



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8429
Report Number: 20641
Project No. 6978

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 25 PIN INJECTION TEST PROCEDURE(S) OF THE ABOVE TEST SPECIFICATION

Formal Name: 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection

Kind of Equipment: Discrete-to-Digital Sensing Integrated Circuit

Test Configuration: Tabletop (Tested at 3.3 Vdc & 16.5 Vdc)

Model Number(s): HI-8429

Model(s) Tested: HI-8429

Serial Number(s): 1, 2, and 3

Date of Tests: December 22, 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).*

2014-10-01 through 2015-09-30

Effective dates



For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)



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1.0 INTRODUCTION:

On December 22, 2014, a series of susceptibility tests were made to demonstrate that the 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection, Model(s) HI-8429, Serial No. 1, 2, and 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 Injection.

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 8-Channel GND/Open or Supply/Open Discrete Sensor 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 T* 36' long x 25' wide x 20' high anechoic/ferrite tile 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 T: Section 22, Lightning Induced Transient Susceptibility Pin Injection

4.0 OPERATING CONDITIONS OF TEST SAMPLE:

All test measurements were made at a laboratory temperature of **72° F** at **35%** humidity with the following mode of operation:

Power up the device 3.3V supply at VLogic and 16.5V at VDD.

5.0 PERFORMANCE MONITORED:

The 8-Channel GND/Open or Supply/Open Discrete Sensor 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 characterized as out of specification.



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

6.1 DESCRIPTION:

8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection.

6.2 DESCRIPTION OF ALL CIRCUIT BOARDS:

Board 1 Ground/Open: Discrete-to-Digital IC on a PCB

SN1 & SN2: HI-8429PSTF
Lot#7128B Date Code 1441

Board 2 Supply/Open: Discrete-to-Digital IC on a PCB

SN3: HI-8429PSTF
Lot#7128B Date Code 1441



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7.0 ADDITIONAL DESCRIPTION OF EQUIPMENT UNDER TEST:

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 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection
Model Number: HI-8429
Serial Number: 1, 2, and 3
- Item 1 Chip SN#1 and SN#2
- Item 2 Chip SN#3



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9.0 PHOTO ID TAKEN DURING TESTING:

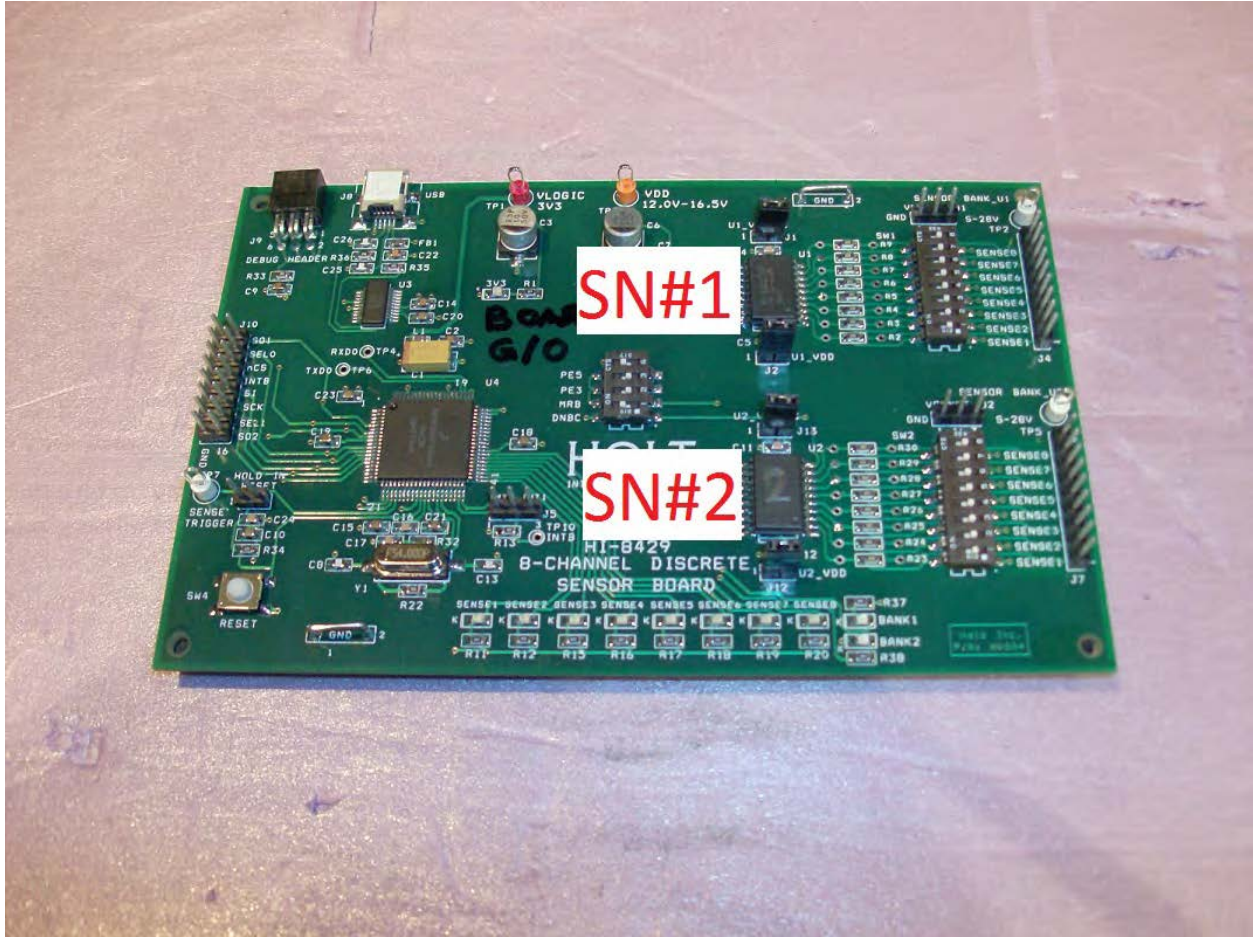


Photo ID 1



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Company: Holt Integrated Circuits, Inc.
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9.0 PHOTO ID TAKEN DURING TESTING:

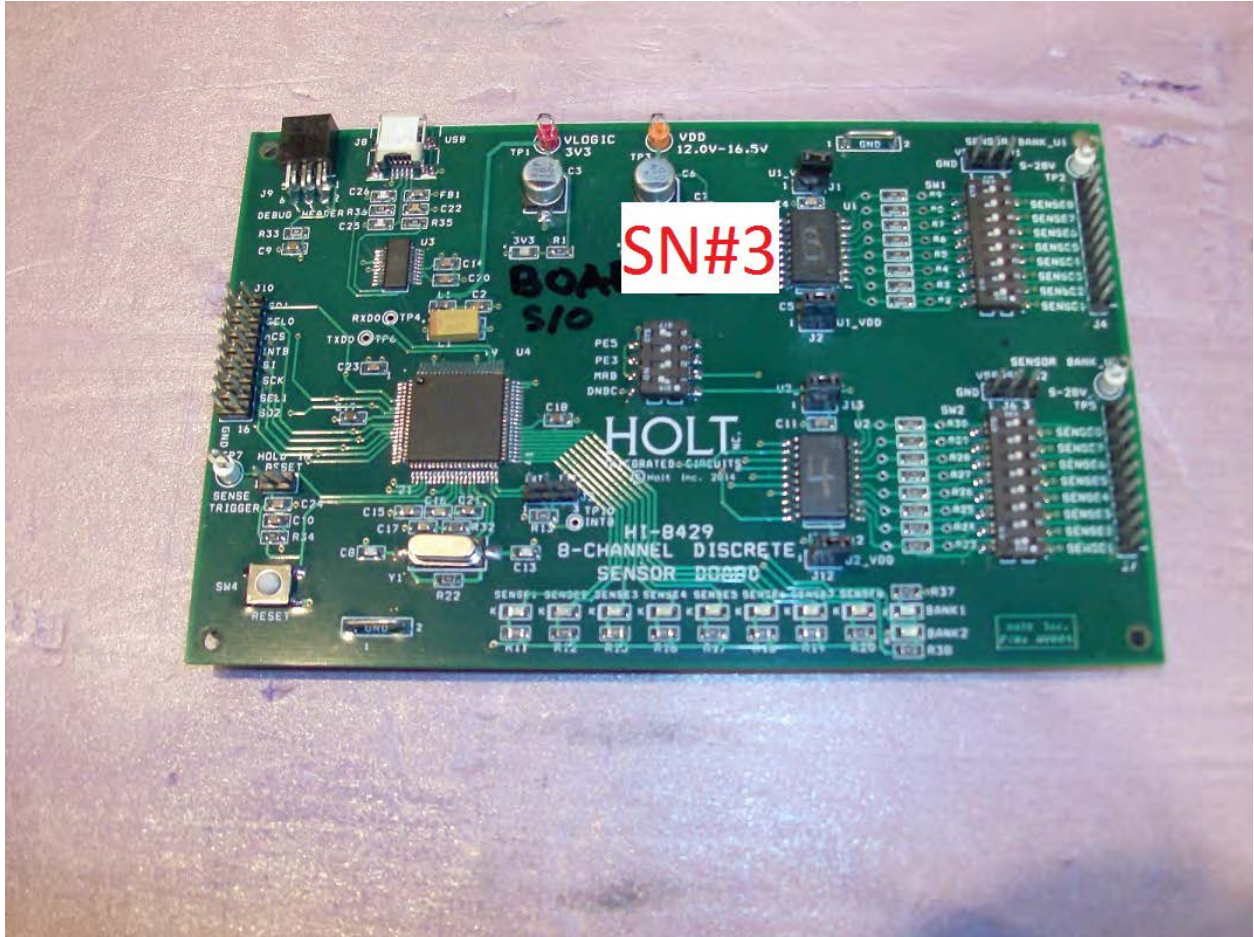


Photo ID 2



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11.0 REFERENCES:

RTCA/DO-160G "Environmental Conditions and Test Procedures for Airborne Equipment" (Radio Technical Commission for Aeronautics, December 8, 2010)

NOTE: All listed paragraphs, figures and tables are reference to the above standard unless otherwise specified.

12.0 TEST RESULTS:

The 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection was subject to the test procedure(s) Section 22 Pin Injection. A detailed explanation of how these tests and their measurements were made is shown in Appendix(es) A at the end of this report.

13.0 CONCLUSION OF SUSCEPTIBILITY TESTS:

The 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection, Model(s) HI-8429, **meets** Section 25 Pin Injection Test Procedure(s) 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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Appendix A

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:

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

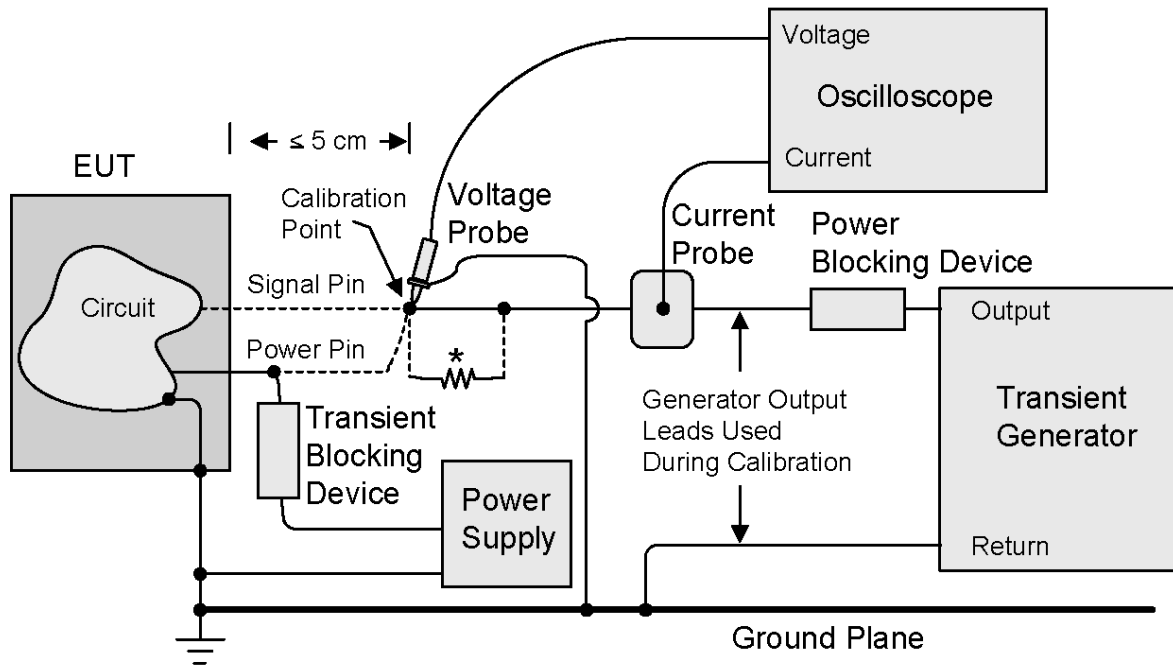
3, 4, 5A, & 5B	3	X	X	X	X
Pin Test Waveform Set	Pin Test Level	Cable Bundle Single and Multiple Stroke Test Waveform Set	Cable Bundle Single and Multiple Stroke Test Level	Cable Bundle Multiple Burst Test Waveform Set	Cable Bundle Multiple Burst Test Level

X = Tests not performed

The equipment under test was tested to the levels and waveforms consistent with its expected use and aircraft installation. The 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection was subjected to Waveform(s) 3, 4, 5A & 5B using Level(s) 3 and Categories A3, B3 & Z3.

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



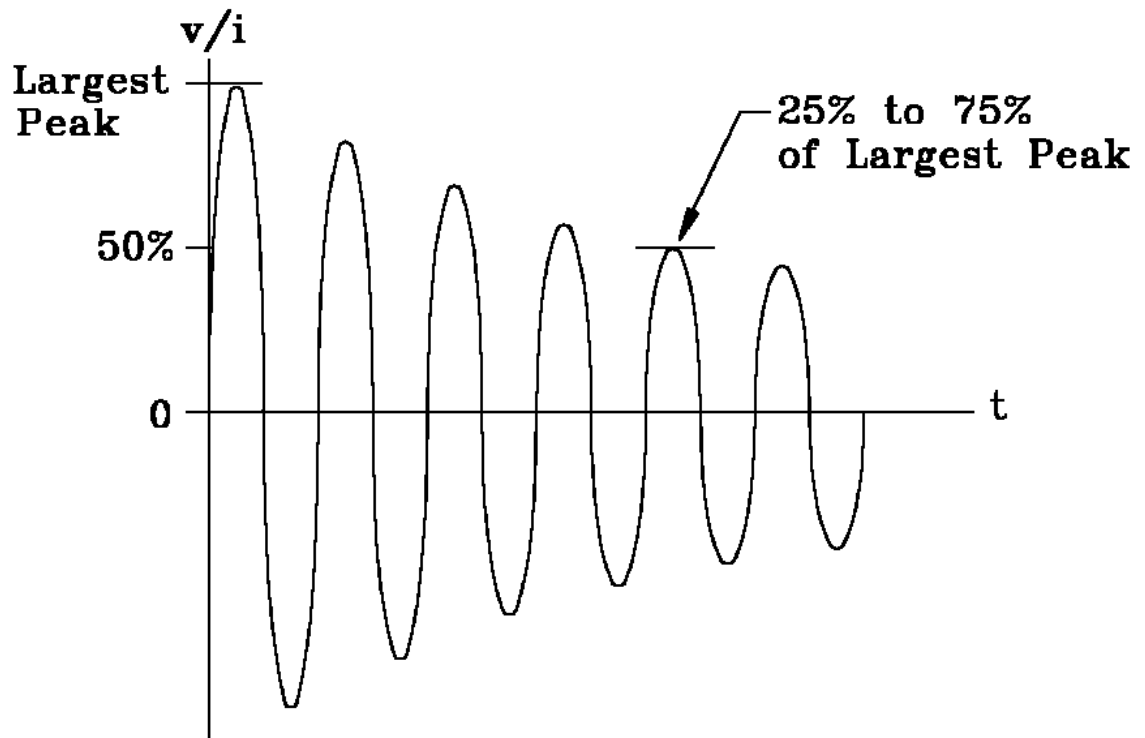
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Appendix A

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.

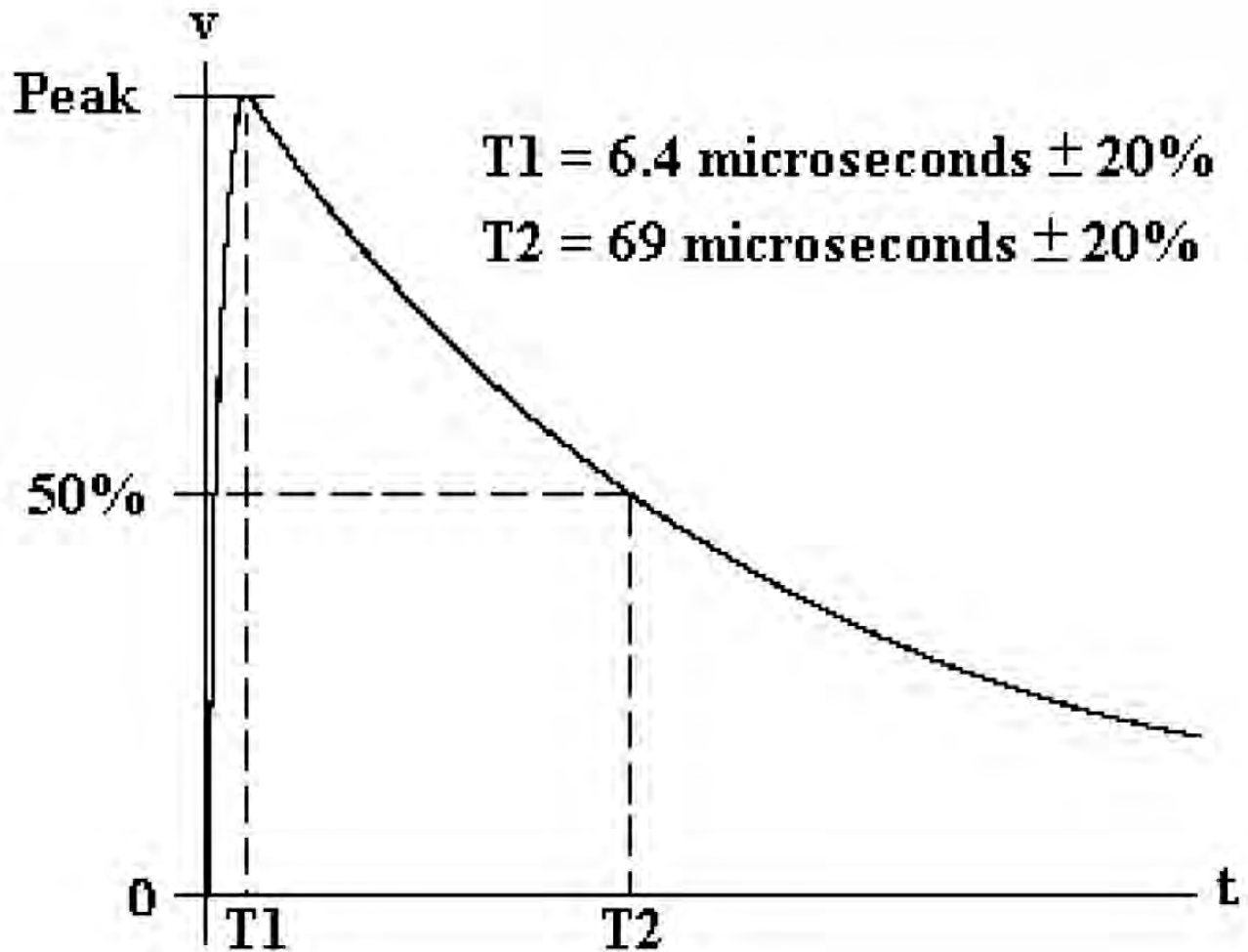


Figure 22-4 Voltage Waveform 4



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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.

