Trigger	C2
	500 μ s/div	Stop	64 V
5.00 kS	1.0 MS/s	Edge	Positive
X1=	42.2 μ s	Δ X=	-43.8 μ s
X2=	-1.6 μ s	1/ Δ X=	-22.83 kHz

2/27/2014 3:42:07 PM

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Vertical Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

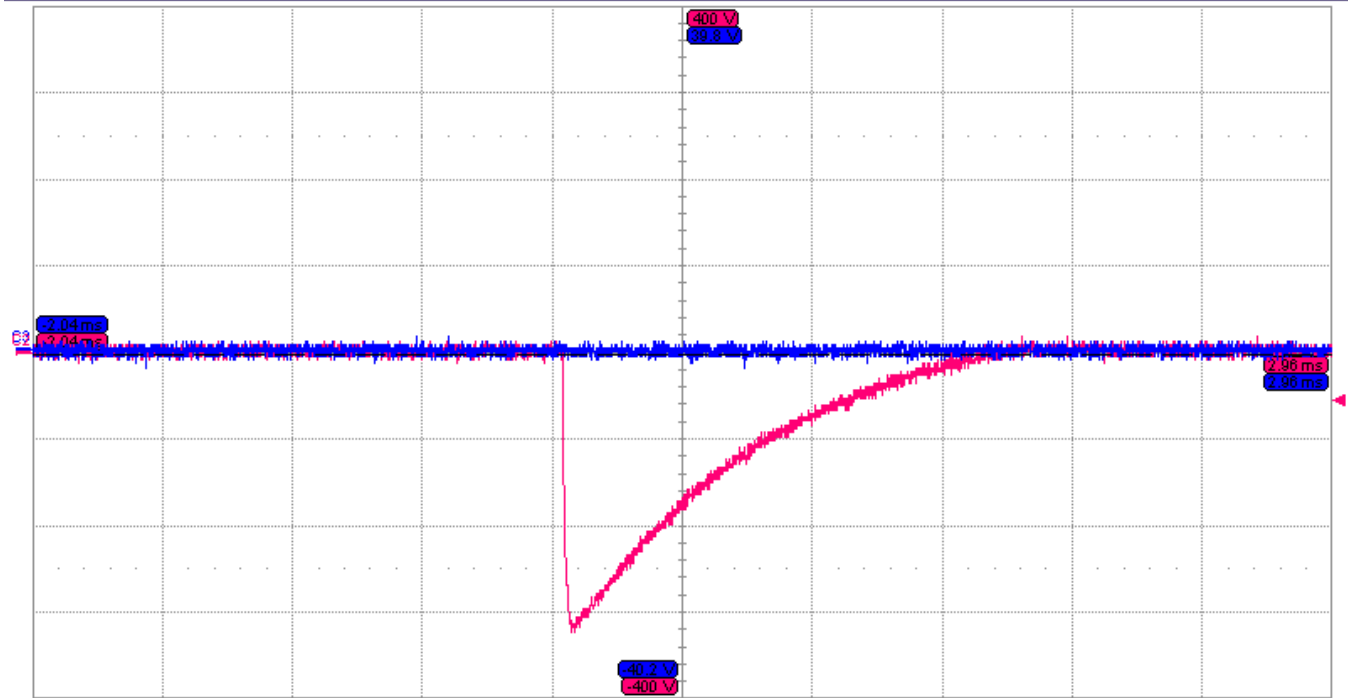
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:52:25 PM

Pin WF5B Test Neg - Board 3 - Input 1A



Holt Integrated Electronics
 Board 3
 Pin Inj. WF5B (Direct Injection)
 Level 3 - 300V/300A
 Gen 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-323 V	-2.0 V						
status	✓	✓						

C2	DCIM	C3	DCIM
100 V/div		10.0 V/div	
0.0 V offset		200 mV offset	
----	-2 V	----	-400 mV
----	-2 V	----	-400 mV

TELEDYNE LECROY	
Timebase	-460 μ s
	500 μ s/div
5.00 kS	1.0 MS/s
X1=	42.2 μ s
X2=	-1.6 μ s
ΔX=	-43.8 μ s
1/ΔX=	-22.83 kHz
	2/27/2014 3:52:37 PM

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Vertical Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

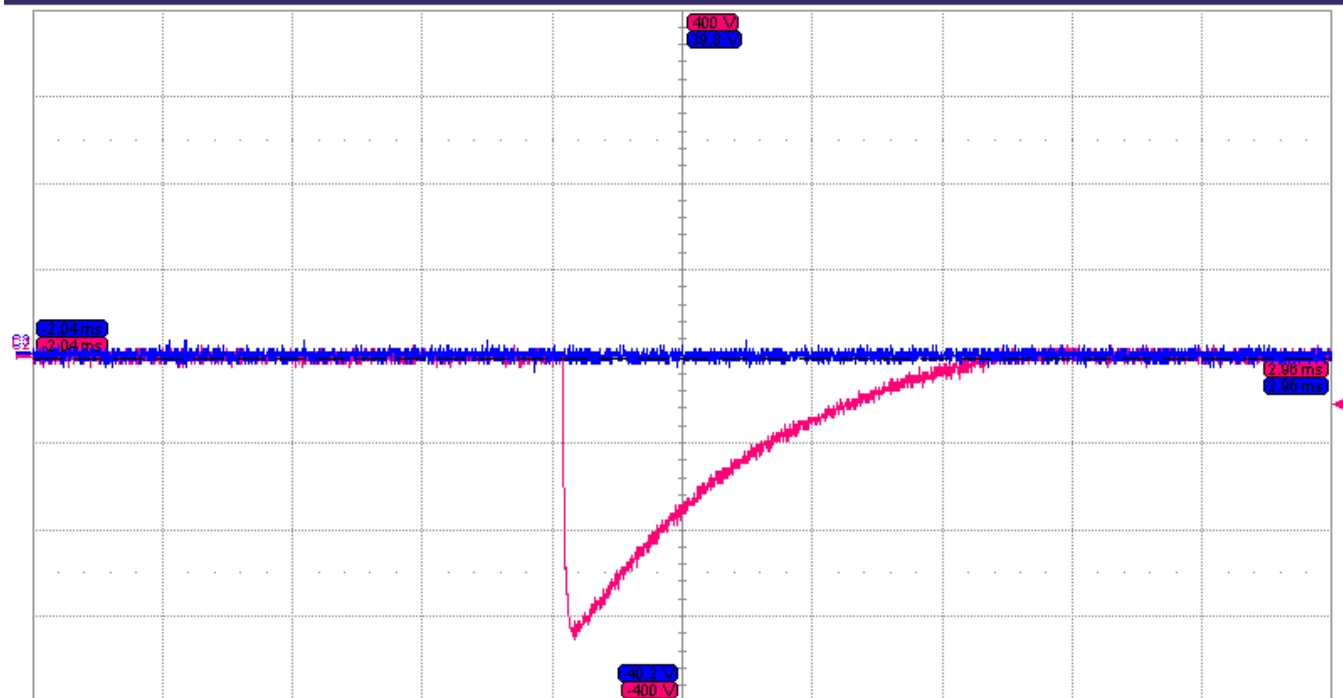
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 3:46:00 PM

Pin WF5B Test Neg - Board 3 - Input 1B



Holt Integrated Electronics
 Board 3
 Pin Inj. WF5B (Direct Injection)
 Level 3 - 300V/300A
 Gen 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(F3)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-327 V	-2.0 V						
status	✓	✓						

Channel	Scale	Offset
C2	100 V/div	0.0 V
C3	10.0 V/div	200 mV

Parameter	Value
Timebase	-460 μs
Trigger	Stop
5.00 kS	1.0 MS/s
X1	42.2 μs
X2	-1.6 μs
ΔX	-43.8 μs
1/ΔX	-22.83 kHz

TELEDYNE LECROY

2/27/2014 3:46:08 PM

Channel Status

	C2	C3
V / Div	100 V	10.0 V
Offset	0.0 V	200 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	200.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
Trigger	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8450
Report Number: 19807
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

PIN INJECTION TEST DATA SHEETS

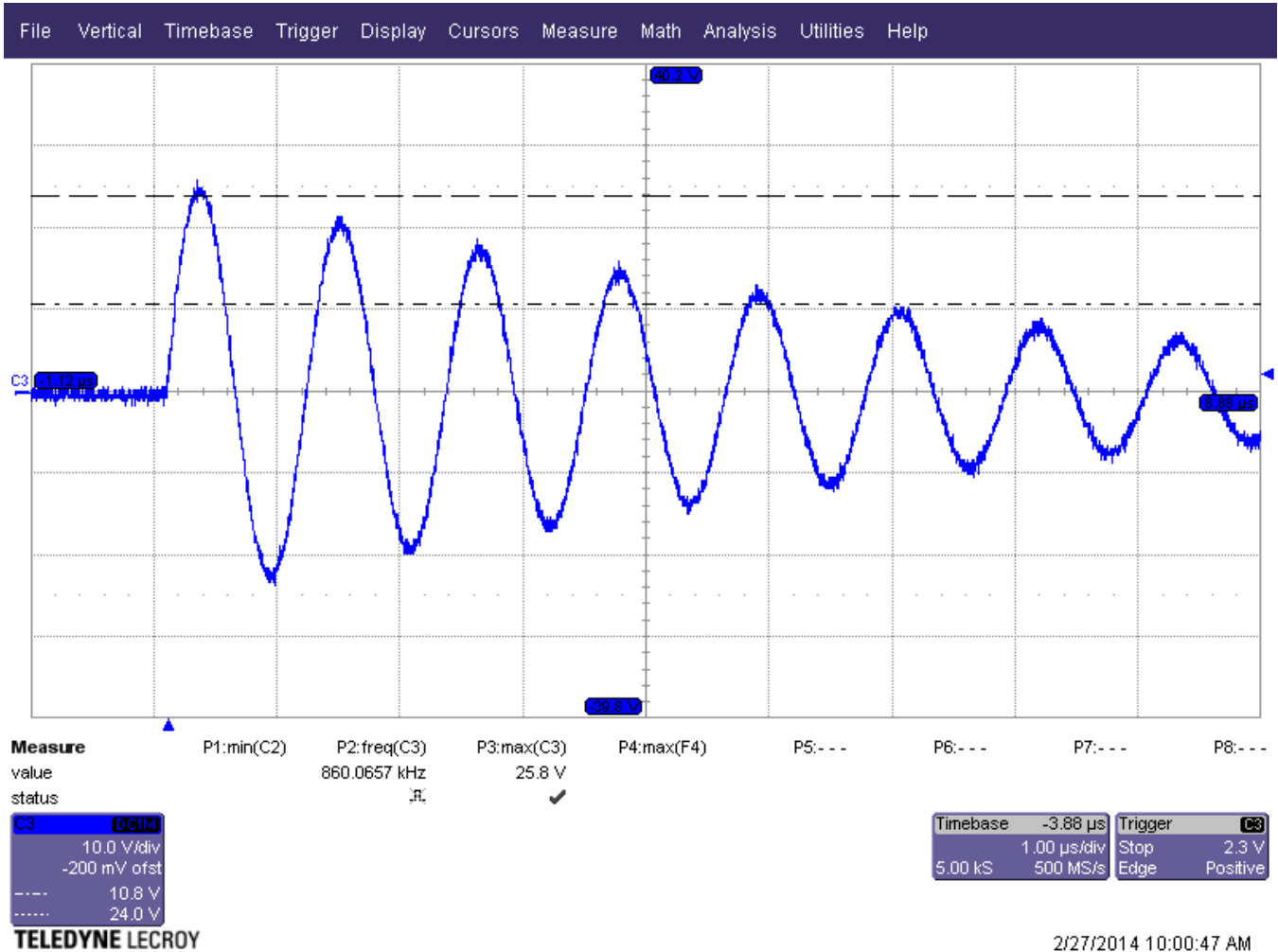
WF3 CALIBRATION DATA

Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 10:00:14 AM

Pin WF3 Level 3 Short Circuit Verification - Positive



WF3 Pin Injection (Direct Injection)
 Short Circuit Verification
 Level 3 600V/24A
 f=1MHz +/-20%
 5th-25%-75% of 1st
 Gen = 650