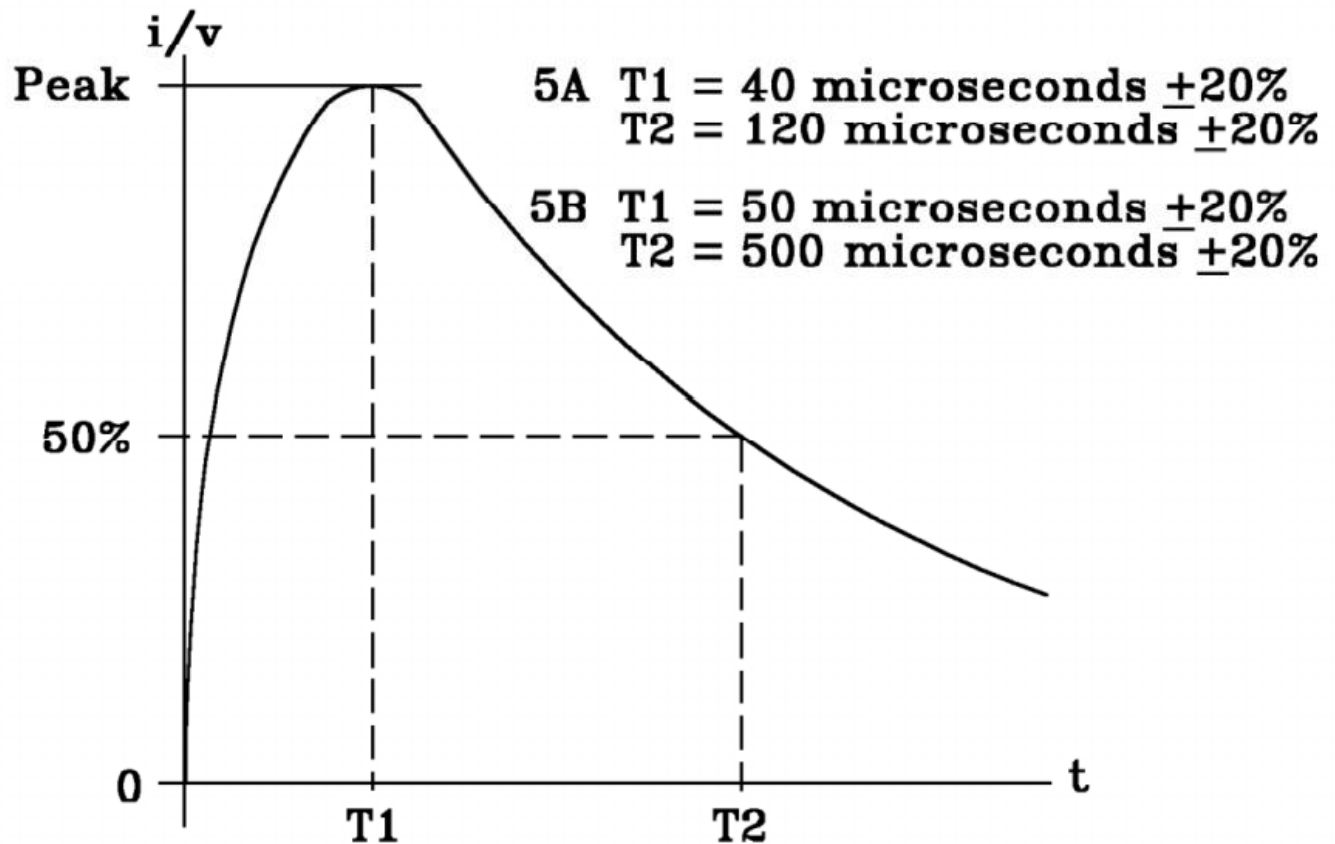


Figure 22-5 Current/Voltage Waveform 5



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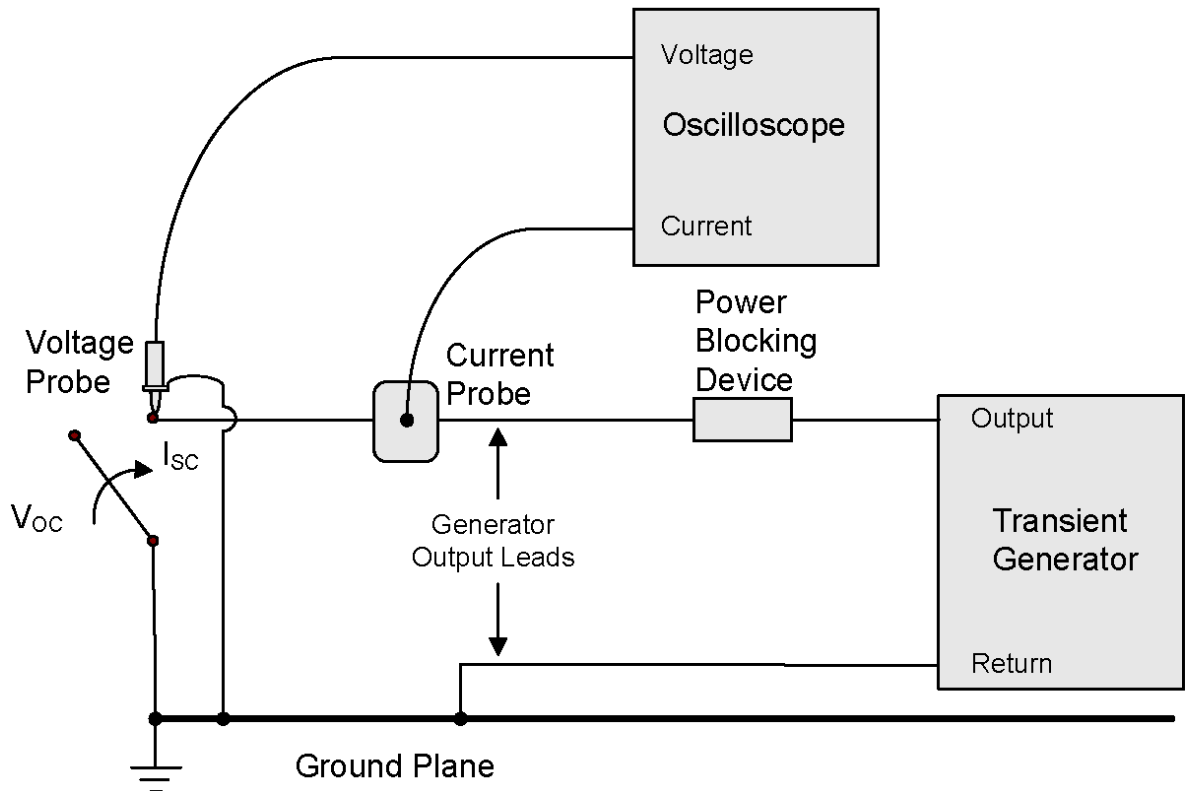
4.0 TEST PROCEDURE:

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) and Waveform 4 (6.4 x 69us double exponential), Waveform 5A (40 x 120us double exponential) and Waveform 5B (50 x 500us double exponential) were each applied at levels 3, positive and negative polarities, to the 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection pins called out in Table 22-1 & 22-2 of RTCA/DO-160G. The 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection was 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.

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. For both waveforms, the waveshape greatly varied from pin to pin due to the different impedances seen by the generator, from the pins and any resistors or capacitors. 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 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection passed the requirements of Section 22 (Pin Injection).

The 8-Channel GND/Open or Supply/Open Discrete Sensor with Integrated DO-160G Level 3 Lightning Protection **meets** the following conditions:

Lab used: T

Summary:

No damage occurred during Section 22 Pin injection testing.

Chip SN#1 : Tested to category A3

Chip SN#2 : Tested to category Z3

Chip SN#3 : Tested to category B3

See the data sheets at the end of this appendix for the test results.

5.3 Pre and Post test current measurements:

Board #1	Pre-Test Current	Post-Test Current
16.5 VDC	29mA	29mA
3.3 VDC	65mA	65mA

Board #2	Pre-Test Current	Post-Test Current
16.5 VDC	35mA	35mA
3.3 VDC	66mA	66mA

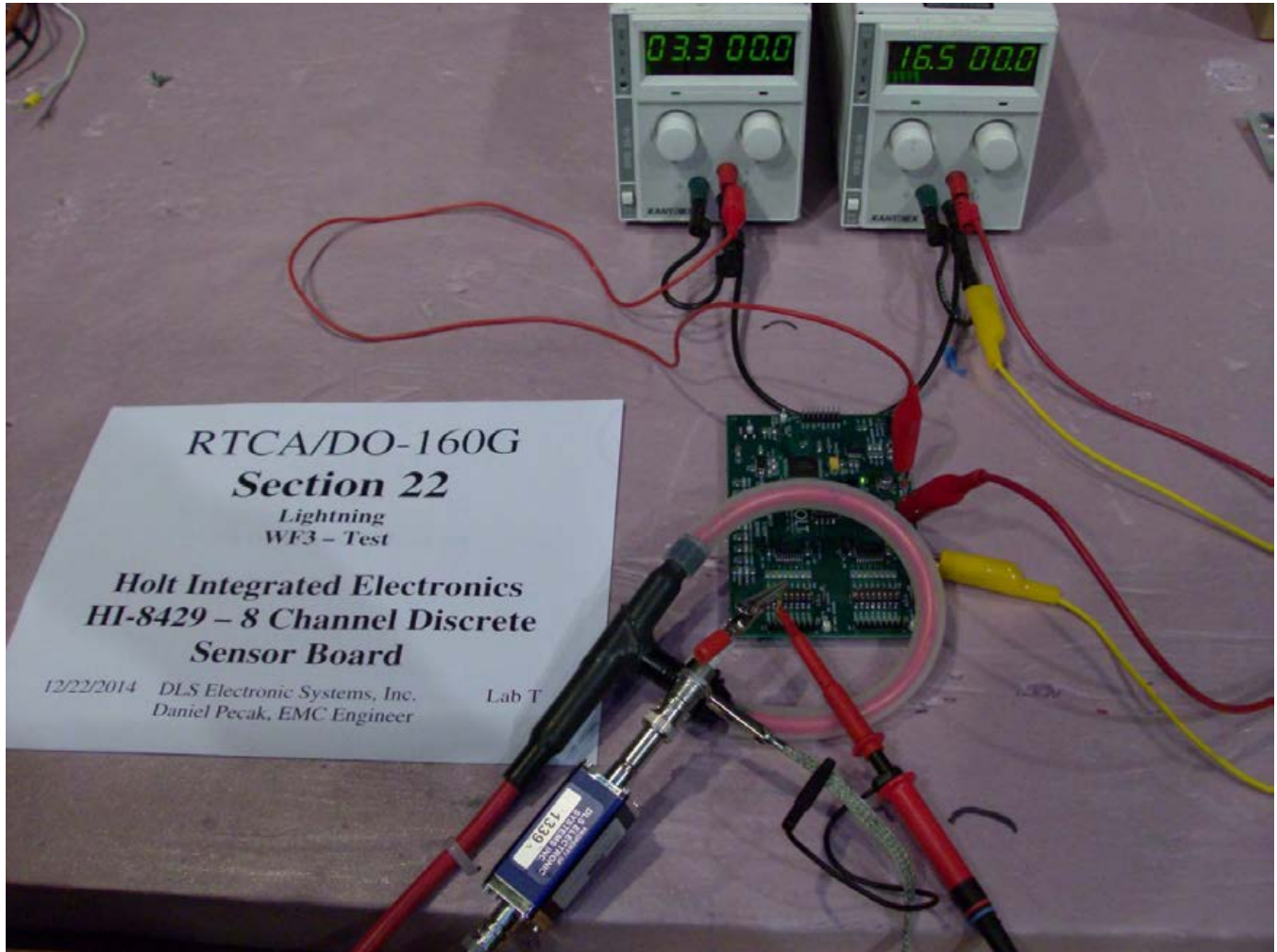


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Appendix A

6.0 PHOTOS TAKEN DURING TESTING



Section 22 - WF3 - Test

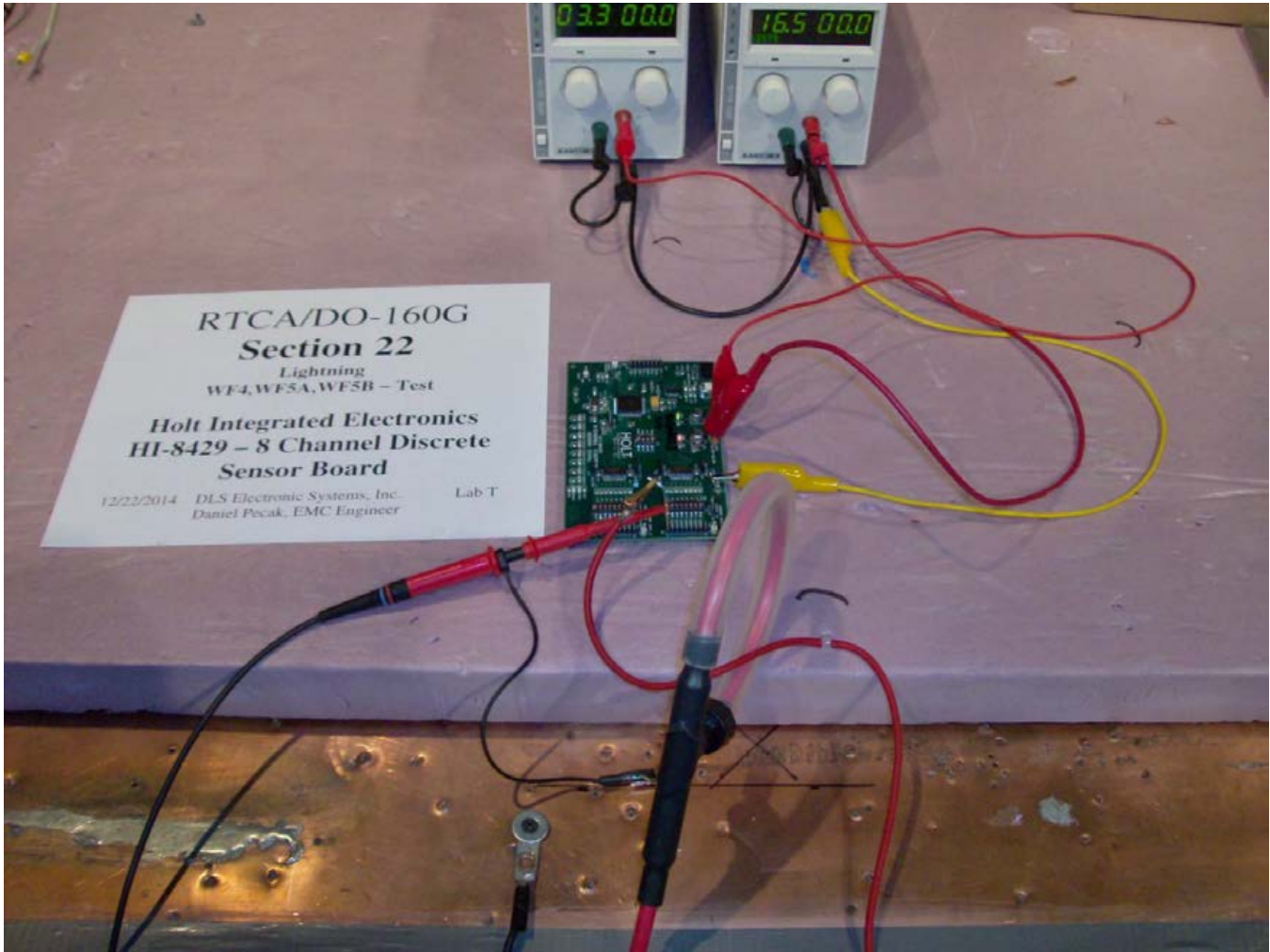


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6.0 PHOTOS TAKEN DURING TESTING



Section 22 - WF4, WF5a, WF5b - Test



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6.0 PHOTOS TAKEN DURING TESTING



Section 22 - WF3 - OC Calibration

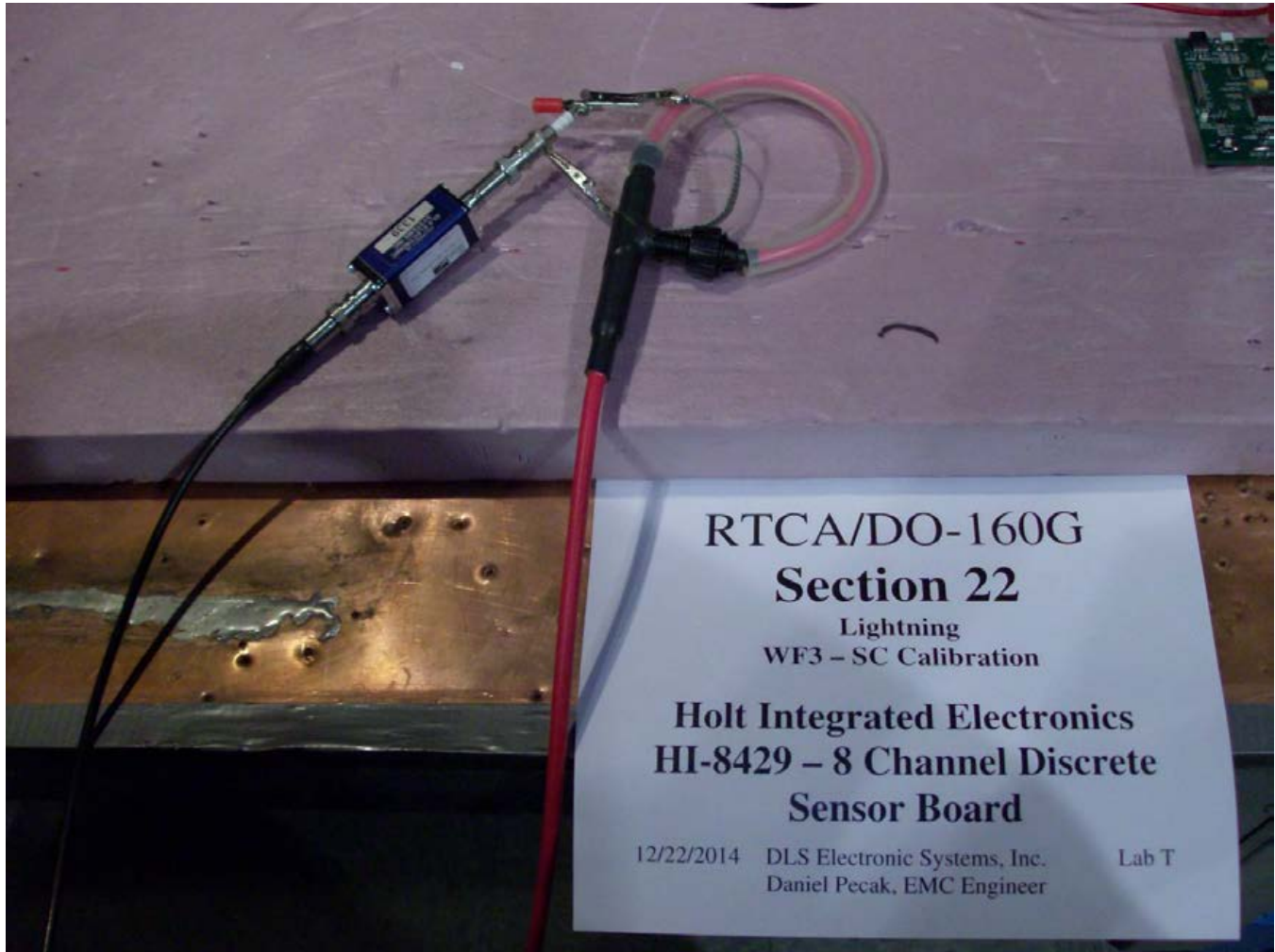


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Section 22 - WF3 - SC Calibration



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Section 22 - WF4, WF5a, WF5b - OC Calibration



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6.0 PHOTOS TAKEN DURING TESTING



Section 22 - WF4, WF5a, WF5b - SC Calibration



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Appendix A

TABLE 1 / TEST INSTRUMENTATION

Description	Manufacturer	Model Number	Serial Number	Range	Cal On	Cal Due Dates
Oscilloscope, Digital	LeCroy	WavePro 7200A	LCRY0705N13389	2 GHz	6/11/2014	6/11/2015
Probe, Current, Rogowski	PEM	CWT 3R	10134-11407	2 kHz	3/6/2014	3/6/2015

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



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TABLE 2 / TEST EQUIPMENT

Description	Manufacturer	Model Number	Serial Number	Range
Decoupler	EMC Partner	AC-DC DECOUPLER2-1524	103170	N/A
Generator, Impulse	EMC Partner	MIG-OS-MB	457	N/A
Generator, Transient	EMC Partner	MIG0600MS	462 & 463	N/A
Power supply, DC	Xantrex	N/A	73473	N/A
Power supply, DC	Xantrex	N/A	73474	N/A

Amplifiers and transmit antennas do not require calibration.



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Appendix A

SECTION 22

PIN INJECTION

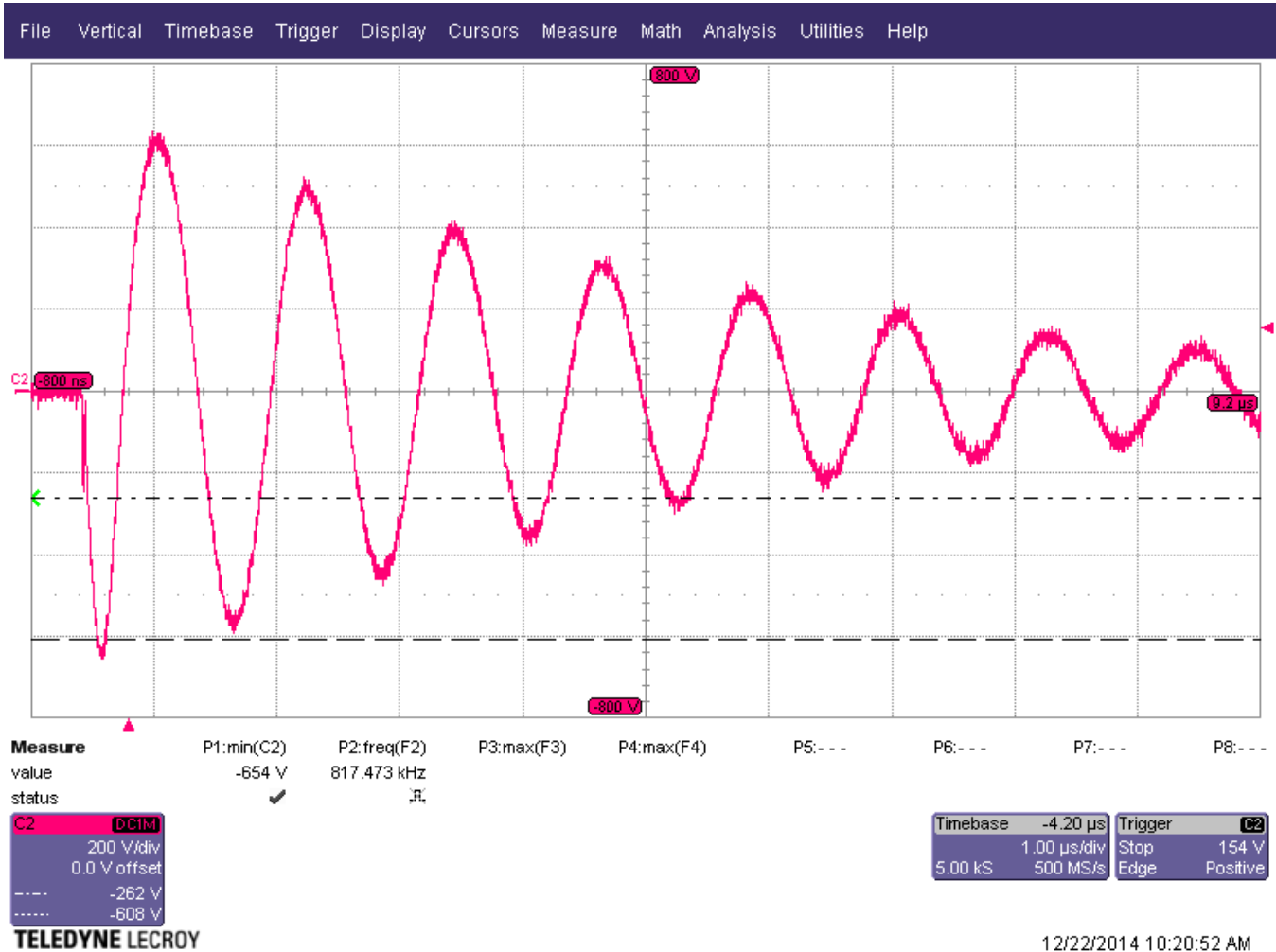
WF3 VERIFICATION DATA SHEETS

Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 10:20:43 AM

Pin WF3 Level 3 Open Circuit Verification - Negative



WF3 Pin Injection
 Open Circuit Verification
 Level 3 600V/24A
 f=1MHz +/-20%
 5th-25%-75% of 1st
 Gen = 670



Channel Status

	C2
V / Div	200 V
Offset	0.0 V
Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div	1.00 μs	Sampling Rate	500 MS/s
------------	---------	---------------	----------

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	154 V
	Source	C2	Coupling	DC

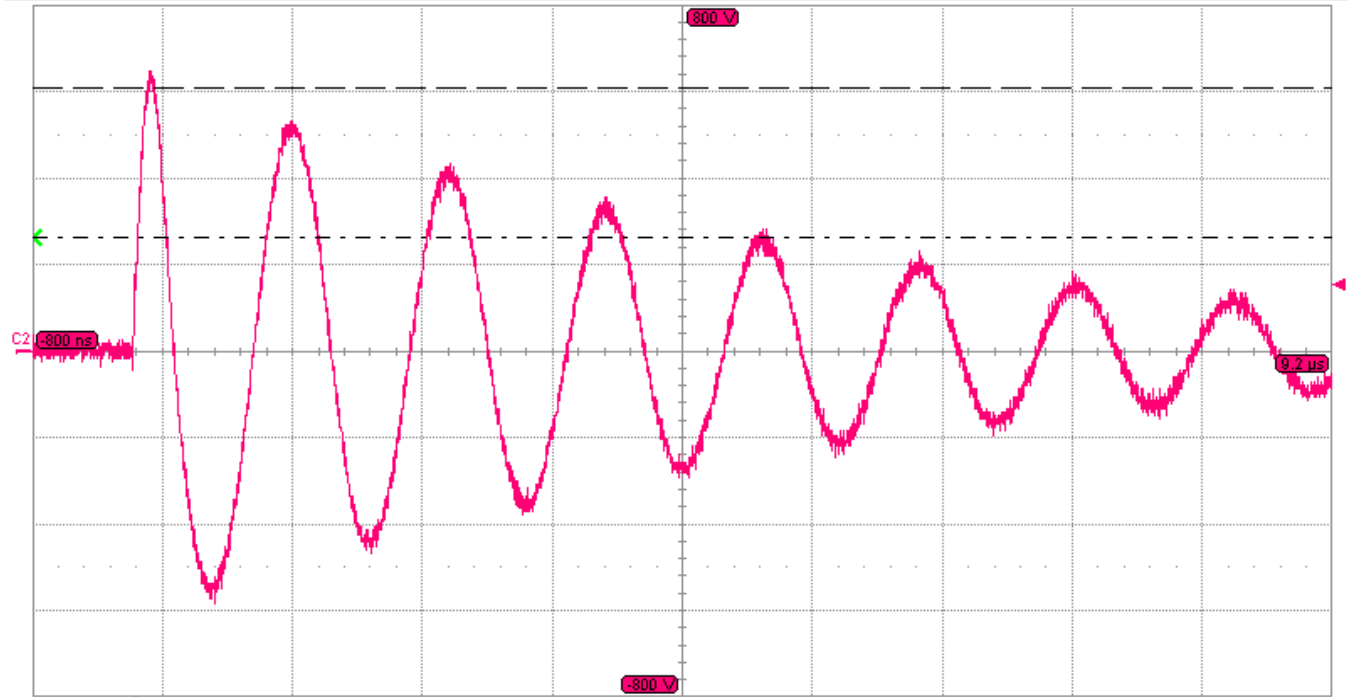
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 10:17:39 AM

Pin WF3 Level 3 Open Circuit Verification - Positive



WF3 Pin Injection
 Open Circuit Verification
 Level 3 600V/24A
 f=1MHz +/-20%
 5th-25%-75% of 1st
 Gen = 670

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 645 V 815.38 kHz
 status ✓

C2 DC1M
 200 V/div
 0.0 V offset
 --- 264 V
 606 V

Timebase -4.20 μs Trigger C2
 1.00 μs/div Stop 154 V
 5.00 kS 500 MS/s Edge Positive

TELEDYNE LECROY

12/22/2014 10:17:55 AM

Channel Status

	C2
V / Div	200 V
Offset	0.0 V
Coupling	DC1MΩ
BW-Limit	Full
Probe	1.000e+3
Sweeps	1 #

Acquisition Status

Time / Div 1.00 μs Sampling Rate 500 MS/s

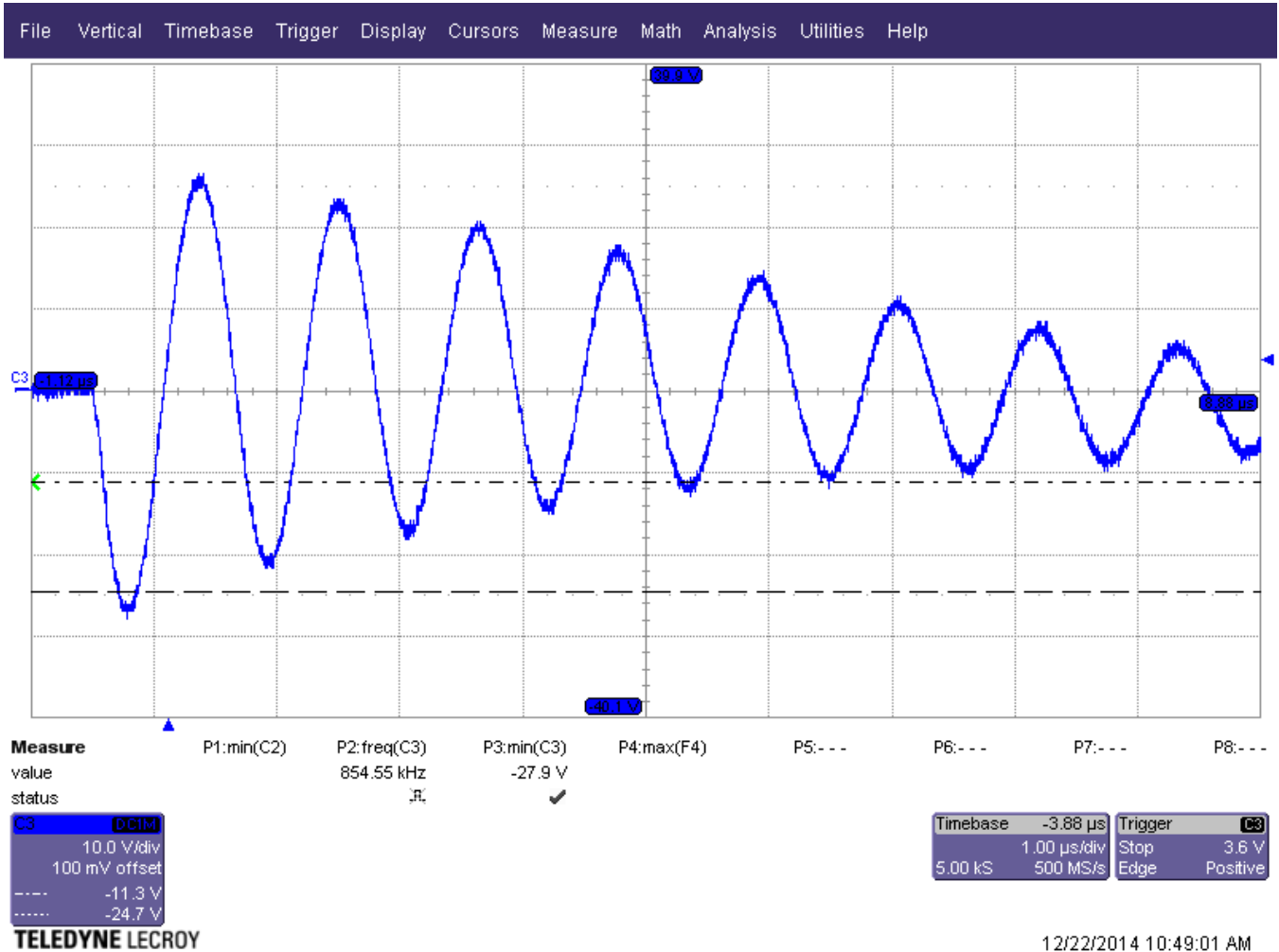
Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	154 V
	Source	C2	Coupling	DC

Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 10:48:52 AM

Pin WF3 Level 3 Short Circuit Verification - Negative



WF3 Pin Injection
 Short Circuit Verification
 Level 3 600V/24A
 f=1MHz +/-20%
 5th-25%-75% of 1st
 Gen = 670



Channel Status

Channel	Setting
V / Div	10.0 V
Offset	100 mV
Coupling	DC1MΩ
BW-Limit	Full
Probe	100.000
Sweeps	1 #

Acquisition Status

Time / Div	1.00 μs	Sampling Rate	500 MS/s
------------	---------	---------------	----------

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-3.88 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	3.6 V
	Source	C3	Coupling	DC