Channel Status

	C3
V / Div	10.0 V
Offset	-
Coupling	DC1MΩ
BW-Limit	Full
Probe	200.000
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

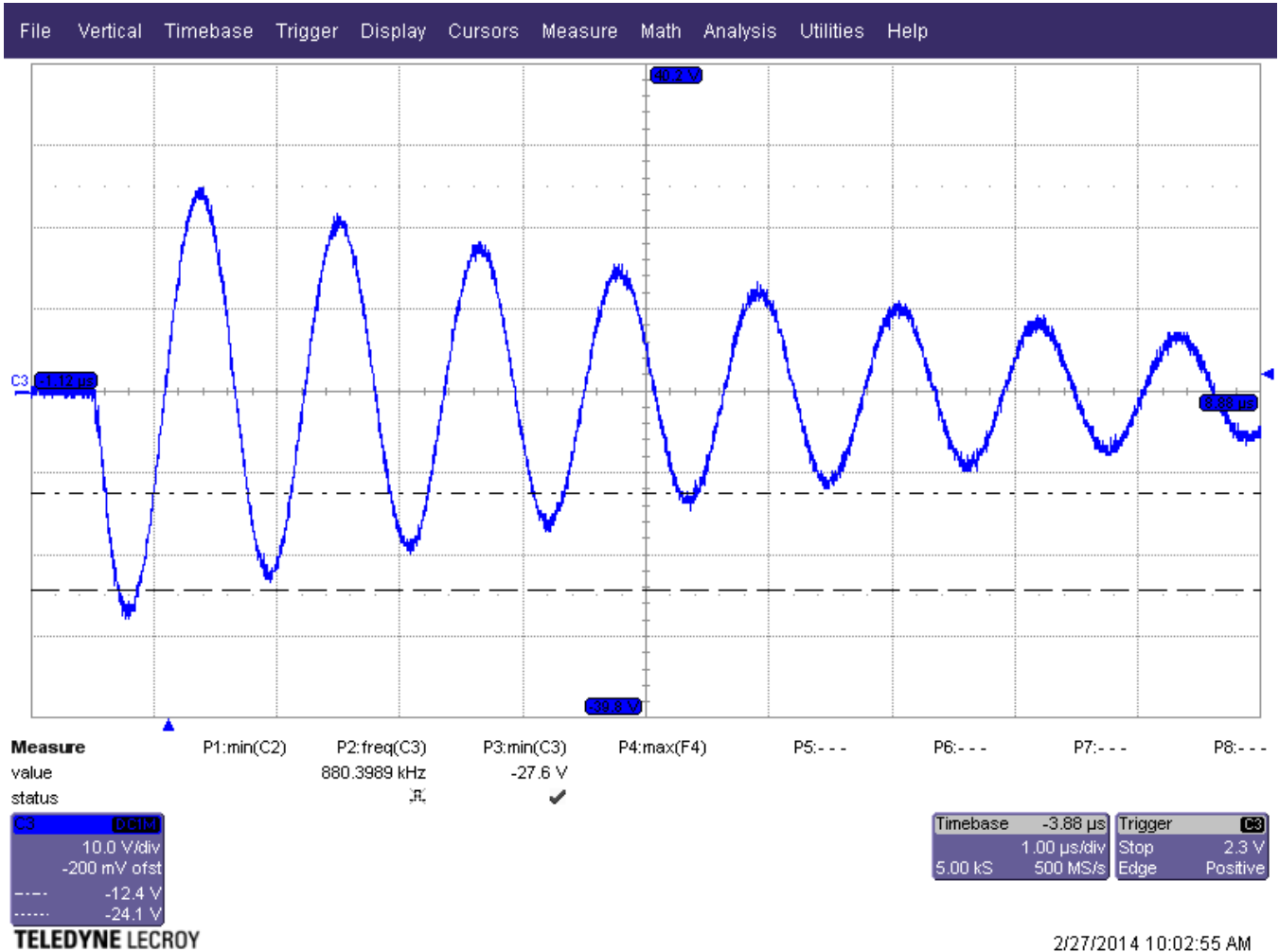
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	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 10:02:46 AM

Pin WF3 Level 3 Short Circuit Verification - Negative



WF3 Pin Injection (Direct Injection)
 Short Circuit Verification
 Level 3 600V/24A
 f=1MHz +/-20%
 5th-25%-75% of 1st
 Gen = 650



2/27/2014 10:02:55 AM

Channel Status

		C3
	V / Div	10.0 V
	Offset	-
Vertical	Coupling	DC1MΩ
	BW-Limit	Full
	Probe	200.000
	Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

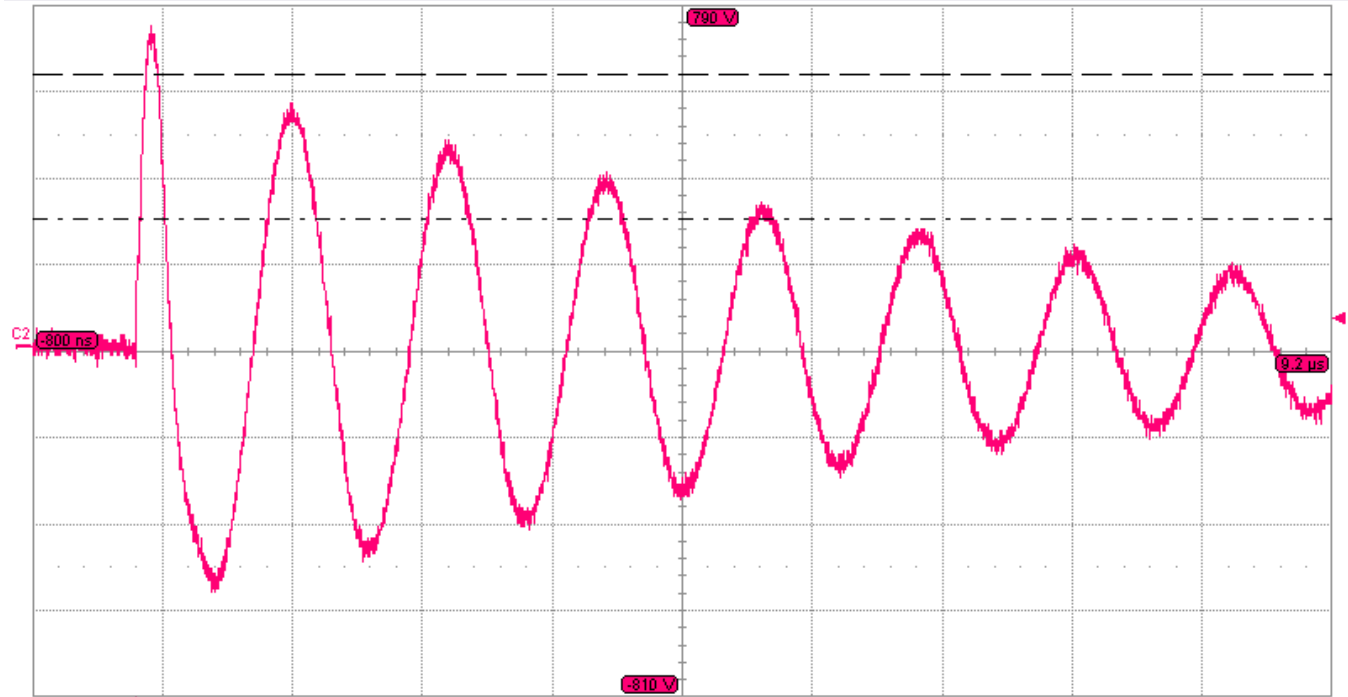
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 10:18:00 AM

Pin WF3 Level 3 Open Circuit Verification - Positive



WF3 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 600V/24A
 f=1MHz +/-20%
 5th-25%-75% of 1st
 Gen = 650

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---
 value 741 V 820.39 kHz
 status

C2 DC1M
 200 V/div
 10.0 V offset
 --- 296 V
 630 V

Timebase -4.20 μs Trigger C2
 5.00 kS 1.00 μs/div Stop 64 V
 500 MS/s Edge Positive

TELEDYNE LECROY

2/27/2014 10:18:09 AM

Channel Status

	C2
V / Div	200 V
Offset	10.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

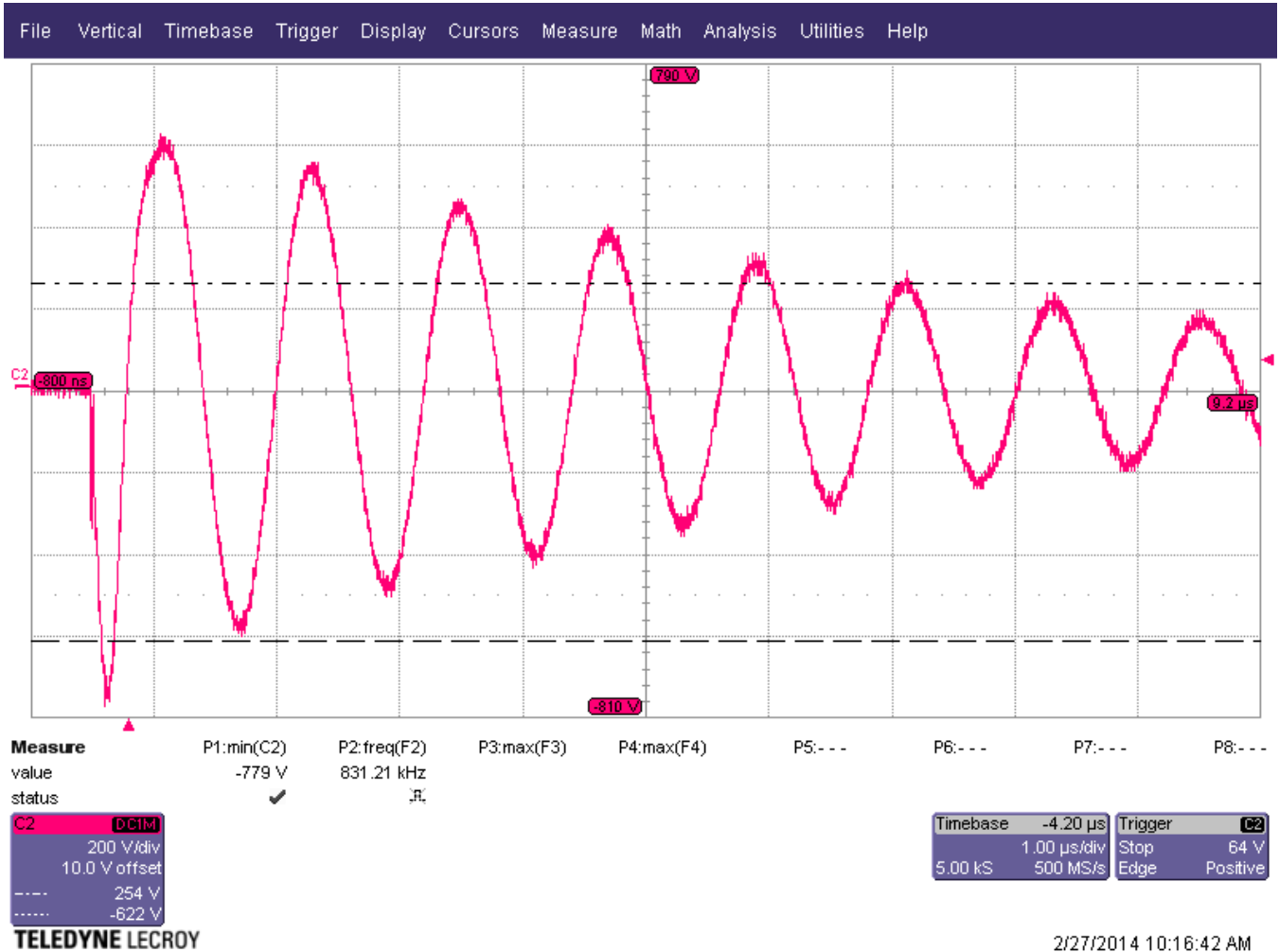
Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 10:16:33 AM