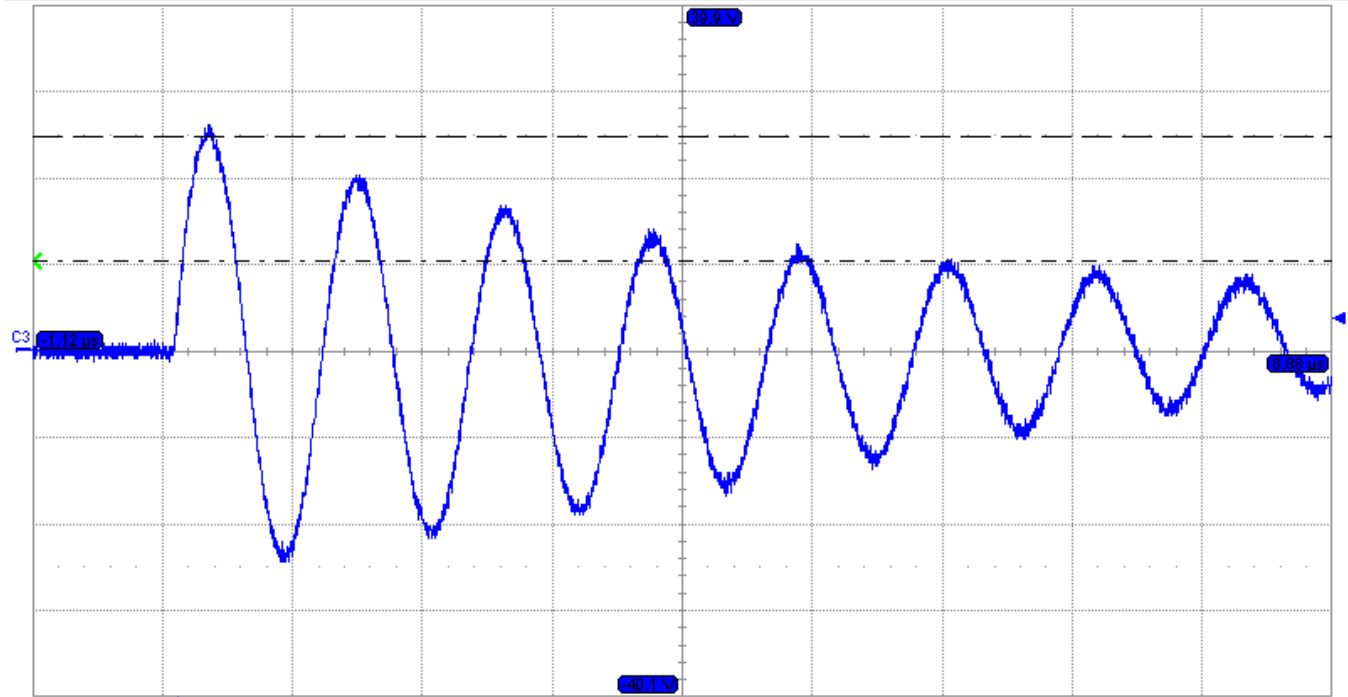
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 10:47:43 AM

Pin WF3 Level 3 Short Circuit Verification - Positive



WF3 Pin Injection
 Short Circuit Verification
 Level 3 600V/24A
 f=1MHz +/-20%
 5th-25%-75% of 1st
 Gen = 670

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure P1:min(C2) P2:freq(C3) P3:max(C3) P4:max(F4) P5:--- P6:--- P7:--- P8:---
 value
 status

C3 DSIM
 10.0 V/div
 100 mV offset
 --- 10.3 V
 ----- 24.7 V

Timebase -3.88 μs Trigger C3
 1.00 μs/div Stop 3.6 V
 5.00 kS 500 MS/s Edge Positive

TELEDYNE LECROY

12/22/2014 10:47:51 AM

Channel Status

	C3
V / Div	10.0 V
Offset	100 mV
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	100.000
Sweeps	1 #

Acquisition Status

Time / Div 1.00 μs Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-3.88 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	3.6 V
	Source	C3	Coupling	DC



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8429
Report Number: 20641
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

SECTION 22

PIN INJECTION

WF4 VERIFICATION DATA SHEETS

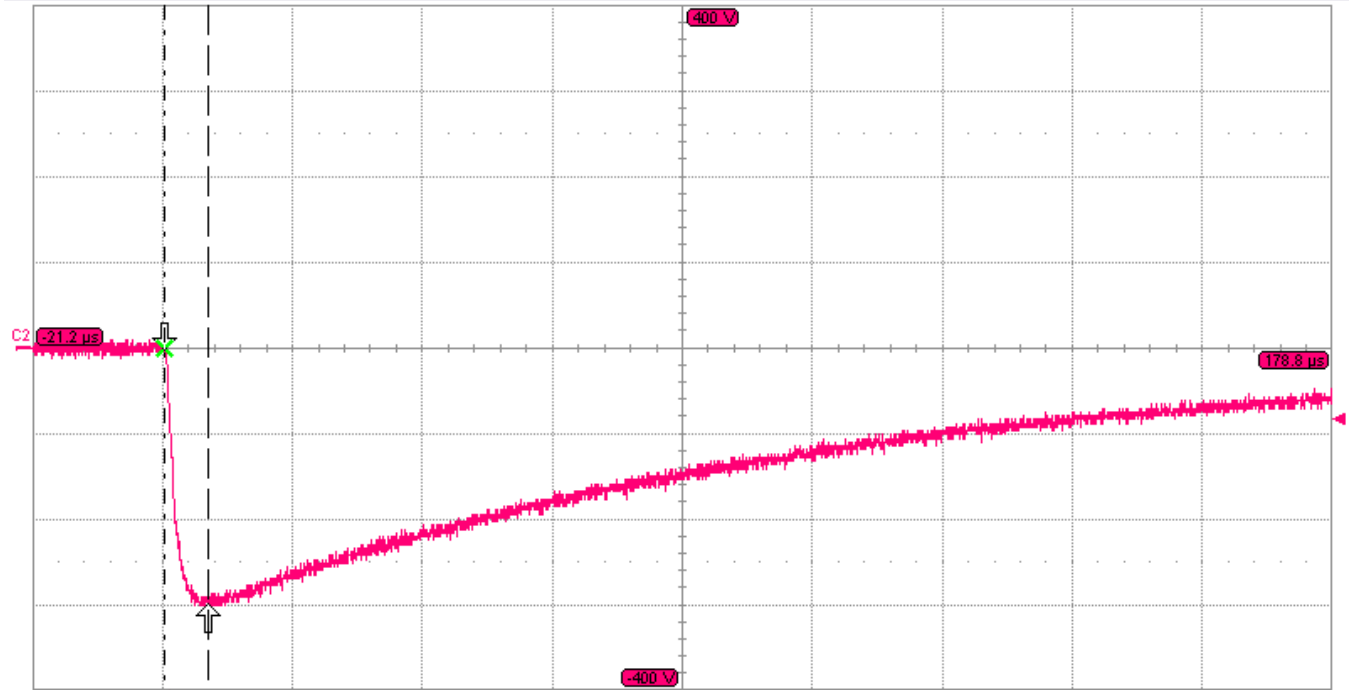
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:10:54 PM

Pin WF4 Level 3 Open Circuit Verification - Negative T1



WF4 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/60A
 T1 = 6.4uS (+/- 20%)
 T2 = 69uS (+/- 20%)
 Gen = 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status P1:min(C2) -305 V P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -500 mV
 ↑ -300.0 V

Timebase -78.8 us
 20.0 us/div
 5.00 kS 25 MS/s
 X1= -880 ns ΔX= 6.84 us
 X2= 5.96 us 1/ΔX= 146.2 kHz

TELEDYNE LECROY

12/22/2014 3:11:04 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 20.0 us Sampling Rate 25 MS/s

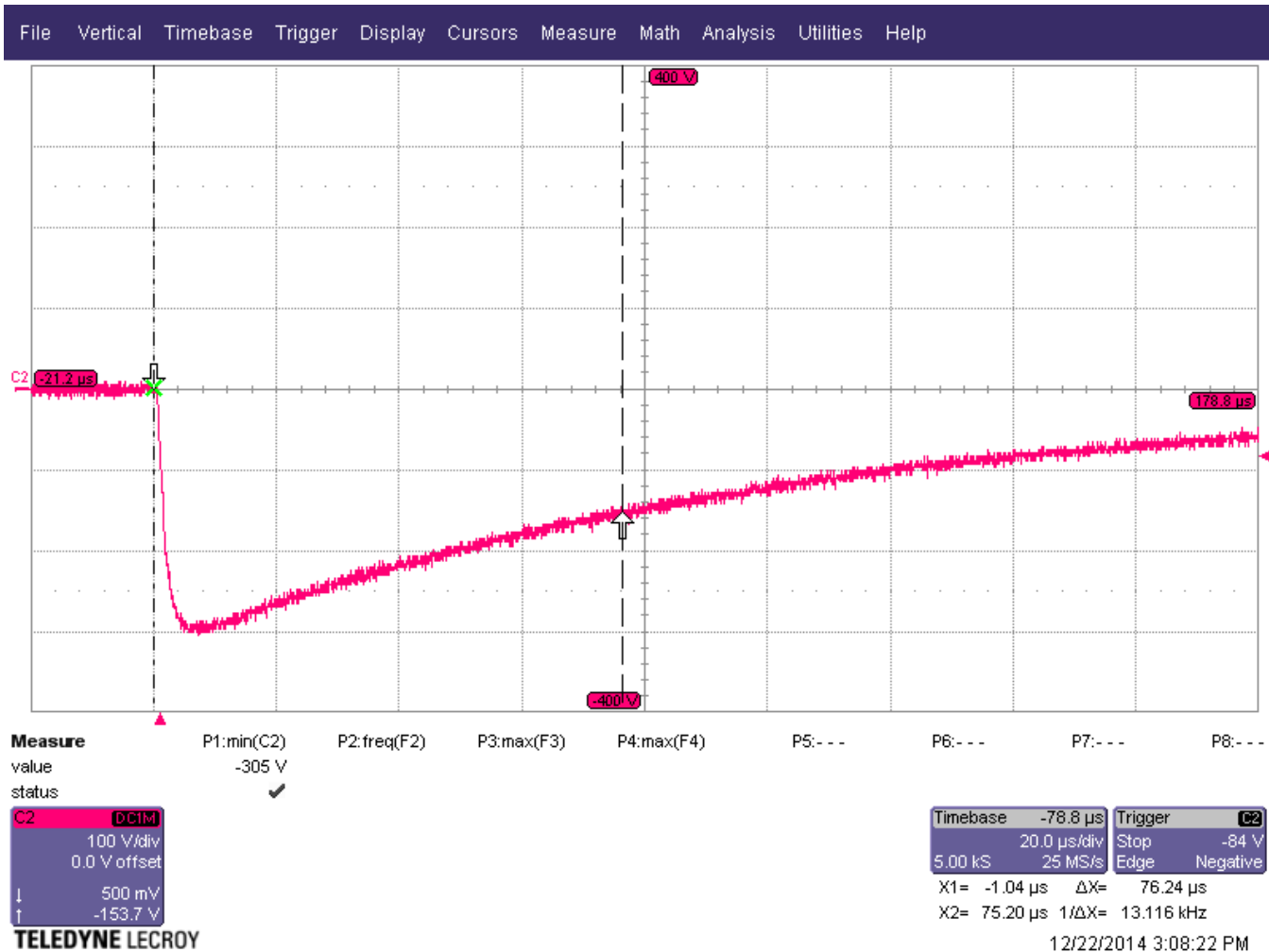
Horizontal	Time / Pt	40.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-78.8 μ s
	Mode	Stop	Slope	Negative
Trigger	Type	Edge	Level	-84 V
	Source	C2	Coupling	DC

Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:08:10 PM

Pin WF4 Level 3 Open Circuit Verification - Negative T2



WF4 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/60A
 T1 = 6.4uS (+/- 20%)
 T2 = 69uS (+/- 20%)
 Gen = 300



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 20.0 us Sampling Rate 25 MS/s

Horizontal	Time / Pt	40.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-78.8 μ s
	Mode	Stop	Slope	Negative
Trigger	Type	Edge	Level	-84 V
	Source	C2	Coupling	DC

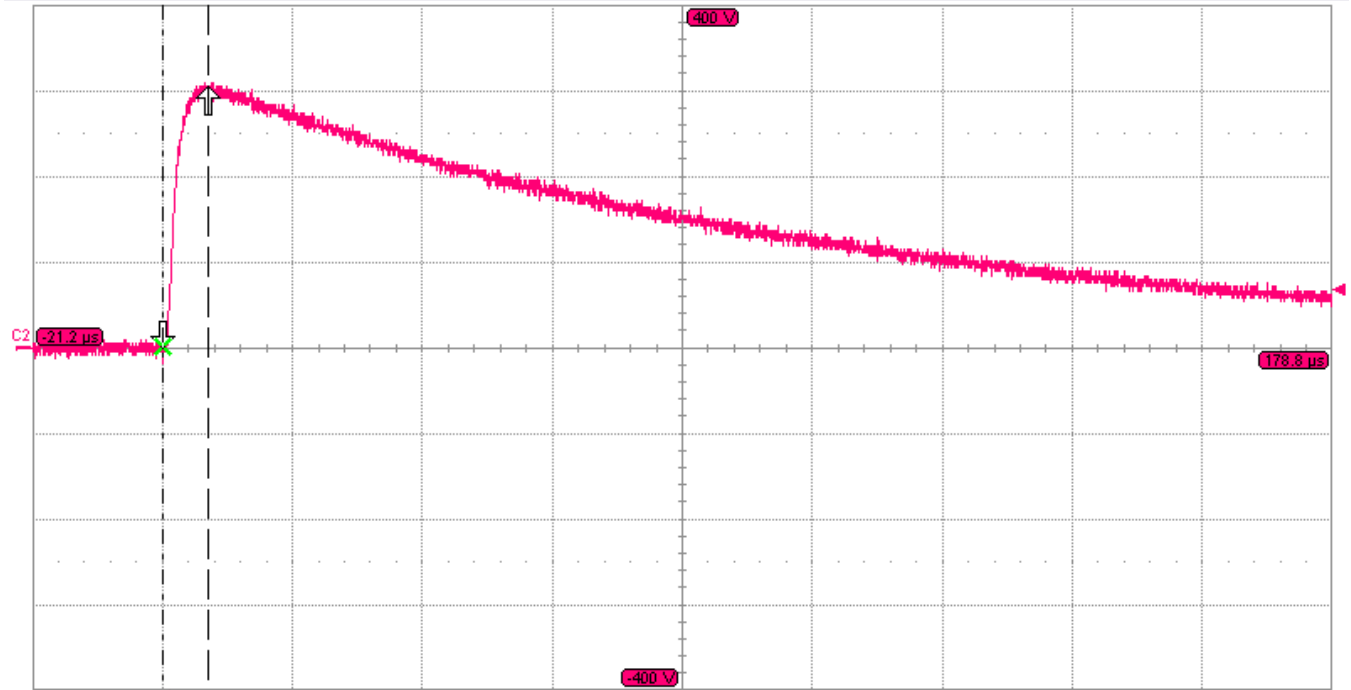
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:04:57 PM

Pin WF4 Level 3 Open Circuit Verification - Positive T1



WF4 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/60A
 T1 = 6.4uS (+/- 20%)
 T2 = 69uS (+/- 20%)
 Gen = 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status
 P1:max(C2) 309 V ✓
 P2:freq(F2)
 P3:max(F3)
 P4:max(F4)
 P5:---
 P6:---
 P7:---
 P8:---

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 0.0 V
 ↑ 303.8 V

Timebase -78.8 us
 20.0 us/div
 5.00 kS 25 MS/s
 Trigger C2
 Stop 67 V
 Edge Positive
 X1= -1.04 us ΔX= 6.76 us
 X2= 5.72 us 1/ΔX= 147.9 kHz

TELEDYNE LECROY

12/22/2014 3:05:11 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 20.0 us Sampling Rate 25 MS/s

Horizontal	Time / Pt	40.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-78.8 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	67 V
	Source	C2	Coupling	DC

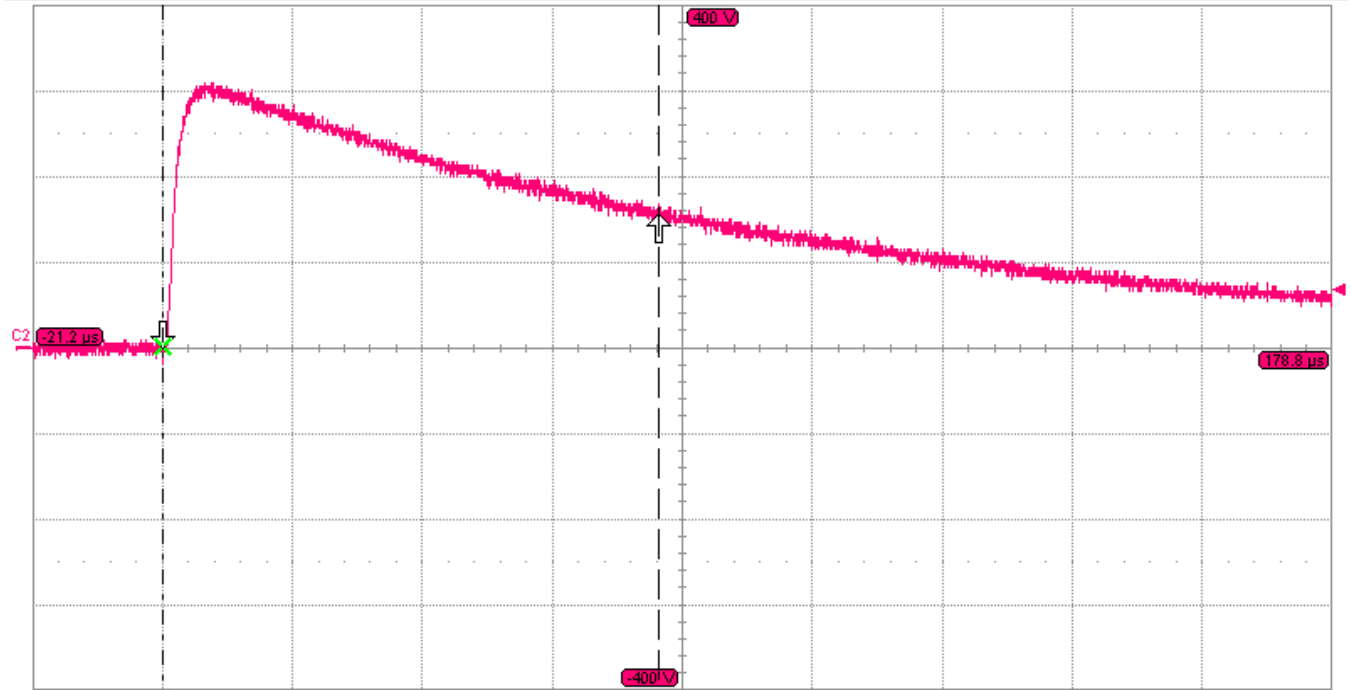
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:06:53 PM

Pin WF4 Level 3 Open Circuit Verification - Positive T2



WF4 Pin Injection (Direct Injection)
 Open Circuit Verification
 Level 3 300V/60A
 T1 = 6.4uS (+/- 20%)
 T2 = 69uS (+/- 20%)
 Gen = 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status
 P1:max(C2) 309 V ✓
 P2:freq(F2)
 P3:max(F3)
 P4:max(F4)
 P5:---
 P6:---
 P7:---
 P8:---

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 0.0 V
 ↑ 154.7 V

Timebase -78.8 us
 20.0 us/div
 5.00 kS 25 MS/s
 Trigger Stop 67 V
 Edge Positive
 X1= -1.04 us ΔX= 76.24 us
 X2= 75.20 us 1/ΔX= 13.116 kHz

TELEDYNE LECROY

12/22/2014 3:07:02 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 20.0 us Sampling Rate 25 MS/s

Horizontal	Time / Pt	40.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-78.8 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	67 V
	Source	C2	Coupling	DC

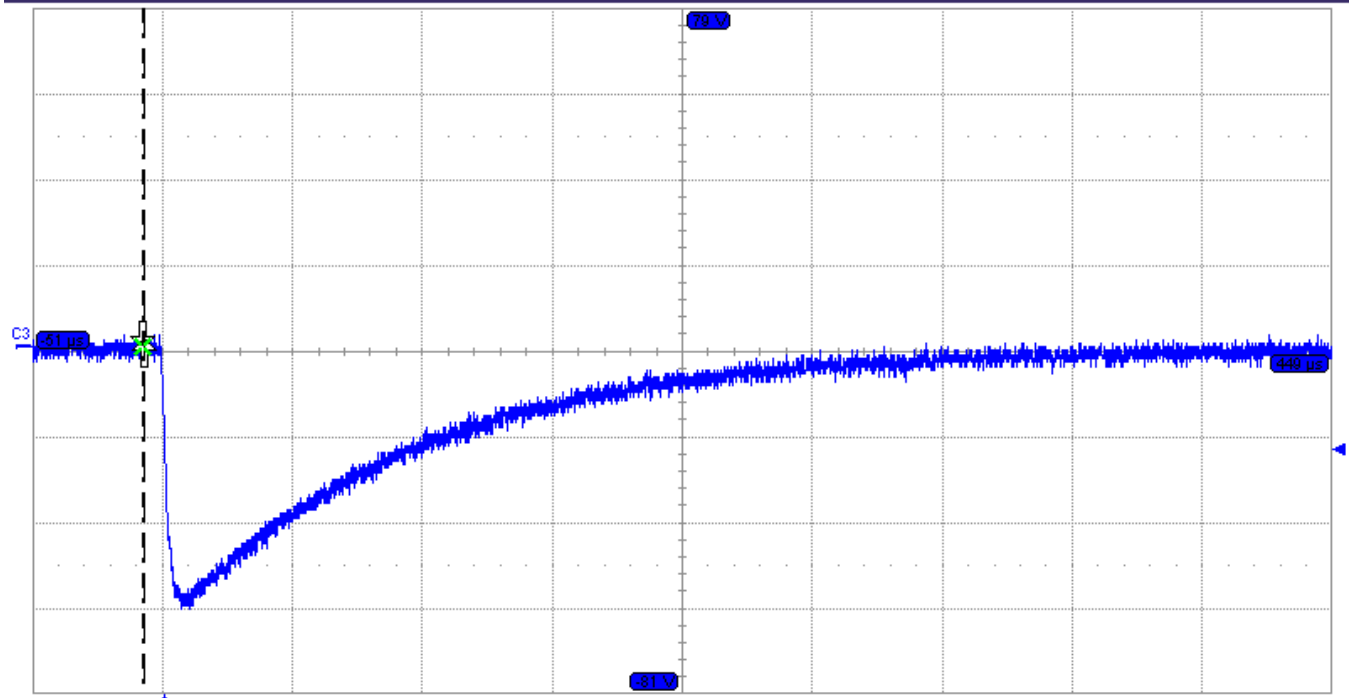
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:29:26 PM

Pin WF4 Level 3 Short Circuit Verification - Negative



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

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	-61.1 V							
status	✓							

C3	0.91M
20.0 V/div	
1.00 V offset	
↓ -180 mV	
↑ 1.47 V	

Timebase	-199 μ s	Trigger	C3
50.0 μ s/div		Stop	-24.2 V
5.00 kS	10 MS/s	Edge	Negative
X1= -8.5 μ s	Δ X= 600 ns		
X2= -7.9 μ s	1/ Δ X= 1.7 MHz		

TELEDYNE LECROY

12/22/2014 3:29:36 PM

Channel Status

	C3
V / Div	20.0 V
Offset	1.00 V
Vertical	DC1M Ω
Coupling	Full
BW-Limit	100.000
Probe	1 #
Sweeps	

Acquisition Status

Horizontal	Time / Div	50.0 μ s	Sampling Rate	10 MS/s
	Time / Pt	100.000 ns	Sampling Mode	RealTime

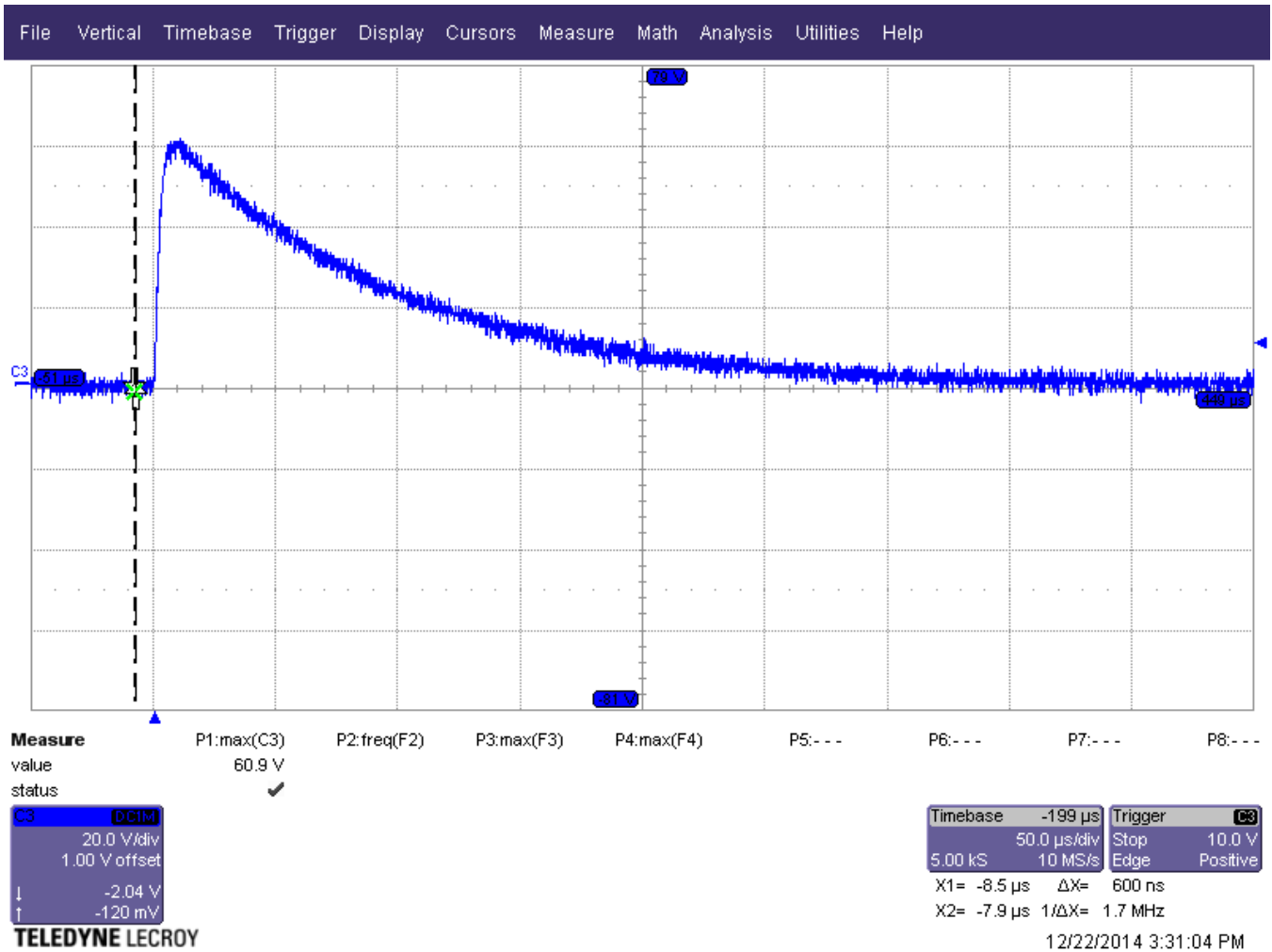
Trigger	Pts / Div	500.0 S	Trigger Delay	-199 μ s
	Mode	Stop	Slope	Negative
	Type	Edge	Level	-24.2 V
	Source	C3	Coupling	DC

Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:30:55 PM

Pin WF4 Level 3 Short Circuit Verification - Positive



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



Channel Status

	C3
V / Div	20.0 V
Offset	1.00 V
Vertical	DC1MΩ
Coupling	Full
BW-Limit	100.000
Probe	1 #
Sweeps	

Acquisition Status

Horizontal	Time / Div	50.0 μs	Sampling Rate	10 MS/s
	Time / Pt	100.000 ns	Sampling Mode	RealTime

Trigger	Pts / Div	500.0 S	Trigger Delay	-199 μ s
	Mode	Stop	Slope	Positive
	Type	Edge	Level	10.0 V
	Source	C3	Coupling	DC



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8429
Report Number: 20641
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

SECTION 22

PIN INJECTION

WF5A VERIFICATION DATA SHEETS

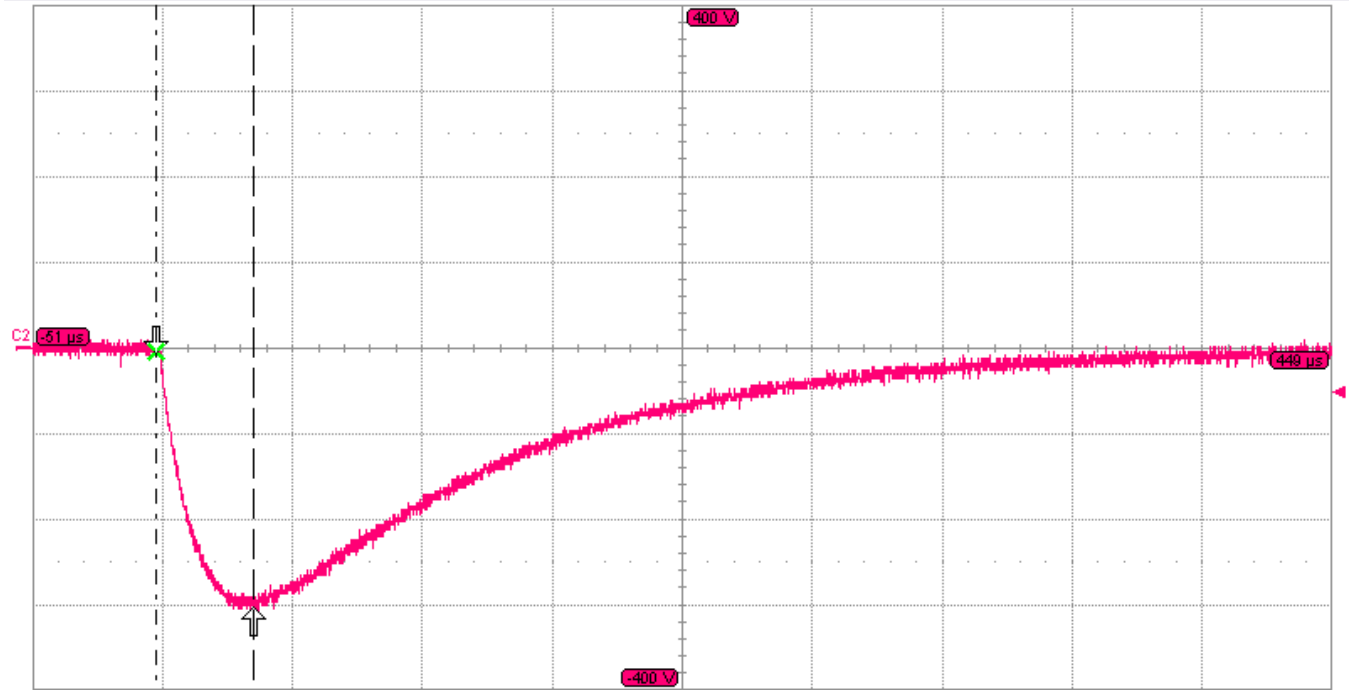
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 2:32:20 PM

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 = 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status P1:min(C2) -309 V P2:freq(F2) P3:max(F3) P4:max(F4) P5:--- P6:--- P7:--- P8:---

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -4.4 V
 ↑ -305.6 V

Timebase -199 µs Trigger C2
 50.0 µs/div Stop -52 V
 5.00 kS 10 MS/s Edge Negative
 X1= -3.4 µs ΔX= 37.6 µs
 X2= 34.2 µs 1/ΔX= 26.60 kHz

TELEDYNE LECROY

12/22/2014 2:32:29 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 50.0 µs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-199 μ s
	Mode	Stop	Slope	Negative
Trigger	Type	Edge	Level	-52 V
	Source	C2	Coupling	DC

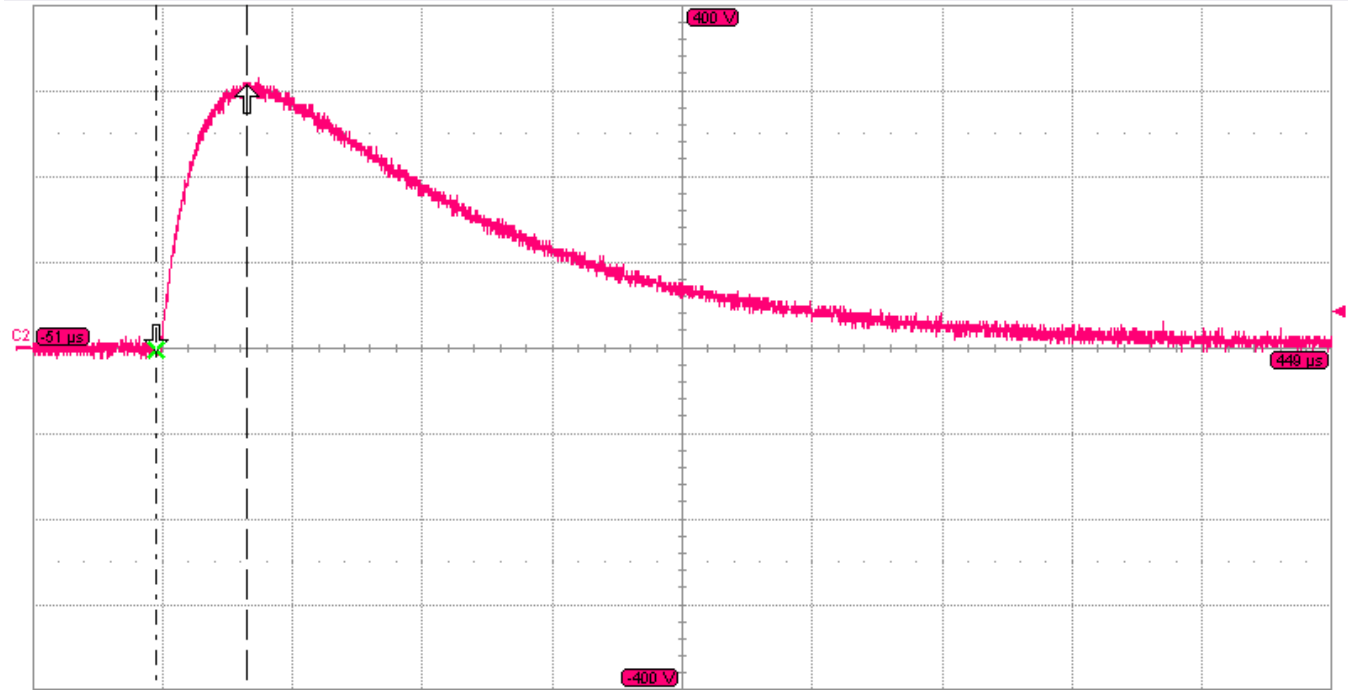
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 2:27:30 PM

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 = 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status
 P1:max(C2) 314 V ✓
 P2:freq(F2)
 P3:max(F3)
 P4:max(F4)
 P5:---
 P6:---
 P7:---
 P8:---

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ -2.7 V
 ↑ 304.2 V

Timebase -199 μs
 50.0 μs/div
 5.00 kS 10 MS/s
 X1= -3.4 μs ΔX= 34.9 μs
 X2= 31.5 μs 1/ΔX= 28.65 kHz

12/22/2014 2:27:42 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 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-199 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	43 V
	Source	C2	Coupling	DC