Pin WF3 Level 3 Open Circuit Verification - Negative



WF3 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 600V/24A
 f=1MHz +/-20%
 5th-25%-75% of 1st
 Gen = 650



Channel Status

	C2
V / Div	200 V
Offset	10.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8450
Report Number: 19807
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

PIN INJECTION TEST DATA SHEETS

WF4 CALIBRATION DATA

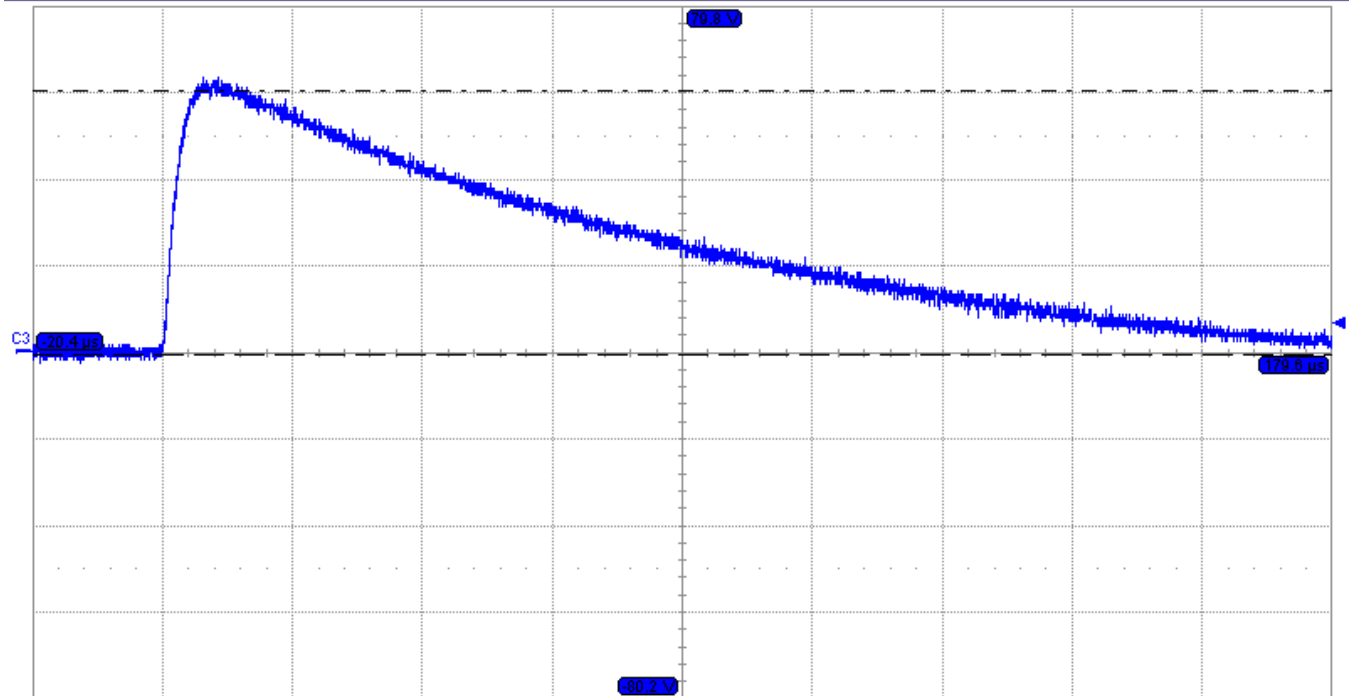
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 DSO S/N:
 User: labadmin
 Time: 2/27/2014 1:43:17 PM

Pin WF4 Level 3 Short Circuit Verification - Positive



WF4 Pin Injection (Direct Injection)
 Short Circuit Verification
 Level 3 300V/60A
 Gen = 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C3) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---
 value 63.4 V
 status ✓

C3 DCIM
 20.0 V/div
 200 mV offset
 --- 60.0 V
 -600 mV

Timebase -79.6 μs Trigger C3
 5.00 kS 20.0 μs/div Stop 6.4 V
 25 MS/s Edge Positive

TELEDYNE LECROY

2/27/2014 1:43:27 PM

Channel Status

	C3
V / Div	20.0 V
Offset	200 mV
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	200.000
Sweeps	1 #

Acquisition Status

Horizontal Time / Div	0 s	Sampling Rate	10.00000000 GS/s
Time / Pt	1 fs	Sampling Mode	undef

Trigger	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

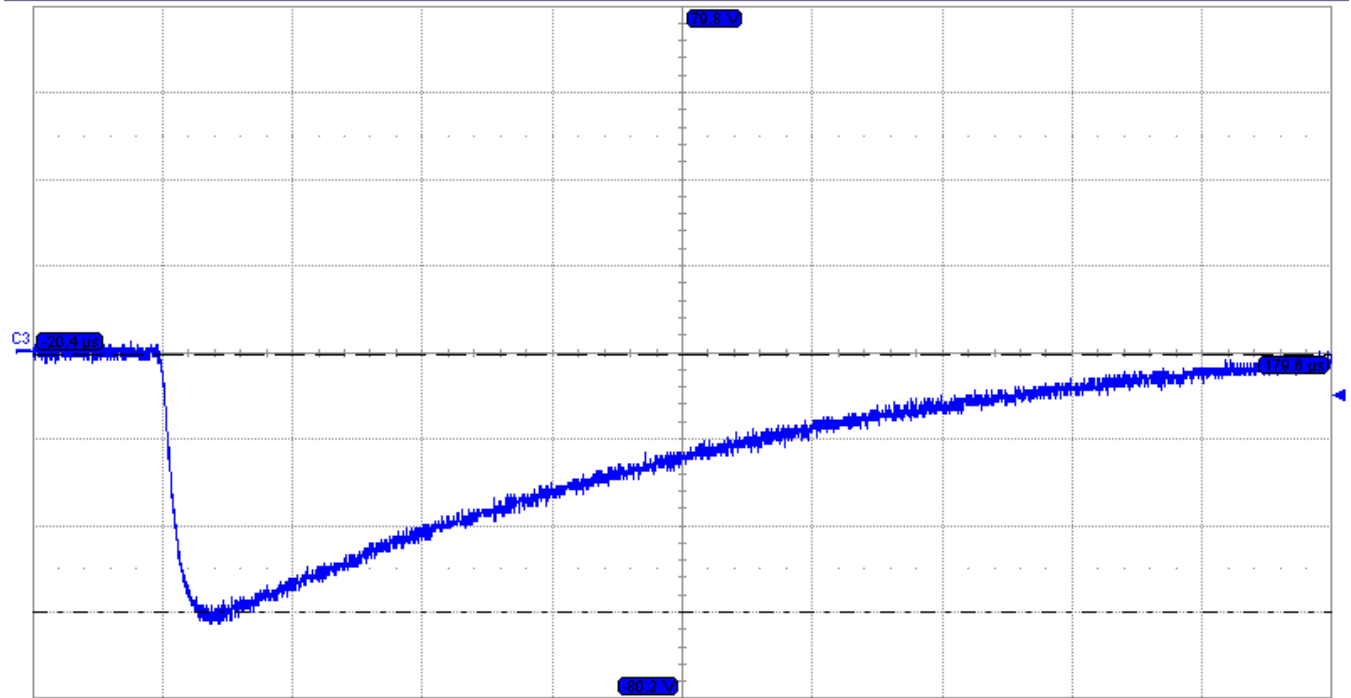
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 1:45:57 PM

Pin WF4 Level 3 Short Circuit Verification - Negative



WF4 Pin Injection (Direct Injection)
 Short Circuit Verification
 Level 3 300V/60A
 Gen = 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C3)	P2:freq(F2)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-63.0 V							
status	✓							

C3	DCIM	Timebase	-79.6 μs	Trigger	C3
20.0 V/div		20.0 μs/div		Stop	-10.4 V
200 mV offset		25 MS/s		Edge	Negative
----- -60.2 V		X1= 80.72 μs	ΔX= -79.72 μs		
----- -600 mV		X2= 1.00 μs	1/ΔX= -12.544 kHz		

TELEDYNE LECROY

2/27/2014 1:46:07 PM

Channel Status

		C3
	V / Div	20.0 V
	Offset	200 mV
Vertical	Coupling	DC1MΩ
	BW-Limit	Full
	Probe	200.000
	Sweeps	1 #

Acquisition Status

Horizontal	Time / Div	0 s	Sampling Rate	10.00000000 GS/s
	Time / Pt	1 fs	Sampling Mode	undef

Trigger	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

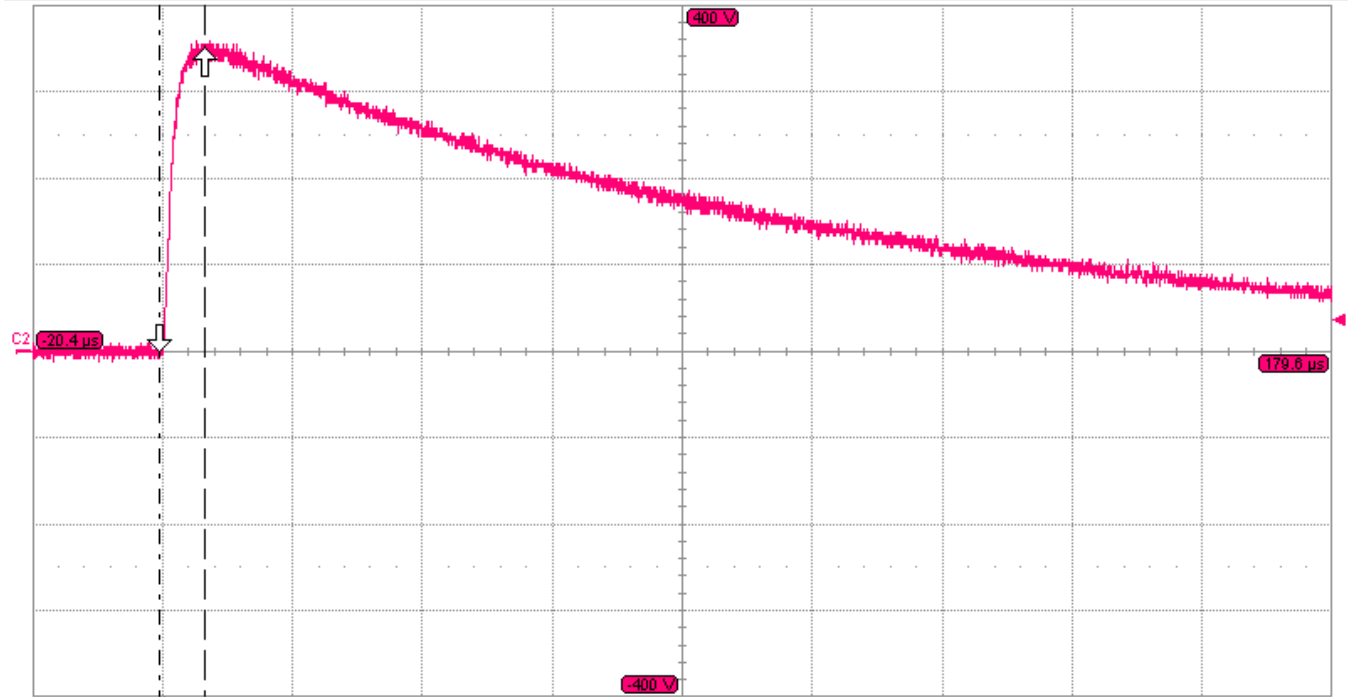
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 1:55:36 PM