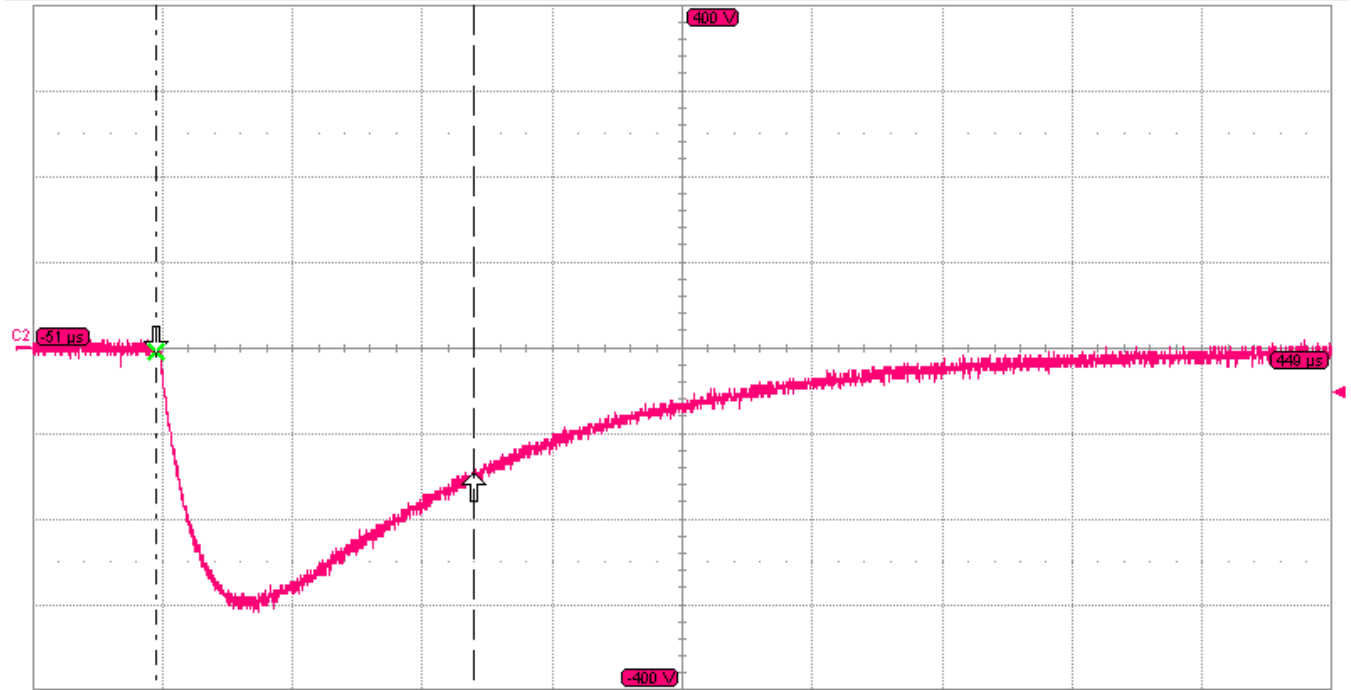
Lab Notebook Entry from LeCroy DSO
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 User: labadmin
 Time: 12/22/2014 2:30:47 PM

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 = 300

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	-309 V							
status	✓							

C2	DC1M	Timebase	-199 μs	Trigger	C2
	100 V/div		50.0 μs/div	Stop	-52 V
	0.0 V offset		10 MS/s	Edge	Negative
	↓ -4.4 V		5.00 kS		
	↑ -149.0 V				

TELEDYNE LECROY

X1= -3.4 μs ΔX= 122.2 μs
 X2= 118.8 μs 1/ΔX= 8.183 kHz

12/22/2014 2:31:00 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 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-199 μ s
	Mode	Stop	Slope	Negative
Trigger	Type	Edge	Level	-52 V
	Source	C2	Coupling	DC

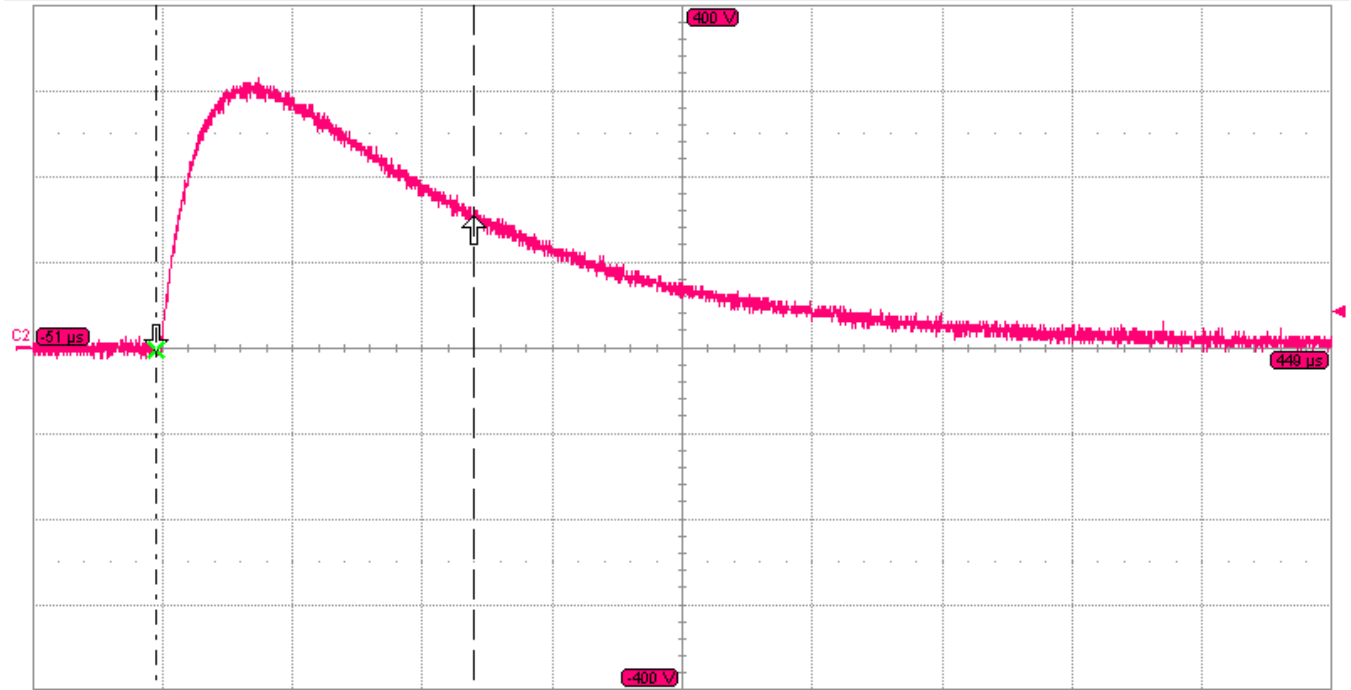
Lab Notebook Entry from LeCroy DSO
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 User: labadmin
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Pin WF5A Level 3 Open Circuit Verification T2 - Positive



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

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	314 V							
status	✓							

C2	DC1M
100 V/div	
0.0 V offset	
↓ -2.7 V	
↑ 152.0 V	

Timebase	-199 μs	Trigger	C2
50.0 μs/div		Stop	43 V
5.00 kS	10 MS/s	Edge	Positive
X1= -3.4 μs	ΔX= 122.2 μs		
X2= 118.8 μs	1/ΔX= 8.183 kHz		

TELEDYNE LECROY

12/22/2014 2:29:35 PM

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	50.0 μs	Sampling Rate	10 MS/s
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Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-199 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	43 V
	Source	C2	Coupling	DC

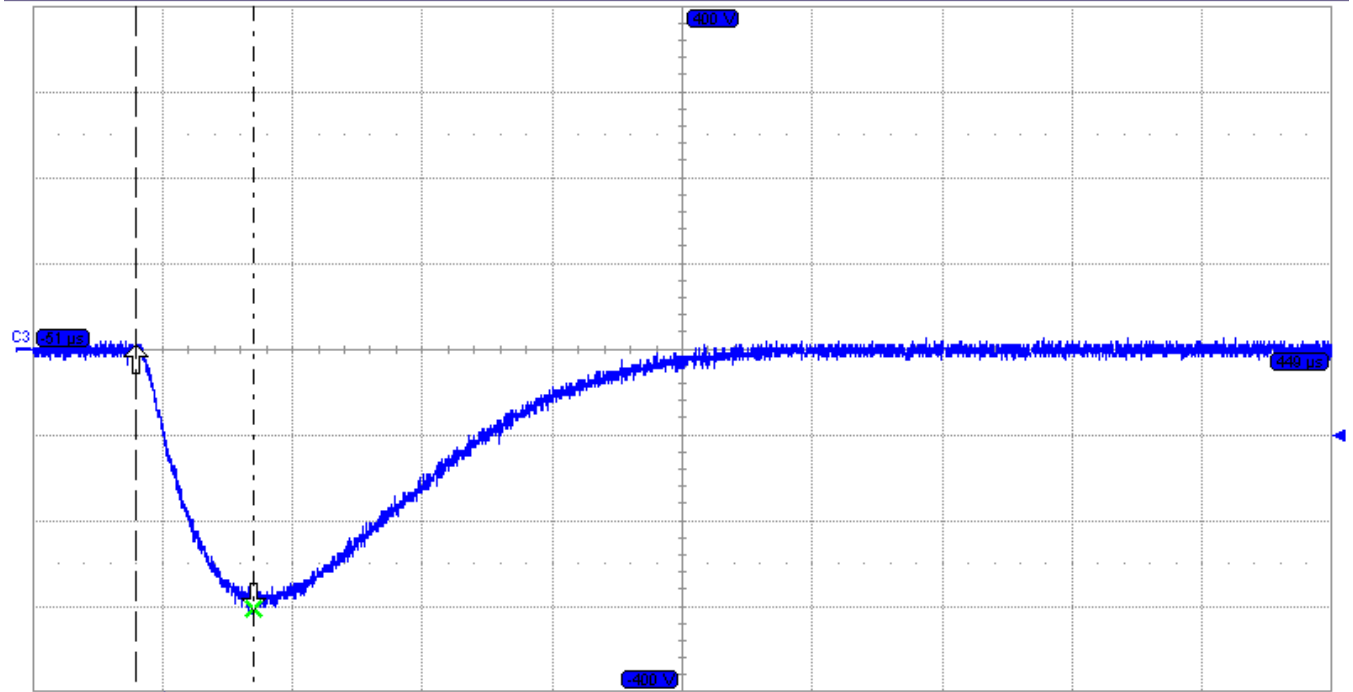
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 2:40:04 PM

Pin WF5A Level 3 Short Circuit Verification - Negative



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

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	-309 V							
status	✓							

C3	0.91M
100 V/div	
0.0 V offset	
↓ -302.2 V	
↑ 3.7 V	

Timebase	-199 μs	Trigger	C3
50.0 μs/div		Stop	-100 V
5.00 kS	10 MS/s	Edge	Negative
X1= 34.1 μs	ΔX= -45.0 μs		
X2= -10.9 μs	1/ΔX= -22.22 kHz		

12/22/2014 2:40:14 PM

Channel Status

	C3
V / Div	100 V
Offset	0.0 V
Vertical	DC1MΩ
Coupling	Full
BW-Limit	100.000
Probe	1 #
Sweeps	

Acquisition Status

Horizontal	Time / Div	50.0 μs	Sampling Rate	10 MS/s
	Time / Pt	100.000 ns	Sampling Mode	RealTime

Trigger	Pts / Div	500.0 S	Trigger Delay	-199 μ s
	Mode	Stop	Slope	Negative
	Type	Edge	Level	-100 V
	Source	C3	Coupling	DC

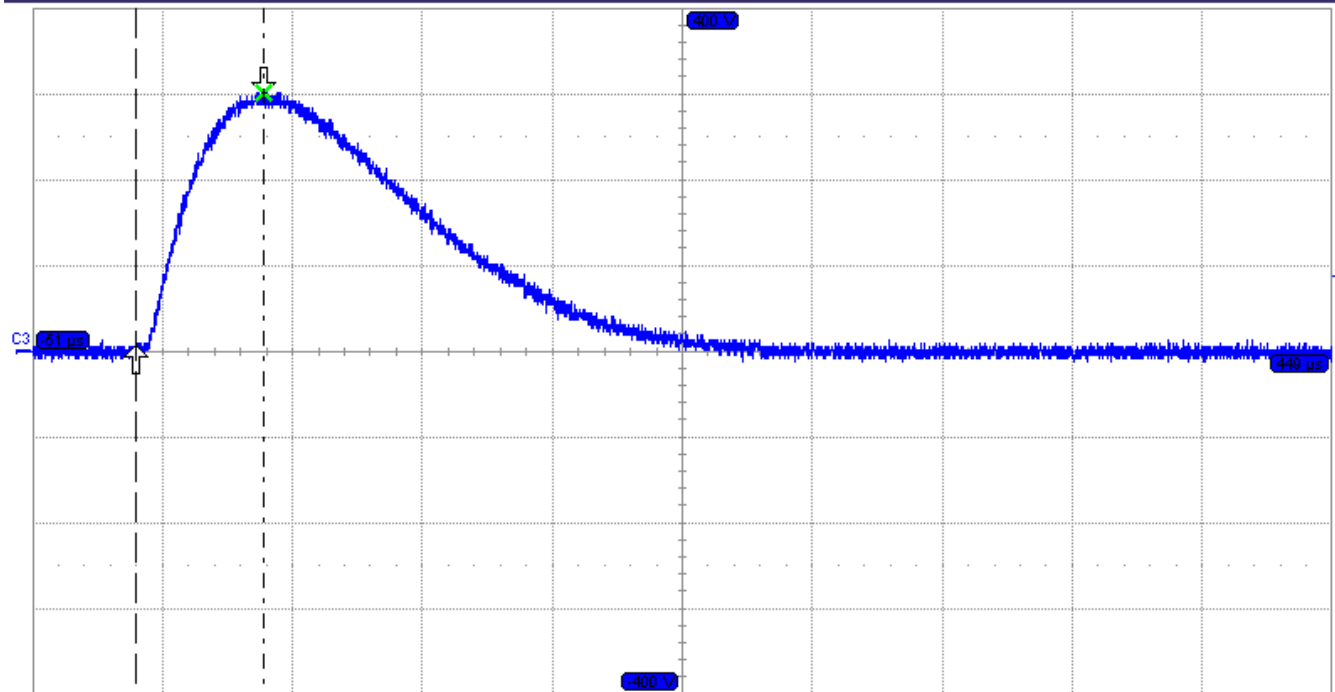
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 2:41:56 PM

Pin WF5A Level 3 Short Circuit Verification - Positive



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

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status
 P1:max(C3) 305 V
 P2:freq(F2)
 P3:max(F3)
 P4:max(F4)
 P5:---
 P6:---
 P7:---
 P8:---

C3 0.01M
 100 V/div
 0.0 V offset
 ↓ 300.1 V
 ↑ 4.0 V

Timebase -199 μs
 50.0 μs/div
 5.00 kS 10 MS/s
 X1= 38.2 μs ΔX= -49.1 μs
 X2= -10.9 μs 1/ΔX= -20.37 kHz
 Trigger C3
 Stop 87 V
 Edge Positive

12/22/2014 2:42:05 PM

Channel Status

	C3
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	100.000
Sweeps	1 #

Acquisition Status

Horizontal	Time / Div	50.0 μs	Sampling Rate	10 MS/s
	Time / Pt	100.000 ns	Sampling Mode	RealTime

Trigger	Pts / Div	500.0 S	Trigger Delay	-199 μ s
	Mode	Stop	Slope	Positive
	Type	Edge	Level	87 V
	Source	C3	Coupling	DC



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8429
Report Number: 20641
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

SECTION 22

PIN INJECTION

WF5B VERIFICATION DATA SHEETS

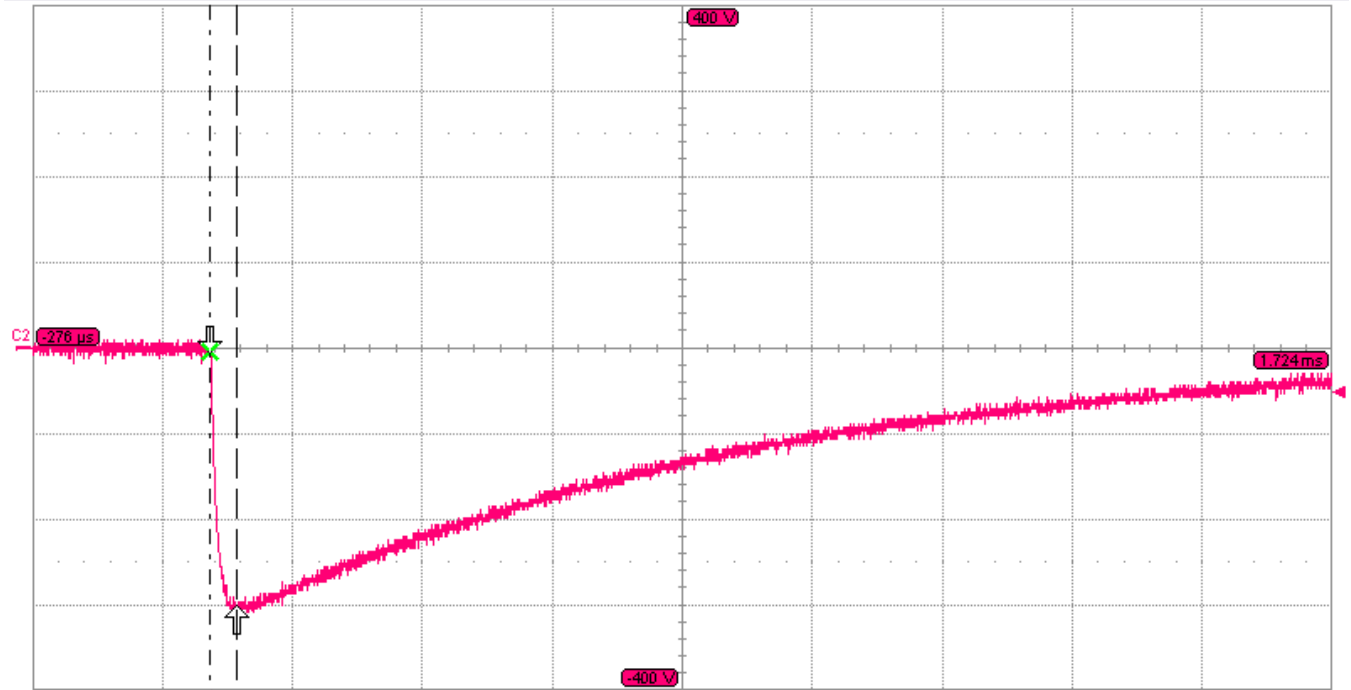
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:00:29 PM

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 = 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status

C2	DC1M	100 V/div	0.0 V offset	-4.4 V	-303.0 V
----	------	-----------	--------------	--------	----------