Pin WF4 Level 3 Open Circuit Verification - Positive T1



WF4 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 600V/60A
 T1 = 6.4uS (+/- 20%)
 T2 = 69uS (+/- 20%)
 Gen = 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value 358 V
 status ✓

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 100 mV
 ↑ 349.3 V

Timebase -79.6 μs Trigger C2
 5.00 kS 20.0 μs/div Stop 35 V
 25 MS/s Edge Positive

X1= -760 ns ΔX= 6.92 μs
 X2= 6.16 μs 1/ΔX= 144.5 kHz
 2/27/2014 1:55:45 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

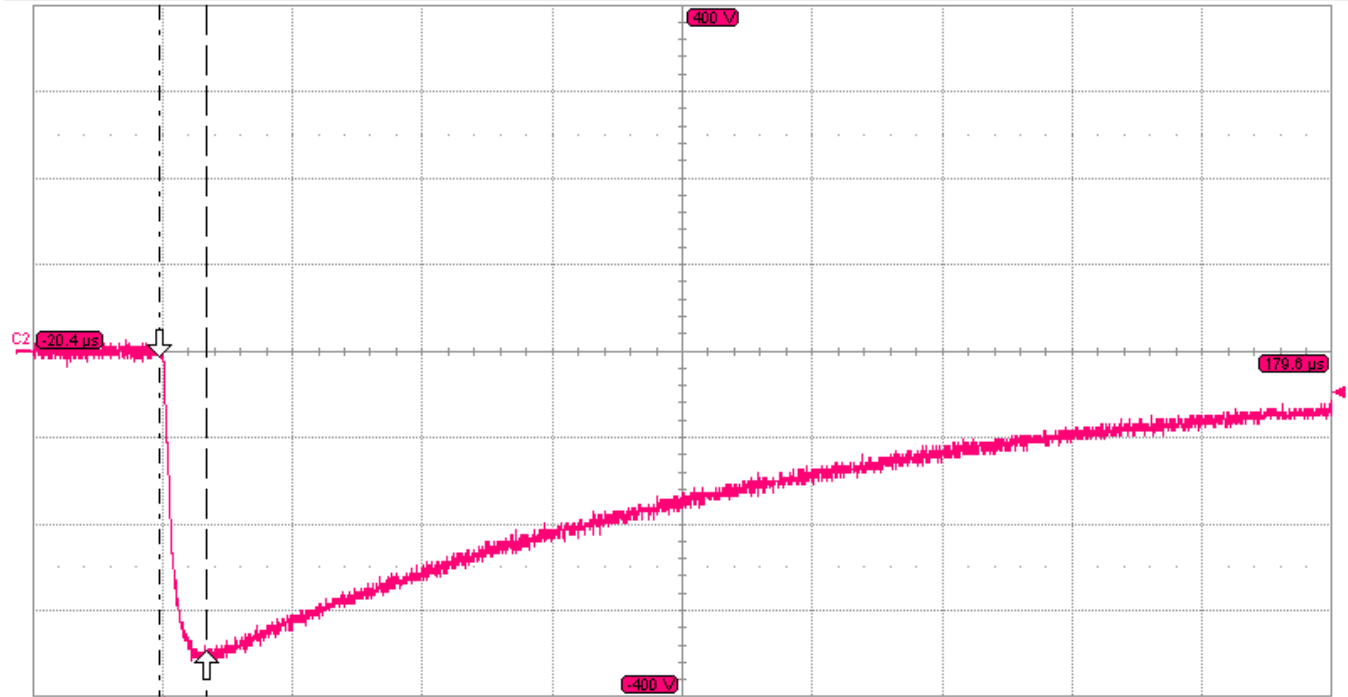
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:00:59 PM

Pin WF4 Level 3 Open Circuit Verification - Negative T1



WF4 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 600V/60A
 T1 = 6.4uS (+/- 20%)
 T2 = 69uS (+/- 20%)
 Gen = 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:min(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value -358 V

status ✓

TELEDYNE LECROY

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -3.9 V
 ↑ -349.1 V

Timebase -79.6 μs Trigger C2
 5.00 kS 20.0 μs/div Stop -48 V
 25 MS/s Edge Negative
 X1= -760 ns ΔX= 7.16 μs
 X2= 6.40 μs 1/ΔX= 139.7 kHz
 2/27/2014 2:01:12 PM

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

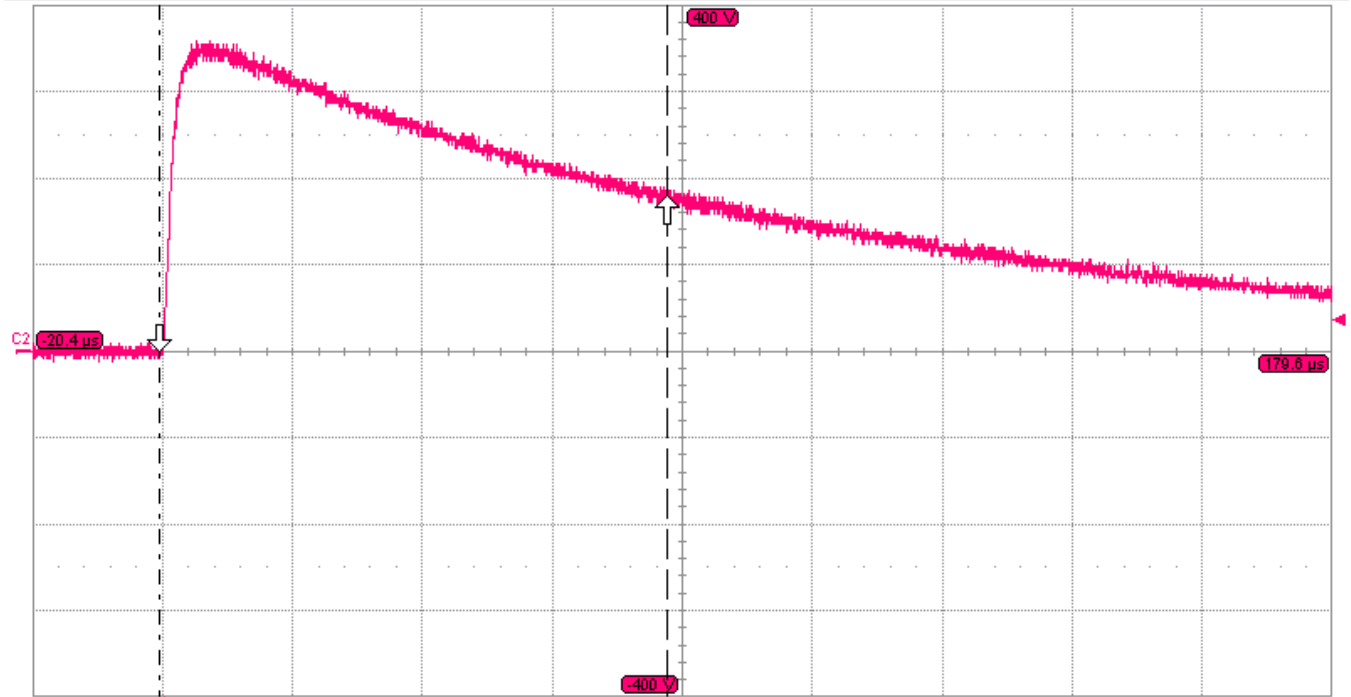
Lab Notebook Entry from LeCroy DSO
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 User: labadmin
 Time: 2/27/2014 1:57:16 PM

Pin WF4 Level 3 Open Circuit Verification - Positive T2



WF4 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 600V/60A
 T1 = 6.4uS (+/- 20%)
 T2 = 69uS (+/- 20%)
 Gen = 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value 358 V
 status ✓

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 100 mV
 ↑ 176.8 V

Timebase -79.6 μs Trigger C2
 5.00 kS 20.0 μs/div Stop 35 V
 25 MS/s Edge Positive

X1= -760 ns ΔX= 78.00 μs
 X2= 77.24 μs 1/ΔX= 12.821 kHz
 2/27/2014 1:57:29 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

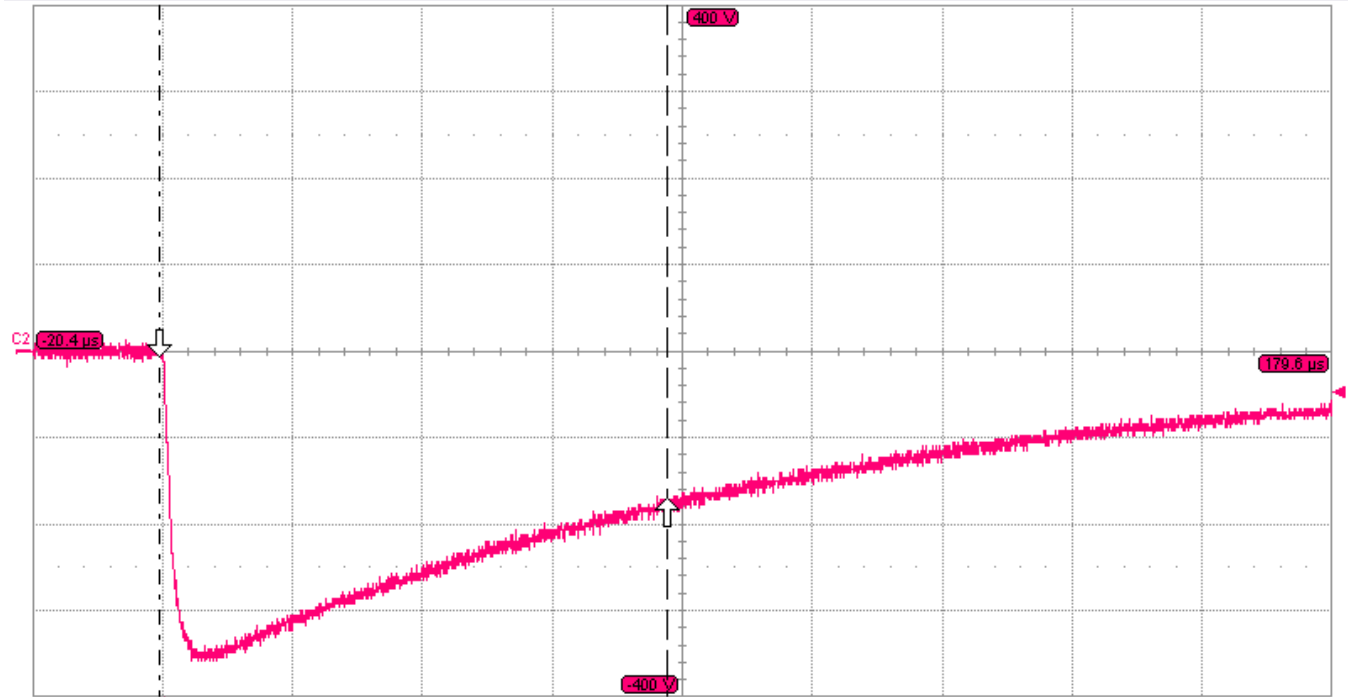
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:00:07 PM

Pin WF4 Level 3 Open Circuit Verification - Negative T2



WF4 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 600V/60A
 T1 = 6.4uS (+/- 20%)
 T2 = 69uS (+/- 20%)
 Gen = 350

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:min(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value -358 V
 status ✓
C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -3.9 V
 ↑ -172.4 V

Timebase -79.6 μs Trigger C2
 20.0 μs/div Stop -48 V
 5.00 kS 25 MS/s Edge Negative

X1= -760 ns ΔX= 78.00 μs
 X2= 77.24 μs 1/ΔX= 12.821 kHz
 2/27/2014 2:00:17 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8450
Report Number: 19807
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

PIN INJECTION

WF5A CALIBRATION DATA SHEETS

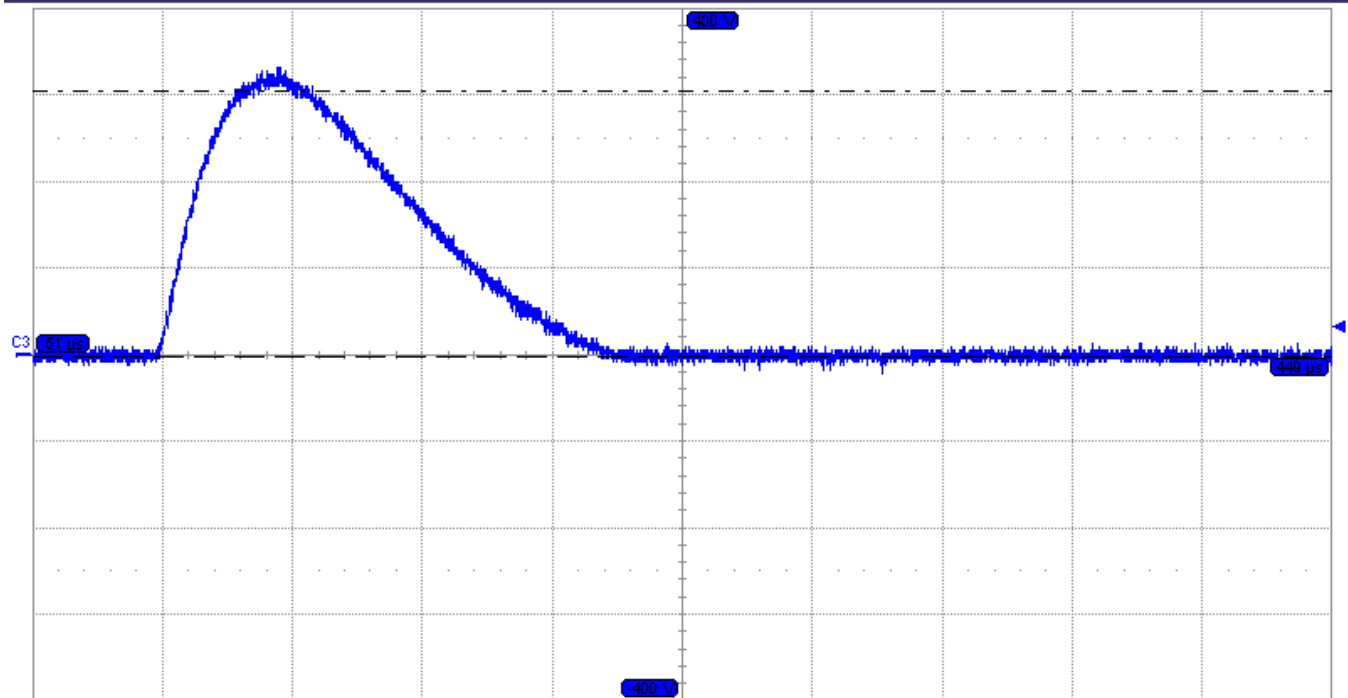
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:07:58 PM

Pin WF5A Level 3 Short Circuit Verification - Positive



WF5A Pin Injection (Direct Injection)
 Short Circuit Verification
 Level 3 300V/300A
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C3) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---
 value 331 V
 status ✓

C3 DCIM
 100 V/div
 0.0 V offset
 --- 303 V
 -2 V

Timebase -199 μs Trigger C3
 5.00 kS 50.0 μs/div Stop 32 V
 10 MS/s Edge Positive

TELEDYNE LECROY

2/27/2014 2:08:18 PM

Channel Status

	C3
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	200.000
Sweeps	1 #

Acquisition Status

Horizontal	Time / Div	0 s	Sampling Rate	10.00000000 GS/s
	Time / Pt	1 fs	Sampling Mode	undef

Trigger	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

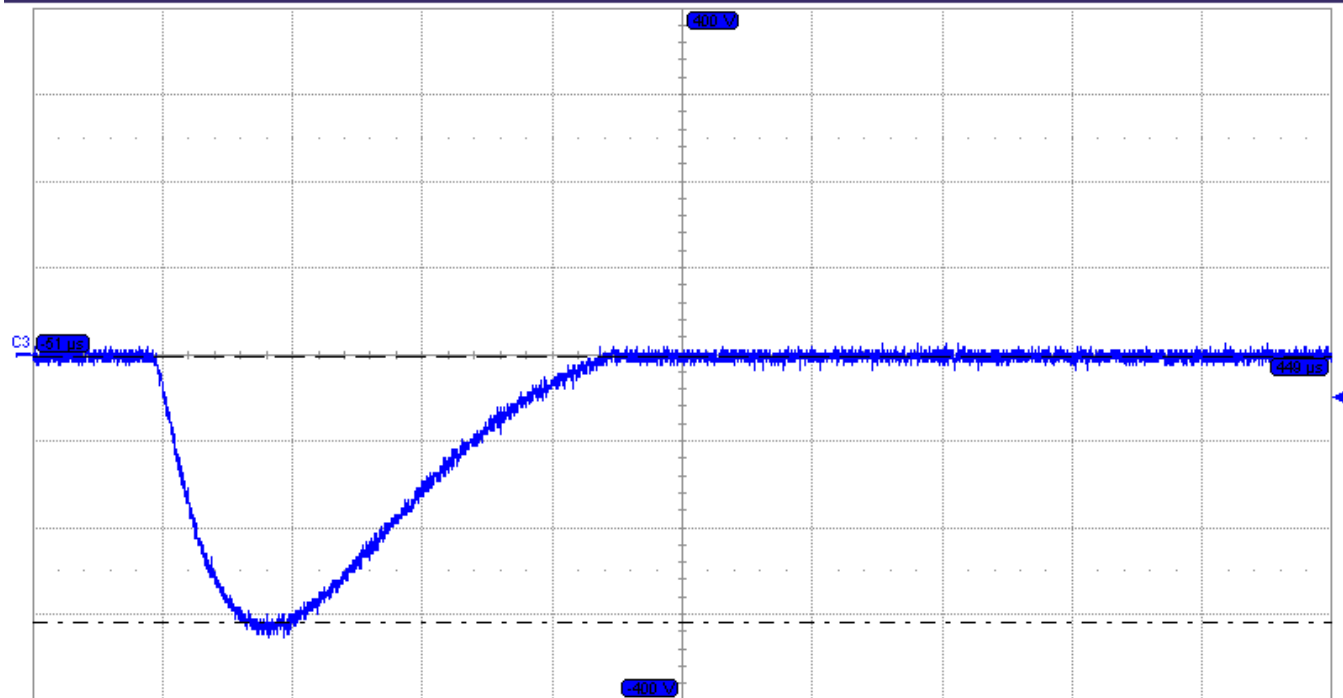
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 Time: 2/27/2014 2:11:48 PM

Pin WF5A Level 3 Short Circuit Verification - Negative



WF5A Pin Injection (Direct Injection)
 Short Circuit Verification
 Level 3 300V/300A
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure

P1:min(C3)	P2:freq(F2)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value							
-327 V							
status							

C3 DC1M
 100 V/div
 0.0 V offset
 ---- -310 V
 -2 V

TELEDYNE LECROY

Timebase	-199 μs	Trigger	C3
	50.0 μs/div	Stop	-50 V
5.00 kS	10 MS/s	Edge	Negative
X1=	38.0 μs	ΔX=	-40.9 μs
X2=	-2.9 μs	1/ΔX=	-24.45 kHz

2/27/2014 2:11:56 PM

Channel Status

	C3
V / Div	100 V
Offset	0.0 V
Vertical	DC1MΩ
Coupling	Full
BW-Limit	200.000
Probe	1 #
Sweeps	

Acquisition Status

Horizontal	Time / Div	0 s	Sampling Rate	10.00000000 GS/s
	Time / Pt	1 fs	Sampling Mode	undef

Trigger	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

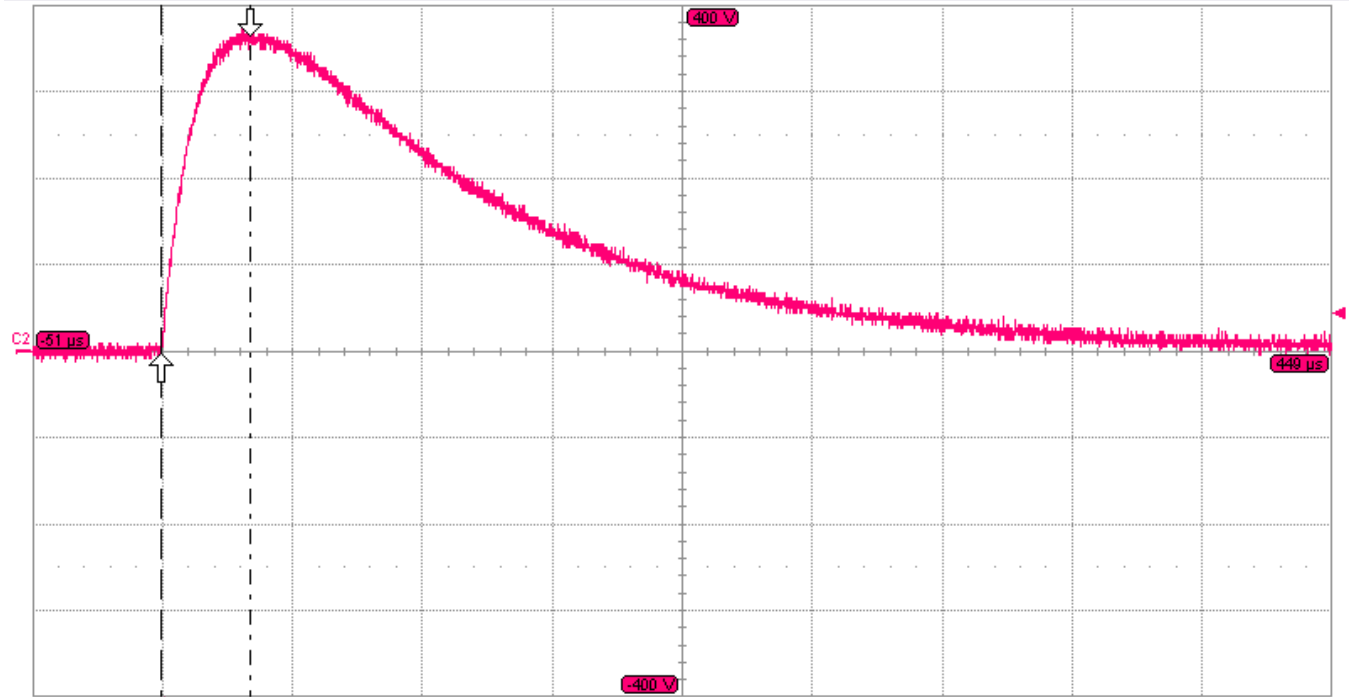
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:17:02 PM

Pin WF5A Level 3 Open Circuit Verification T1 - Positive



WF5A Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/300A
 T1 = 40uS (+/- 20%)
 T2 = 120uS (+/- 20%)
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value 371 V
 status ✓