TELEDYNE LECROY

Timebase: -724 μs, 5.00 kS, 2.5 MS/s
 Trigger: Stop, -51 V, Edge, Negative
 X1 = -4.0 μs, ΔX = 42.8 μs
 X2 = 38.8 μs, 1/ΔX = 23.4 kHz
 12/22/2014 3:00:38 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	200 μs	Sampling Rate	2.5 MS/s
------------	--------	---------------	----------

Horizontal	Time / Pt	400.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-724 μ s
	Mode	Stop	Slope	Negative
Trigger	Type	Edge	Level	-51 V
	Source	C2	Coupling	DC

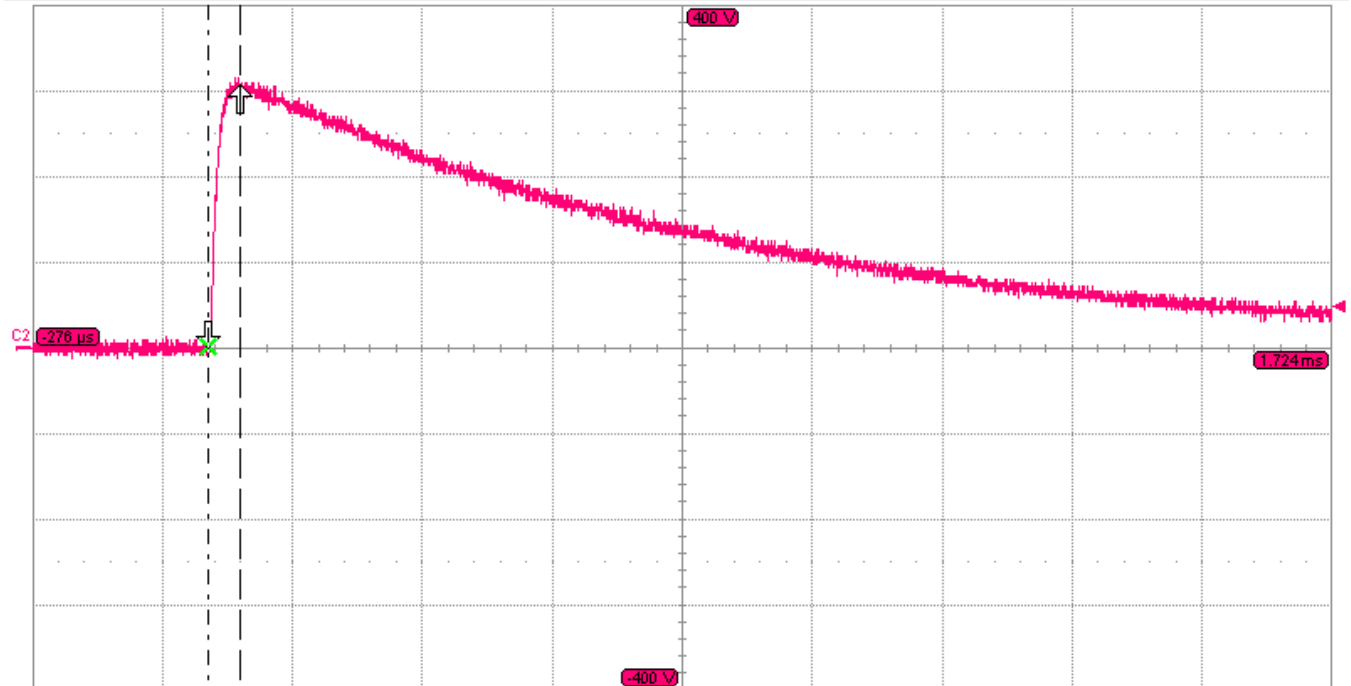
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 DSO S/N:
 User: labadmin
 Time: 12/22/2014 2:51:44 PM

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 = 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure
 value
 status

P1:max(C2)	314 V	P2:freq(F2)	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
------------	-------	-------------	------------	------------	--------	--------	--------	--------

C2 DC1M
 100 V/div
 0.0 V offset
 ↓ 0.0 V
 ↑ 304.9 V

Timebase -724 μs
 5.00 kS 200 μs/div 2.5 MS/s
 Trigger Stop 48 V
 Edge Positive
 X1= -4.4 μs ΔX= 48.8 μs
 X2= 44.4 μs 1/ΔX= 20.5 kHz

TELEDYNE LECROY

12/22/2014 2:51:55 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 200 μs Sampling Rate 2.5 MS/s

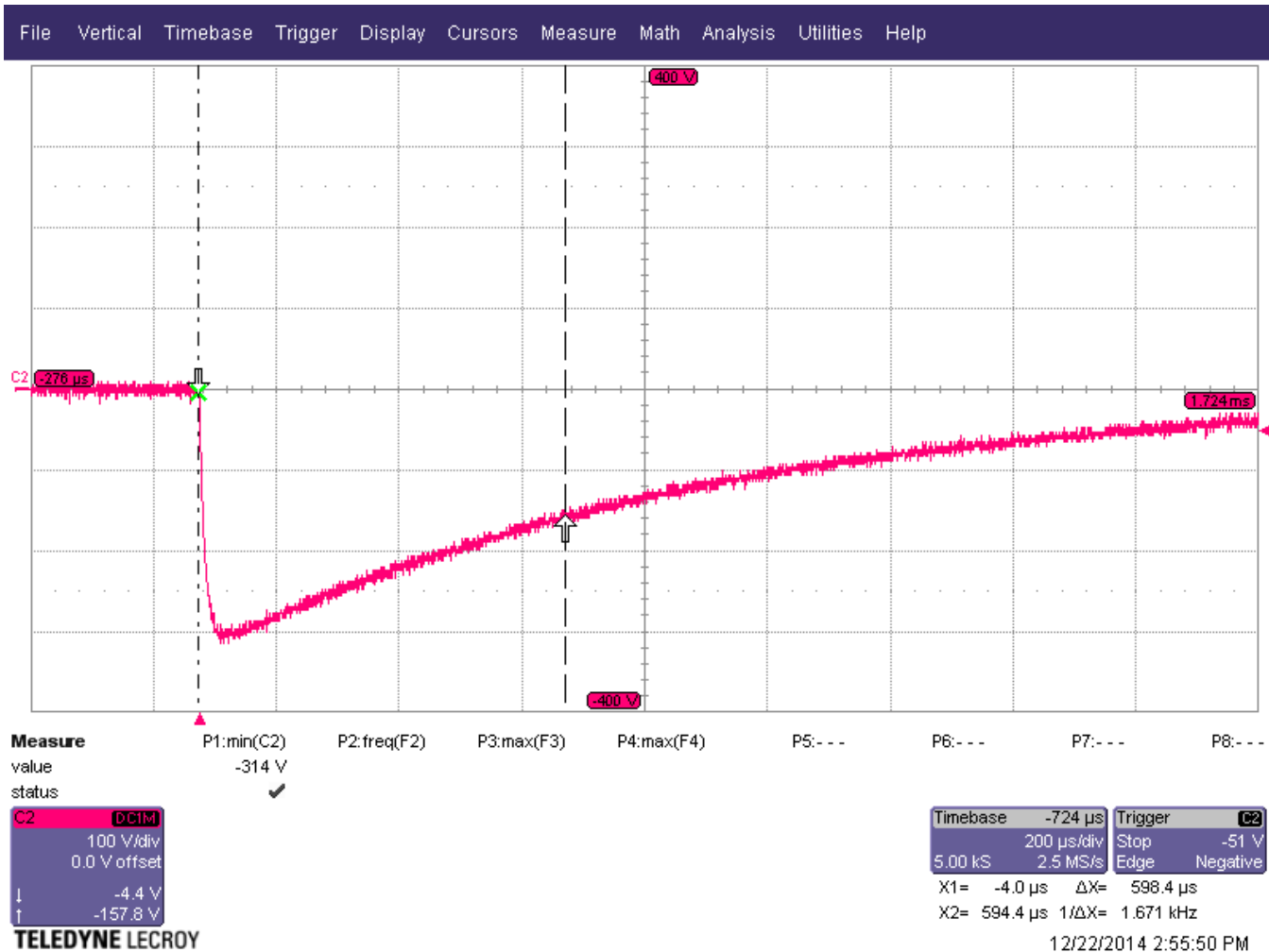
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	Pts / Div	500.0 S	Trigger Delay	-724 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	48 V
	Source	C2	Coupling	DC

Lab Notebook Entry from LeCroy DSO
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 Time: 12/22/2014 2:55:39 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 = 300



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	200 μs	Sampling Rate	2.5 MS/s
------------	--------	---------------	----------

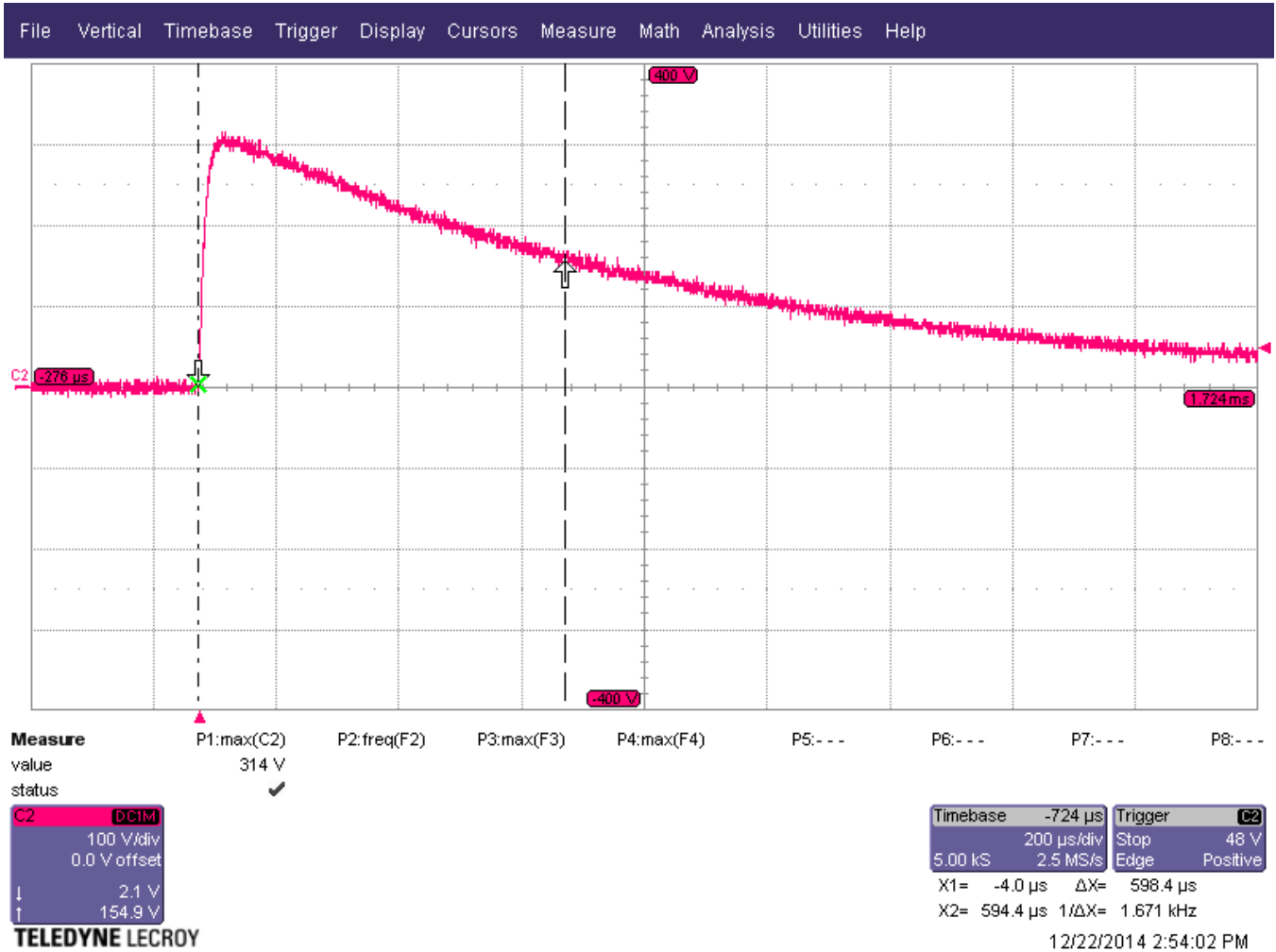
Horizontal	Time / Pt	400.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-724 μ s
	Mode	Stop	Slope	Negative
Trigger	Type	Edge	Level	-51 V
	Source	C2	Coupling	DC

Lab Notebook Entry from LeCroy DSO
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 Time: 12/22/2014 2:53:51 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 = 300



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 200 μs Sampling Rate 2.5 MS/s

Horizontal	Time / Pt	400.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-724 μ s
	Mode	Stop	Slope	Positive
Trigger	Type	Edge	Level	48 V
	Source	C2	Coupling	DC

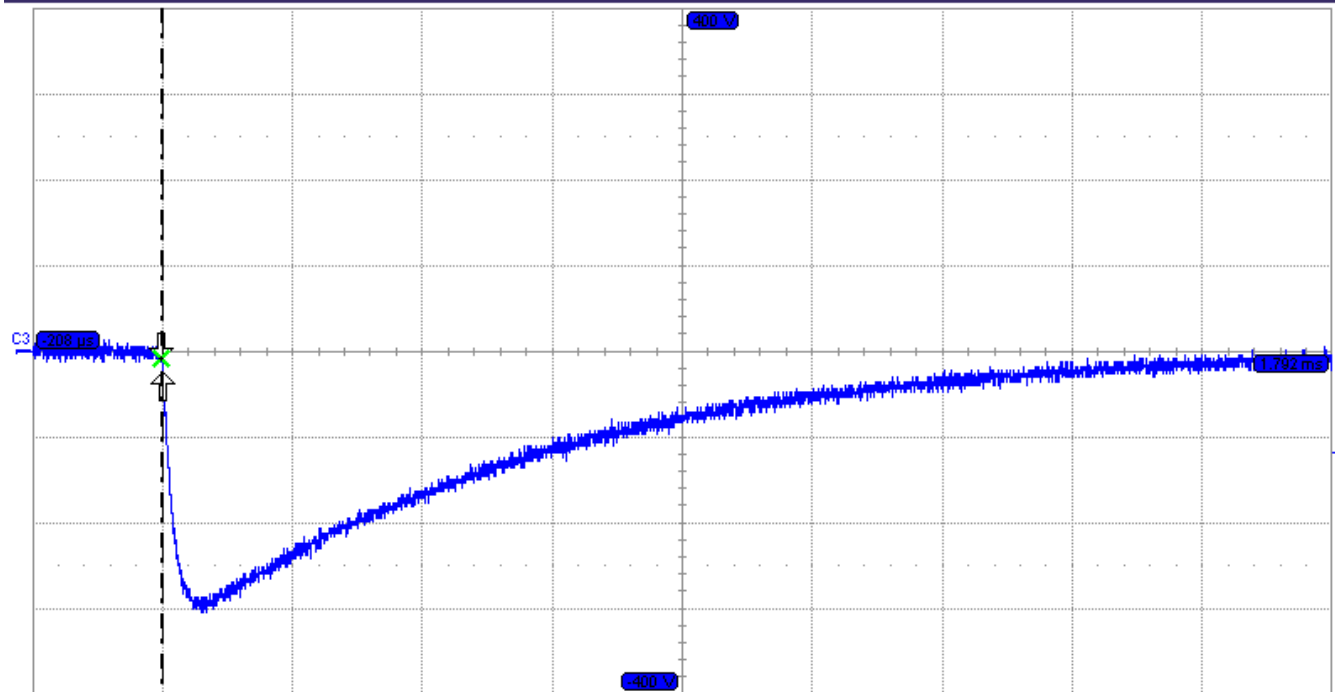
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Pin WF5B Level 3 Short Circuit Verification - Negative



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

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status
 P1:min(C3) -305 V
 P2:freq(F2)
 P3:max(F3)
 P4:max(F4)
 P5:---
 P6:---
 P7:---
 P8:---

C3 0.01M
 100 V/div
 0.0 V offset
 ↓ -8.7 V
 ↑ -26.3 V

Timebase -792 μs
 200 μs/div
 5.00 kS 2.5 MS/s
 X1= -10.0 μs ΔX= 2.8 μs
 X2= -7.2 μs 1/ΔX= 357 kHz
 Trigger C3
 Stop -118 V
 Edge Negative

12/22/2014 2:47:58 PM

Channel Status

	C3
V / Div	100 V
Offset	0.0 V
Vertical Coupling	DC1MΩ
BW-Limit	Full
Probe	100.000
Sweeps	1 #

Acquisition Status

Horizontal	Time / Div	200 μs	Sampling Rate	2.5 MS/s
	Time / Pt	400.000 ns	Sampling Mode	RealTime

Trigger	Pts / Div	500.0 S	Trigger Delay	-792 μ s
	Mode	Stop	Slope	Negative
	Type	Edge	Level	-118 V
	Source	C3	Coupling	DC