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 366.1 V
 ↑ -4.4 V

Timebase -199 µs Trigger C2
 50.0 µs/div Stop 43 V
 5.00 kS 10 MS/s Edge Positive

X1= 32.8 µs ΔX= -34.4 µs
 X2= -1.6 µs 1/ΔX= -29.07 kHz

2/27/2014 2:17:13 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

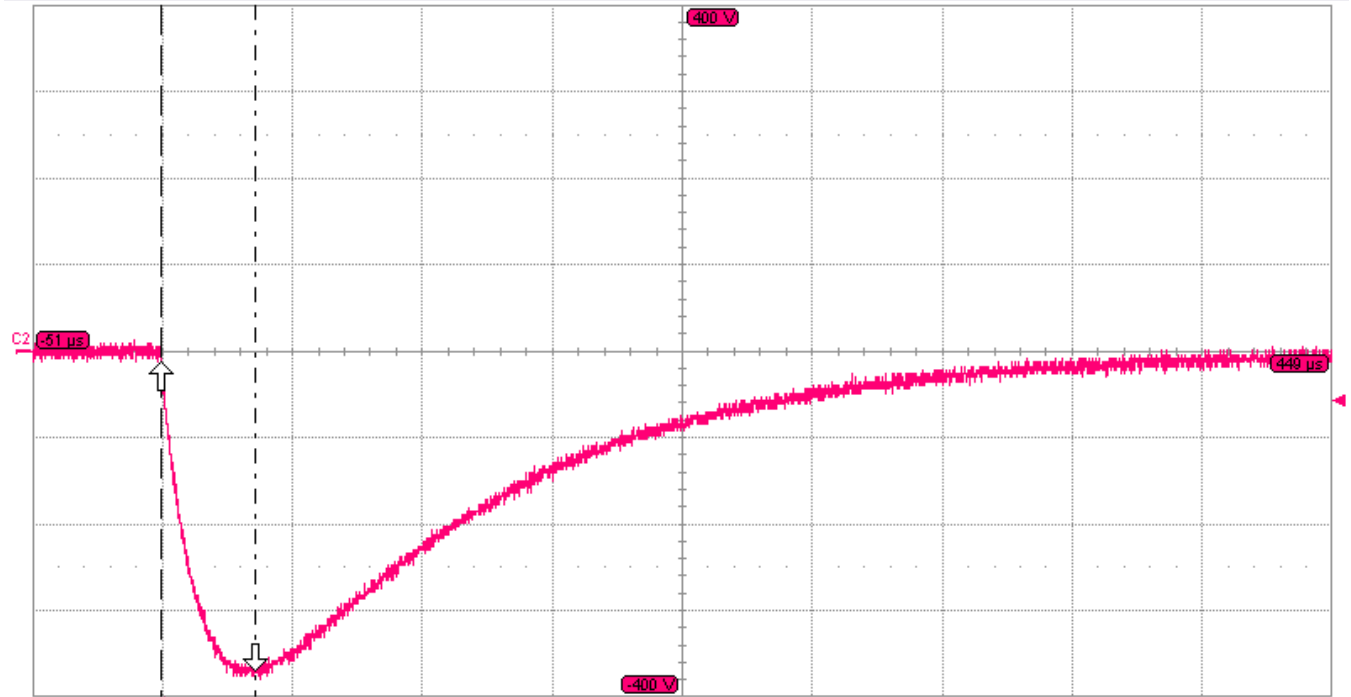
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 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:21:34 PM

Pin WF5A Level 3 Open Circuit Verification T1 - Negative



WF5A Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/300A
 T1 = 40uS (+/- 20%)
 T2 = 120uS (+/- 20%)
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status
 P1:min(C2) -380 V ✓
 P2:freq(F2)
 P3:max(F3)
 P4:max(F4)
 P5:---
 P6:---
 P7:---
 P8:---

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -367.9 V
 ↑ -14.3 V
TELEDYNE LECROY

Timebase -199 μs
 50.0 μs/div
 5.00 kS
 X1= 34.7 μs ΔX= -36.3 μs
 X2= -1.6 μs 1/ΔX= -27.55 kHz
 Trigger C2
 Stop -57 V
 Edge Negative
 2/27/2014 2:21:46 PM

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

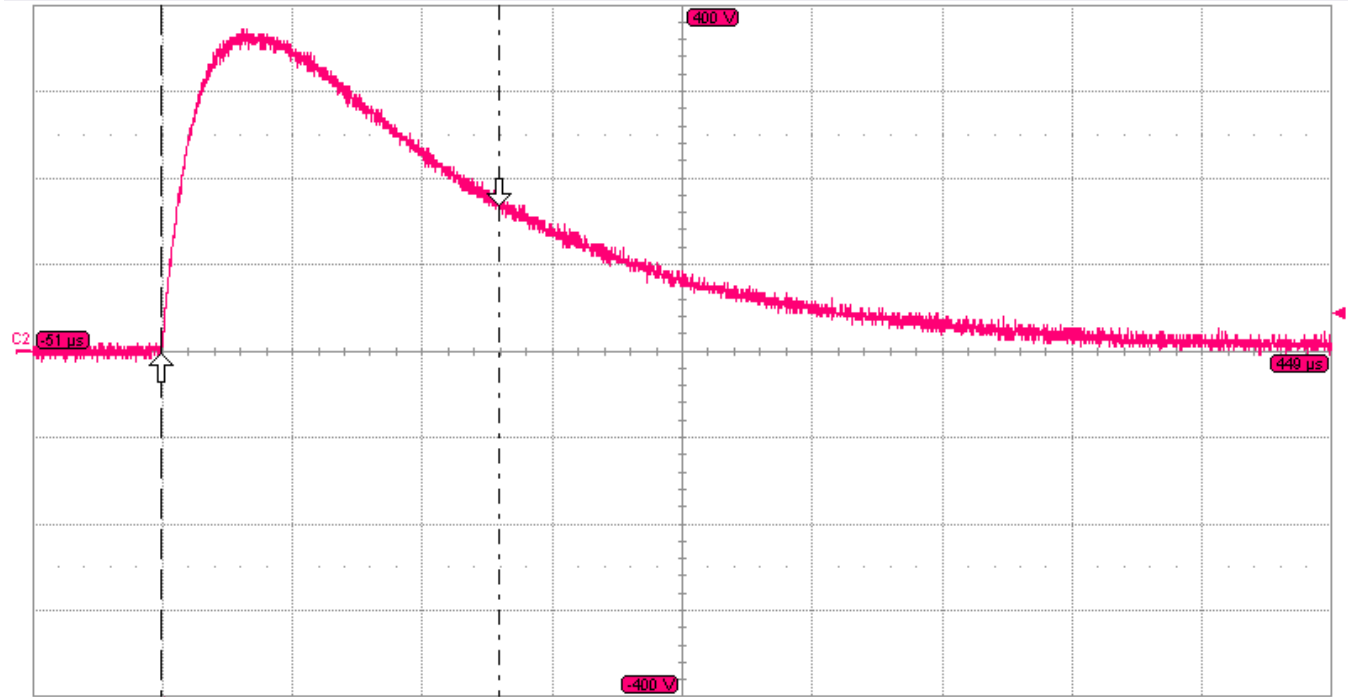
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:17:34 PM

Pin WF5A Level 3 Open Circuit Verification T2 - Positive



WF5A Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/300A
 T1 = 40uS (+/- 20%)
 T2 = 120uS (+/- 20%)
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value 371 V
 status ✓

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 169.4 V
 ↑ -4.4 V

Timebase -199 µs Trigger C2
 5.00 kS 50.0 µs/div Stop 43 V
 10 MS/s Edge Positive

X1= 128.2 µs ΔX= -129.8 µs
 X2= -1.6 µs 1/ΔX= -7.704 kHz
 2/27/2014 2:17:46 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

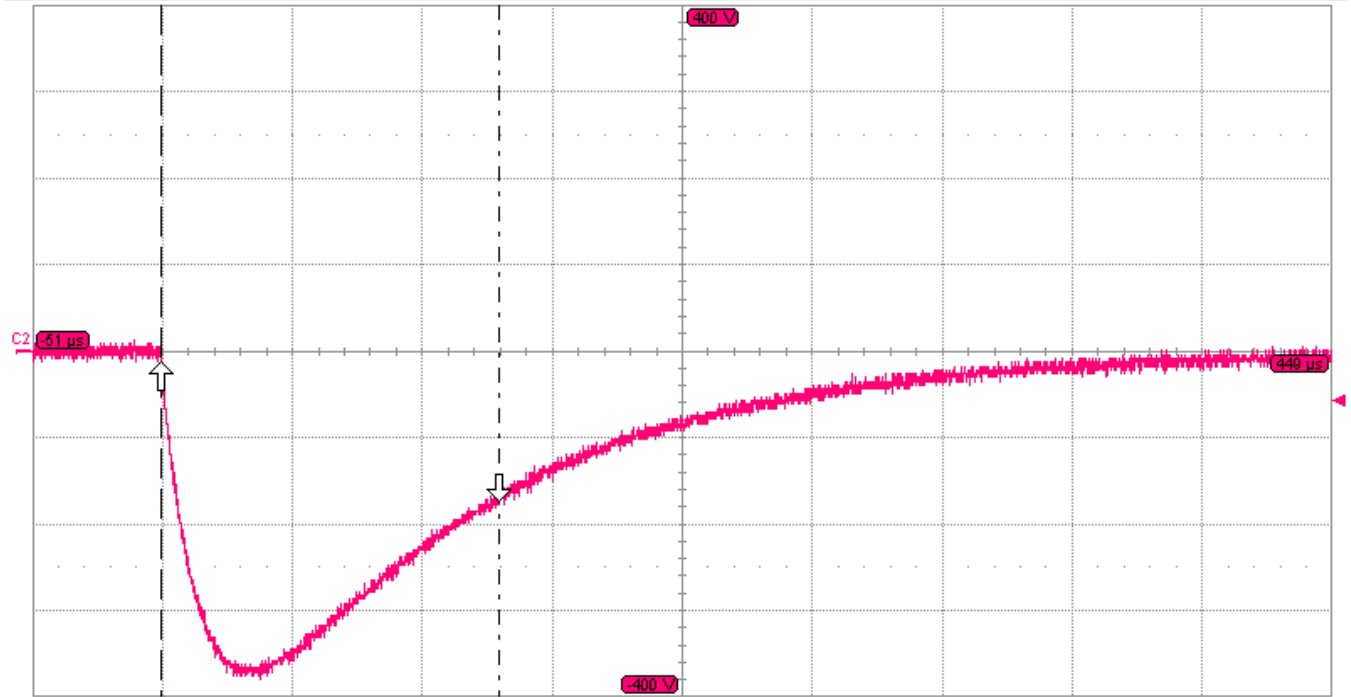
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 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:20:12 PM

Pin WF5A Level 3 Open Circuit Verification T2 - Negative



WF5A Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/300A
 T1 = 40uS (+/- 20%)
 T2 = 120uS (+/- 20%)
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status
 P1:min(C2) -380 V
 P2:freq(F2)
 P3:max(F3)
 P4:max(F4)
 P5:---
 P6:---
 P7:---
 P8:---

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -171.3 V
 ↑ -14.3 V

Timebase -199 uS
 5.00 kS 50.0 uS/div 10 MS/s
 Trigger C2
 Stop -57 V
 Edge Negative

X1= 128.2 uS ΔX= -129.8 uS
 X2= -1.6 uS 1/ΔX= -7.704 kHz
 2/27/2014 2:20:54 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8450
Report Number: 19807
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

PIN INJECTION

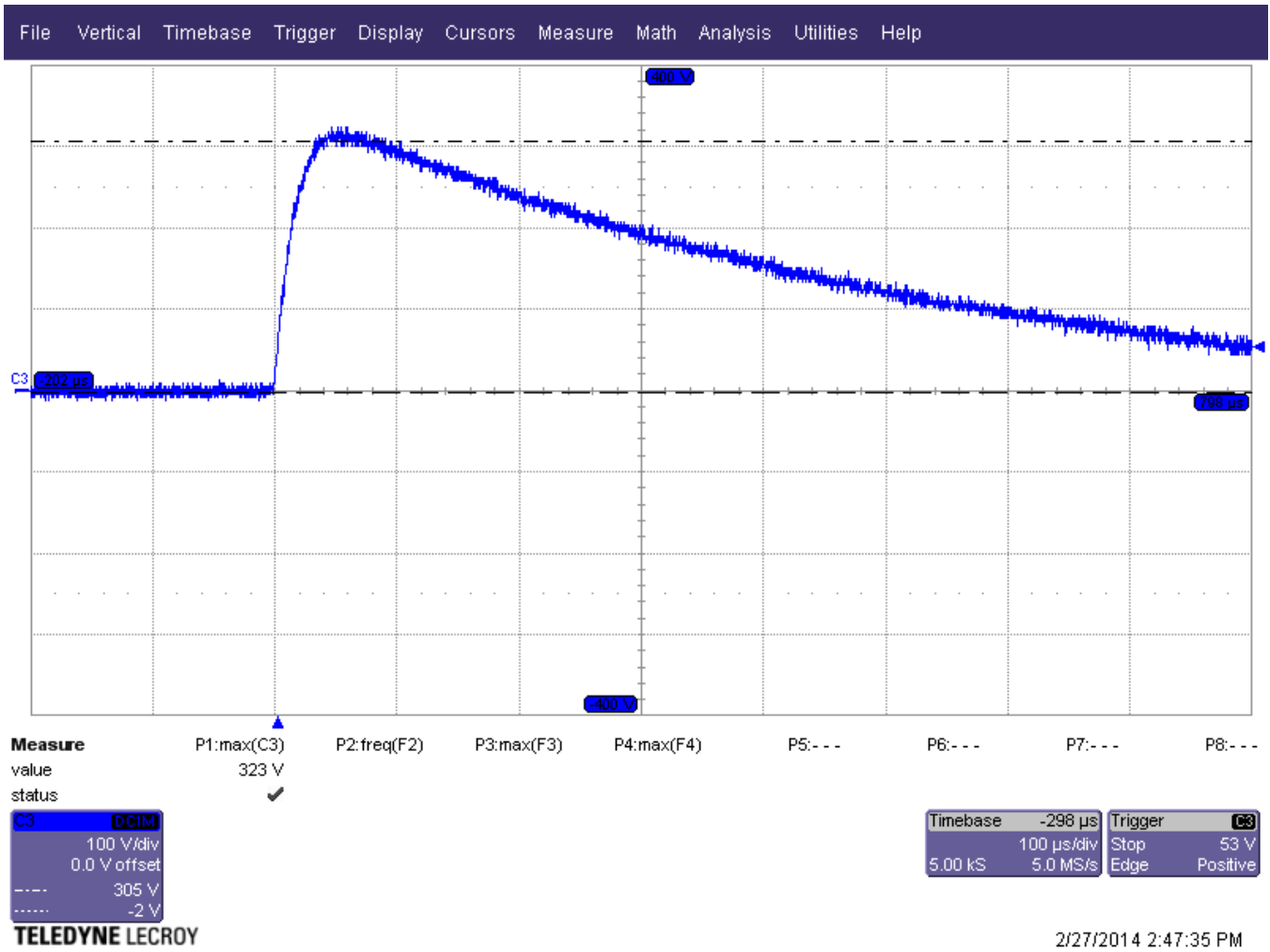
WF5B CALIBRATION DATA SHEETS

Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:47:24 PM

Pin WF5B Level 3 Short Circuit Verification - Positive



WF5B Pin Injection (Direct Injection)
 Short Circuit Verification
 Level 3 300V/300A
 Gen = 370



Channel Status

		C3
V / Div		100 V
Offset		0.0 V
Vertical	Coupling	DC1MΩ
	BW-Limit	Full
	Probe	200.000
	Sweeps	1 #

Acquisition Status

Horizontal	Time / Div	0 s	Sampling Rate	10.00000000 GS/s
	Time / Pt	1 fs	Sampling Mode	undef

Trigger	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

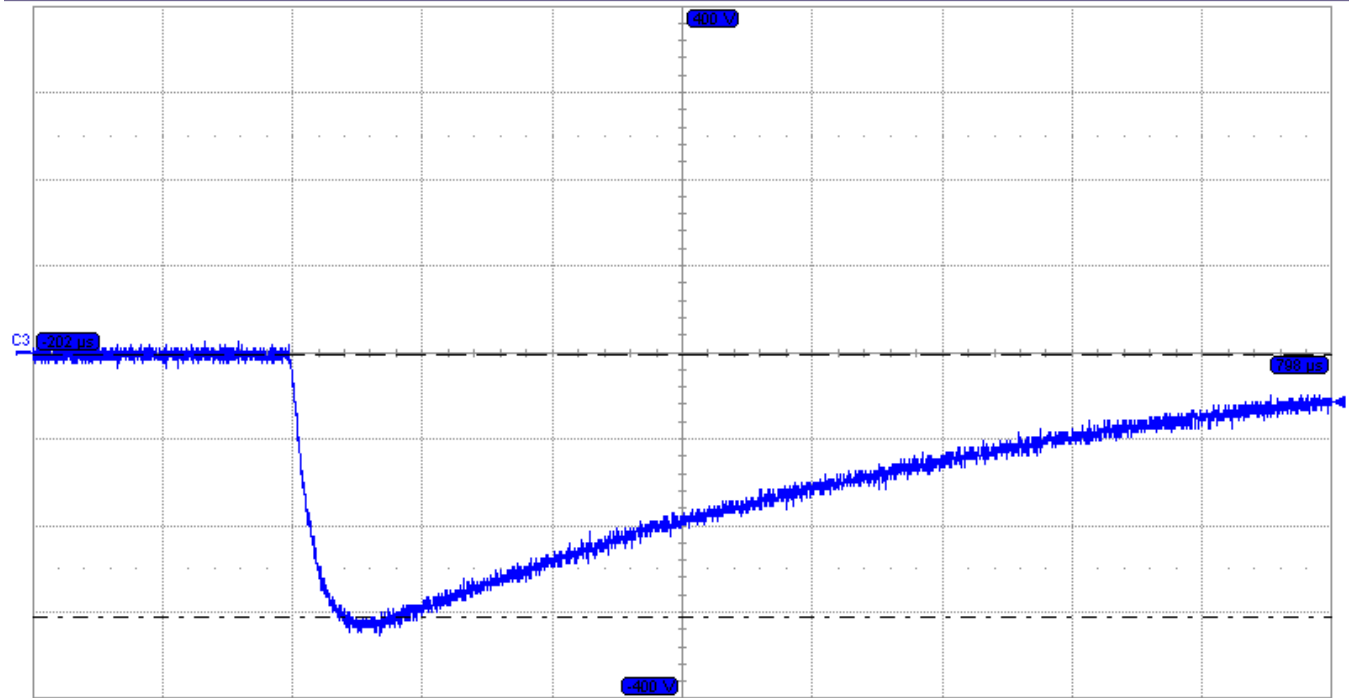
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 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:48:55 PM

Pin WF5B Level 3 Short Circuit Verification - Negative



WF5B Pin Injection (Direct Injection)
 Short Circuit Verification
 Level 3 300V/300A
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C3)	P2:freq(F2)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
value	-327 V							
status	✓							

C3	DC1M	Timebase	-298 μs	Trigger	C3
100 V/div		100 μs/div		Stop	-57 V
0.0 V offset		5.0 MS/s		Edge	Negative
----	-306 V	X1=	48.8 μs	ΔX=	-51.6 μs
.....	-2 V	X2=	-2.8 μs	1/ΔX=	-19.38 kHz

TELEDYNE LECROY

2/27/2014 2:49:05 PM

Channel Status

		C3
	V / Div	100 V
	Offset	0.0 V
Vertical	Coupling	DC1MΩ
	BW-Limit	Full
	Probe	200.000
	Sweeps	1 #

Acquisition Status

Horizontal	Time / Div	0 s	Sampling Rate	10.00000000 GS/s
	Time / Pt	1 fs	Sampling Mode	undef

Trigger	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

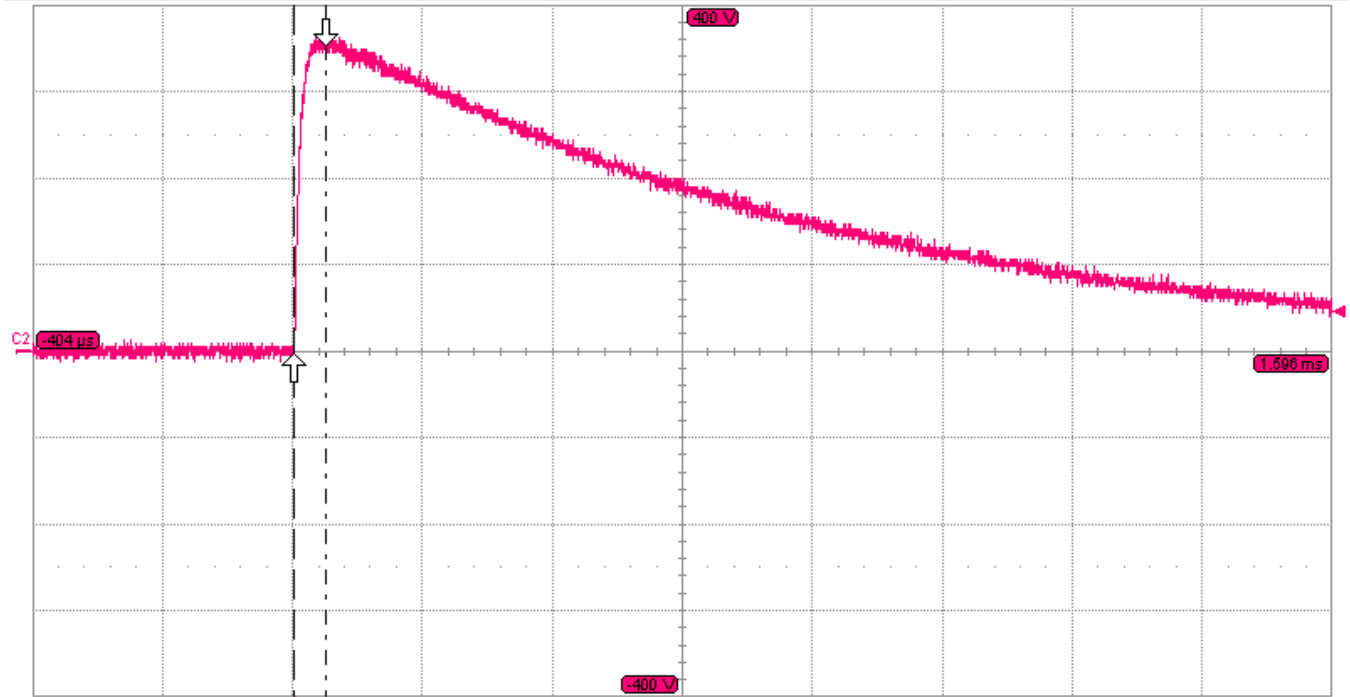
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:51:58 PM

Pin WF5B Level 3 Open Circuit Verification T1 - Positive



WF5B Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/300A
 T1 = 50uS (+/- 20%)
 T2 = 500uS (+/- 20%)
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---
 value 367 V
 status ✓

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 353.6 V
 ↑ -5.7 V

Timebase -596 µs Trigger C2
 5.00 kS 200 µs/div Stop 46 V
 2.5 MS/s Edge Positive

X1= 48.4 µs ΔX= -50.0 µs
 X2= -1.6 µs 1/ΔX= -20.0 kHz
 2/27/2014 2:52:10 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

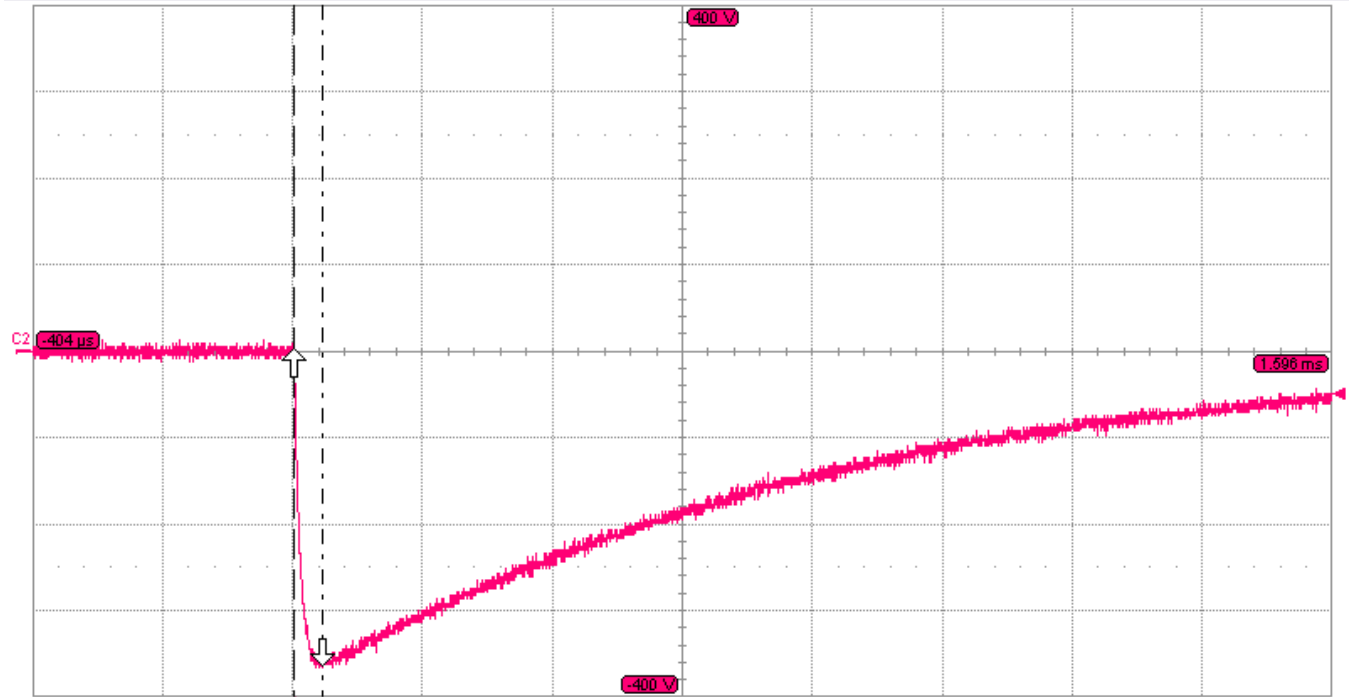
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:56:49 PM

Pin WF5B Level 3 Open Circuit Verification T1 - Negative



WF5B Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/300A
 T1 = 50uS (+/- 20%)
 T2 = 500uS (+/- 20%)
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:min(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value -367 V

status ✓

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -361.4 V
 ↑ 0.0 V

Timebase -596 μs Trigger C2
 200 μs/div Stop -50 V
 5.00 kS 2.5 MS/s Edge Negative

X1= 42.0 μs ΔX= -43.6 μs
 X2= -1.6 μs 1/ΔX= -22.9 kHz

2/27/2014 2:57:02 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

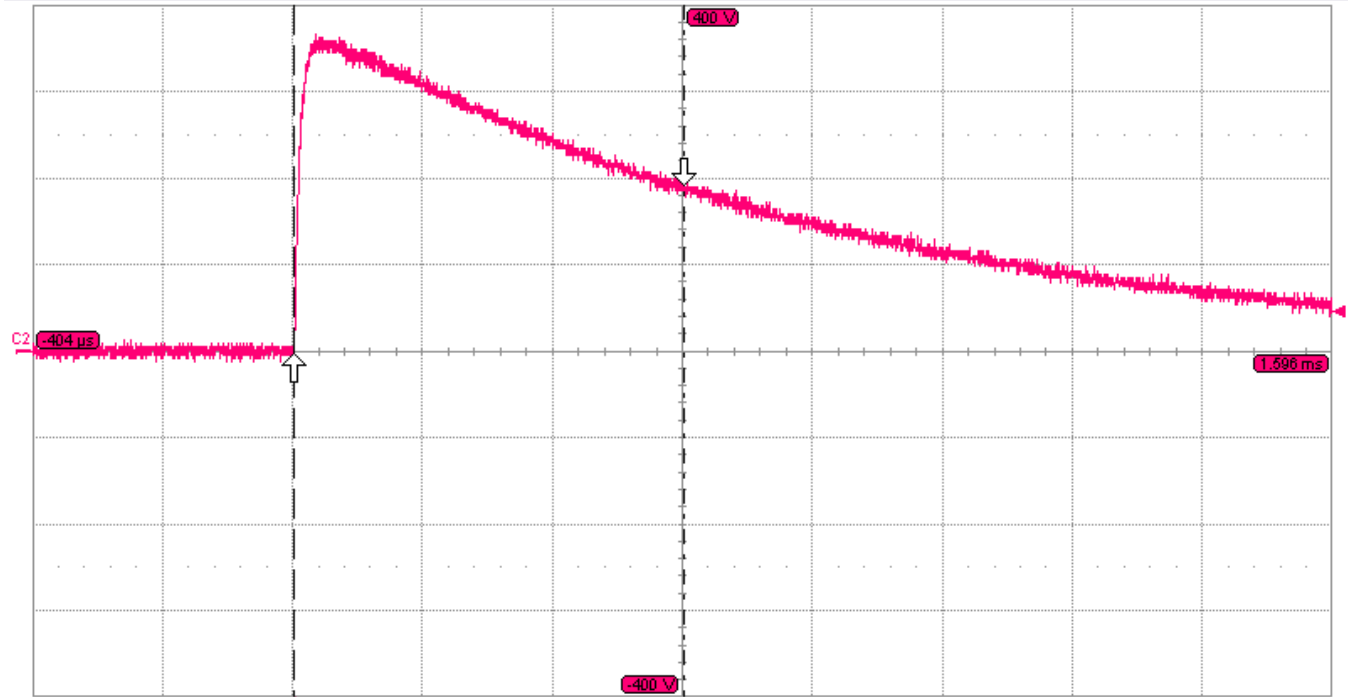
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:53:55 PM

Pin WF5B Level 3 Open Circuit Verification T2 - Positive



WF5B Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/300A
 T1 = 50uS (+/- 20%)
 T2 = 500uS (+/- 20%)
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:max(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value 367 V
 status ✓
C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 193.2 V
 ↑ -5.7 V

Timebase -596 µs Trigger C2
 5.00 kS 200 µs/div Stop 46 V
 2.5 MS/s Edge Positive
 X1= 598.0 µs ΔX= -599.6 µs
 X2= -1.6 µs 1/ΔX= -1.668 kHz
 2/27/2014 2:54:06 PM

TELEDYNE LECROY

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef

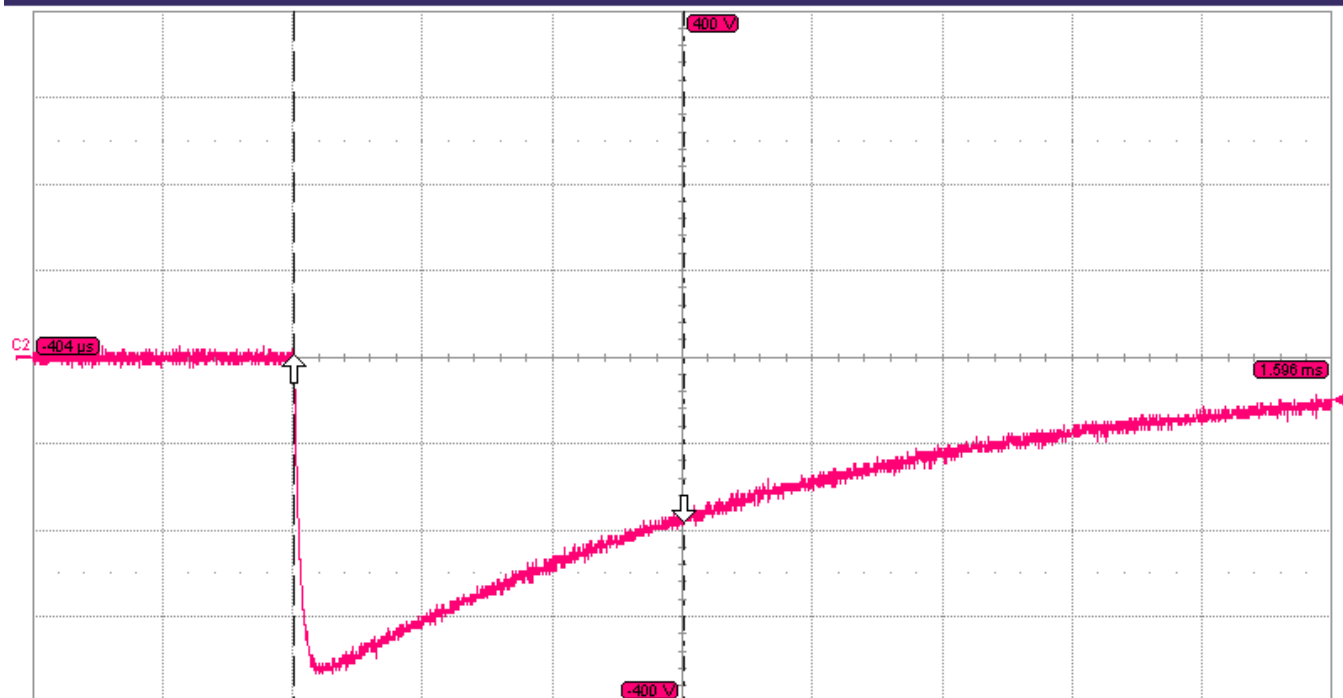
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 2/27/2014 2:55:33 PM

Pin WF5B Level 3 Open Circuit Verification T2 - Negative



WF5B Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/300A
 T1 = 50uS (+/- 20%)
 T2 = 500uS (+/- 20%)
 Gen = 370

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:min(C2) P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

value -367 V

status ✓
C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -190.0 V
 ↑ 0.0 V

TELEDYNE LECROY

Timebase -596 μs Trigger C2
 5.00 kS 200 μs/div Stop -50 V
 2.5 MS/s Edge Negative

X1= 598.0 μs ΔX= -599.6 μs
 X2= -1.6 μs 1/ΔX= -1.668 kHz
 2/27/2014 2:55:44 PM

Channel Status

	C2
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 0 s Sampling Rate 10.00000000 GS/s

Horizontal	Time / Pt	1 fs	Sampling Mode	undef
	Pts / Div	0.0 S	Trigger Delay	1.0
	Mode	Normal	Slope	undef
Trigger	Type	undef	Level	50 mV
	Source	undef	Coupling	undef