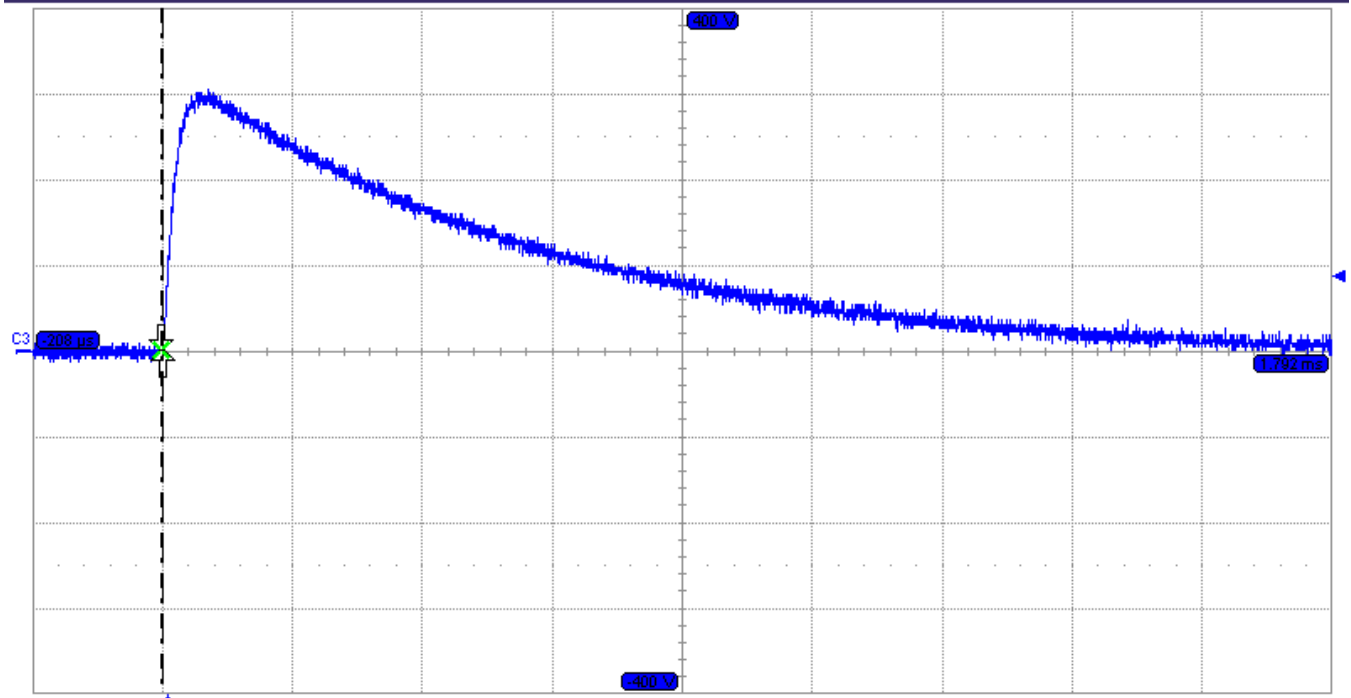
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 Time: 12/22/2014 2:45:42 PM

Pin WF5B Level 3 Short Circuit Verification - Positive



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

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status

P1:max(C3)	305 V
P2:freq(F2)	
P3:max(F3)	
P4:max(F4)	
P5:---	
P6:---	
P7:---	
P8:---	

C3 100 V/div
 0.0 V offset
 1.5 V
 0.0 V

TELEDYNE LECROY

Timebase	-792 μs	Trigger	C3
	200 μs/div	Stop	87 V
5.00 kS	2.5 MS/s	Edge	Positive
X1=	-10.0 μs	ΔX=	2.8 μs
X2=	-7.2 μs	1/ΔX=	357 kHz

12/22/2014 2:45:52 PM

Channel Status

		C3
V / Div		100 V
Offset		0.0 V
Vertical	Coupling	DC1MΩ
	BW-Limit	Full
	Probe	100.000
	Sweeps	1 #

Acquisition Status

Horizontal	Time / Div	200 μs	Sampling Rate	2.5 MS/s
	Time / Pt	400.000 ns	Sampling Mode	RealTime

Trigger	Pts / Div	500.0 S	Trigger Delay	-792 μ s
	Mode	Stop	Slope	Positive
	Type	Edge	Level	87 V
	Source	C3	Coupling	DC



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8429
Report Number: 20641
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

SECTION 22

PIN INJECTION TEST DATA SHEETS

WF3 & WF 4 SN 1

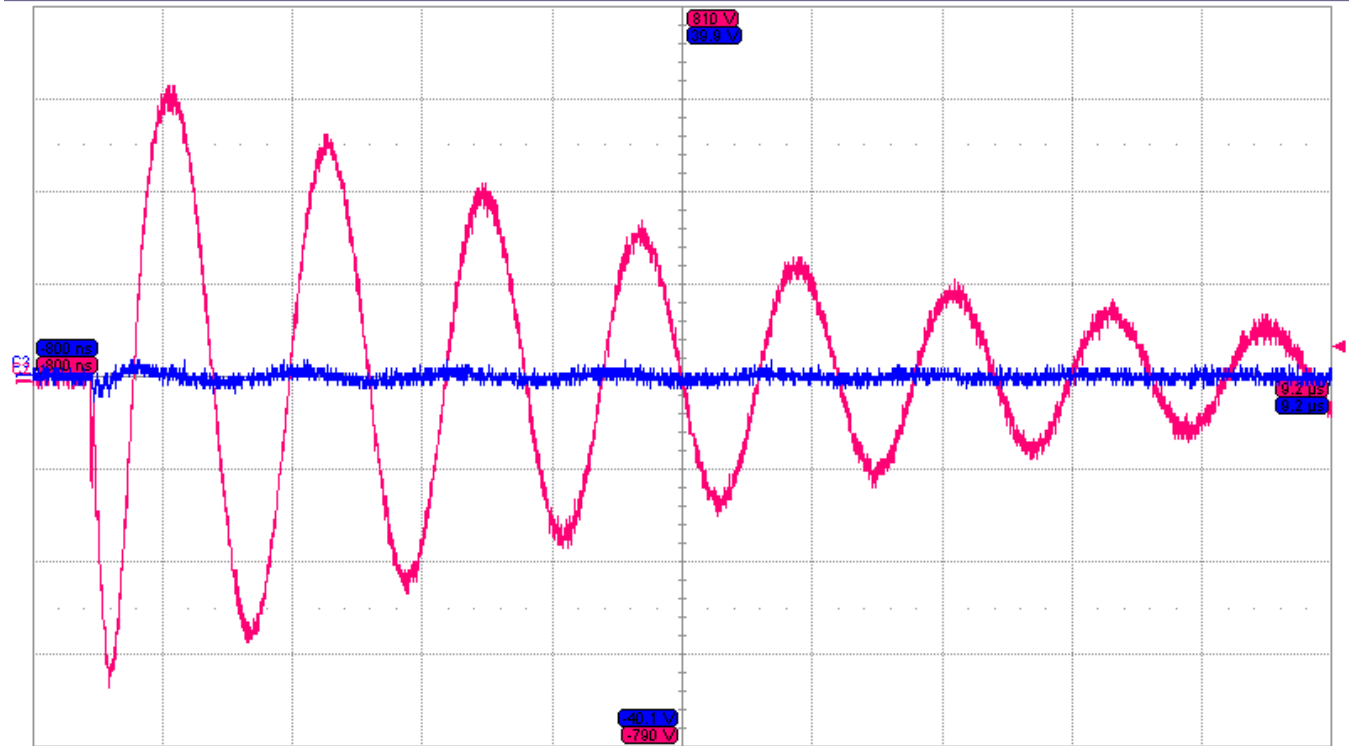
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Pin WF3 Test Neg - Chip 1 - Sense 1



Holt Integrated Electronics
 Board 1 - Chip #1
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	-662 V	-2.8 V					
status	✓	✓					

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

TELEDYNE LECROY

Timebase: -4.20 μ s, 1.00 μ s/div, 5.00 kS
 Trigger: C2, Stop, 76 V, Edge, Positive

12/22/2014 11:41:01 AM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	-10.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	76 V
	Source	C2	Coupling	DC

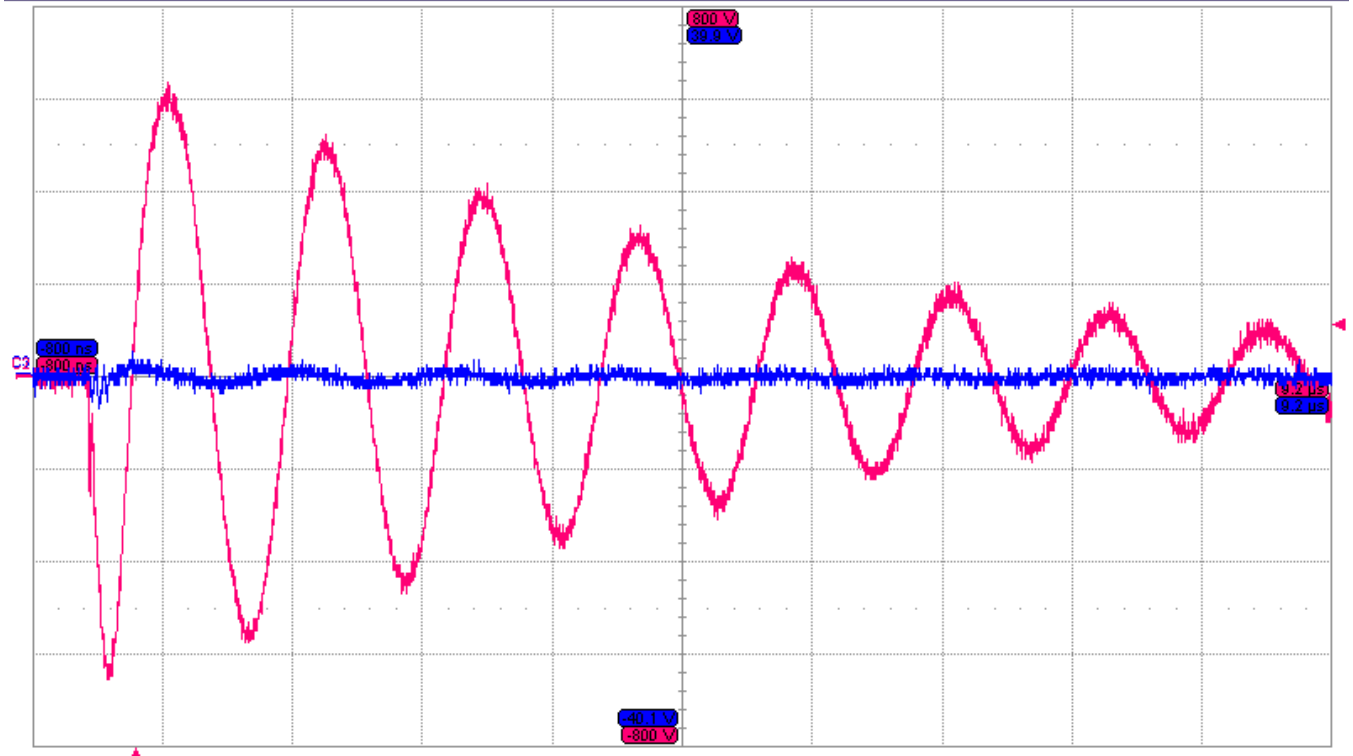
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Pin WF3 Test Neg - Chip 1 - Sense 2



Holt Integrated Electronics
 Board 1 - Chip #1
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	-654 V	-3.6 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	10.0 V/div		
0.0 V offset	100 mV offset		

Timebase	-4.20 μs	Trigger	C2
	1.00 μs/div	Stop	112 V
5.00 kS	500 MS/s	Edge	Positive

12/22/2014 1:08:39 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1MΩ	DC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μs Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

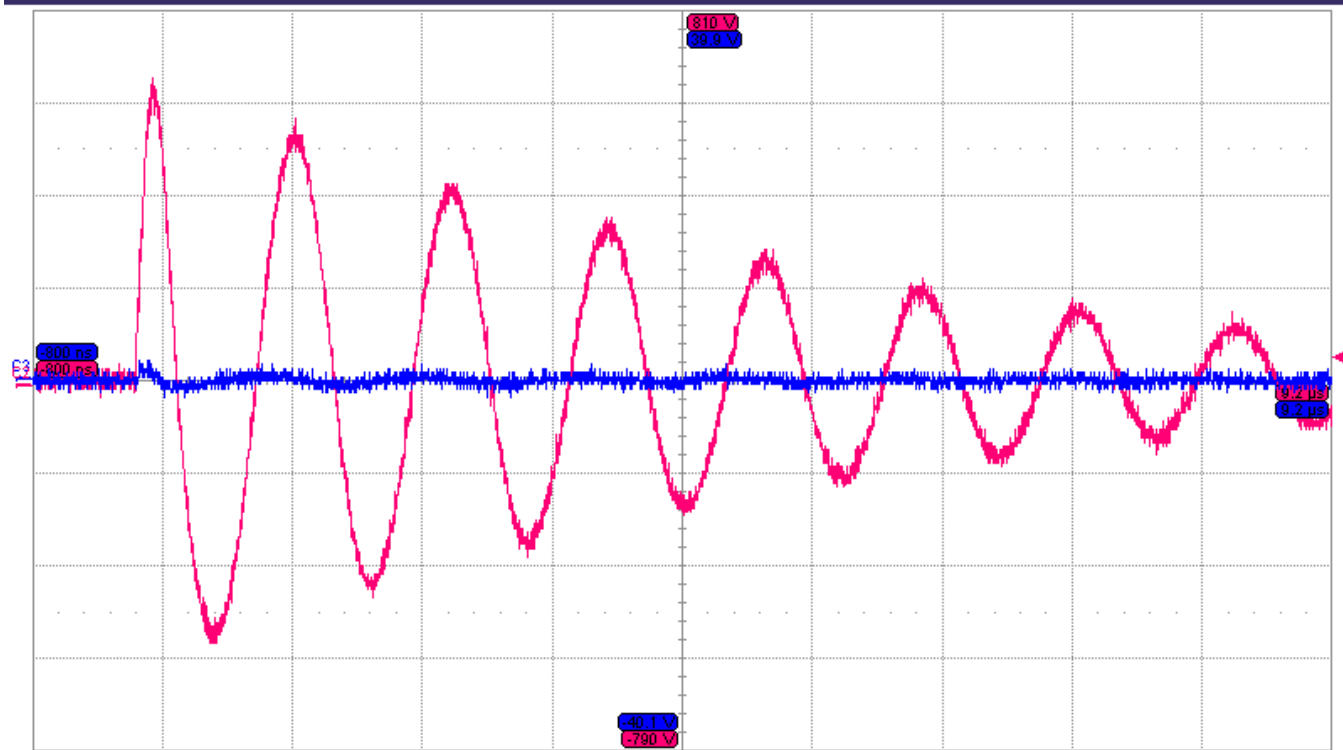
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 DSO S/N:
 User: labadmin
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Pin WF3 Test Pos - Chip 1 - Sense 1



Holt Integrated Electronics
 Board 1 - Chip #1
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	664 V	2.1 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	10.0 V/div		
-10.0 V offset	100 mV offset		

TELEDYNE LECROY	Timebase	-4.20 μ s	Trigger	C2
		1.00 μ s/div	Stop	60 V
		5.00 kS	Edge	Positive
				12/22/2014 11:39:45 AM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	-10.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	60 V
	Source	C2	Coupling	DC

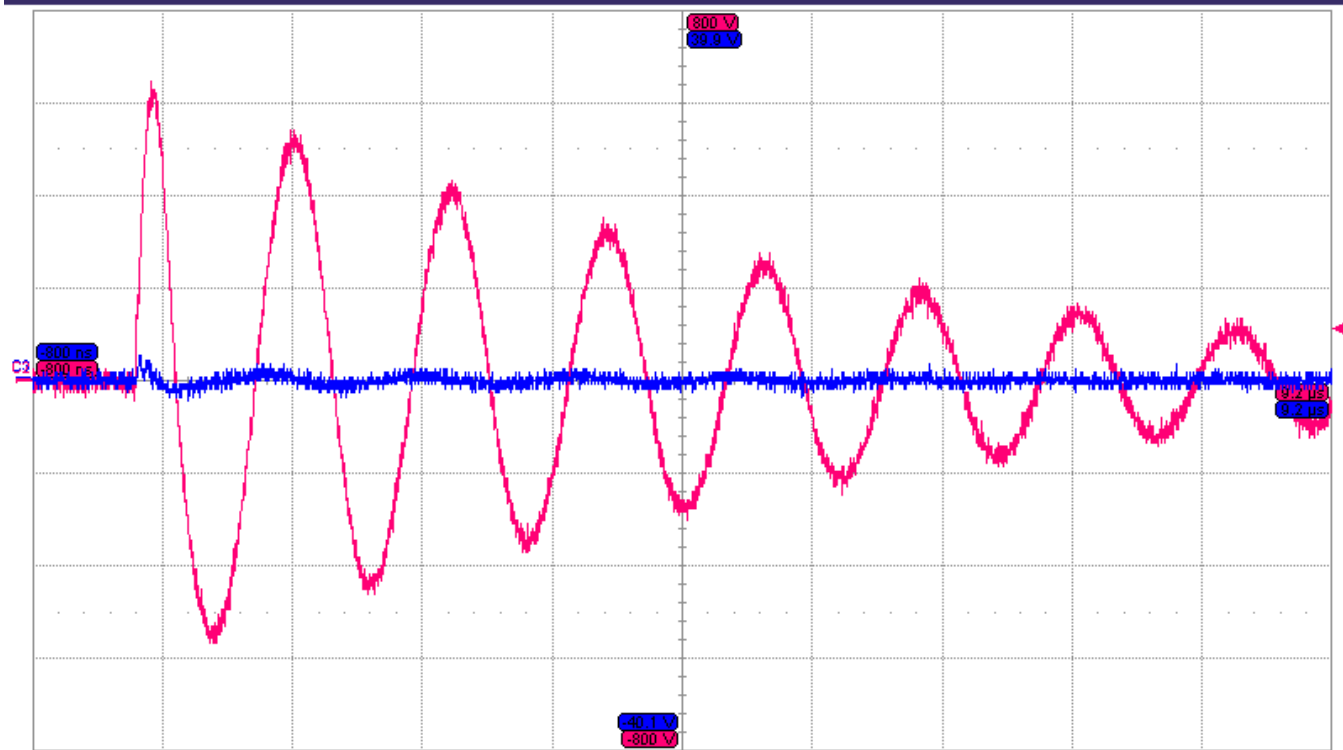
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Pin WF3 Test Pos - Chip 1 - Sense 2



Holt Integrated Electronics
 Board 1 - Chip #1
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure value status

P1:max(C2)	645 V	P2:max(C3)	2.6 V	P3:max(F3)	P4:max(F4)	P5:---	P6:---	P7:---	P8:---
------------	-------	------------	-------	------------	------------	--------	--------	--------	--------

C2: 200 V/div, 0.0 V offset, DC1M
 C3: 10.0 V/div, 100 mV offset, DC1M

Timebase: -4.20 μ s, 5.00 kS
 Trigger: Stop, Edge, Positive, 112 V, 500 MS/s

TELEDYNE LECROY

12/22/2014 1:14:21 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div: 1.00 μ s, Sampling Rate: 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

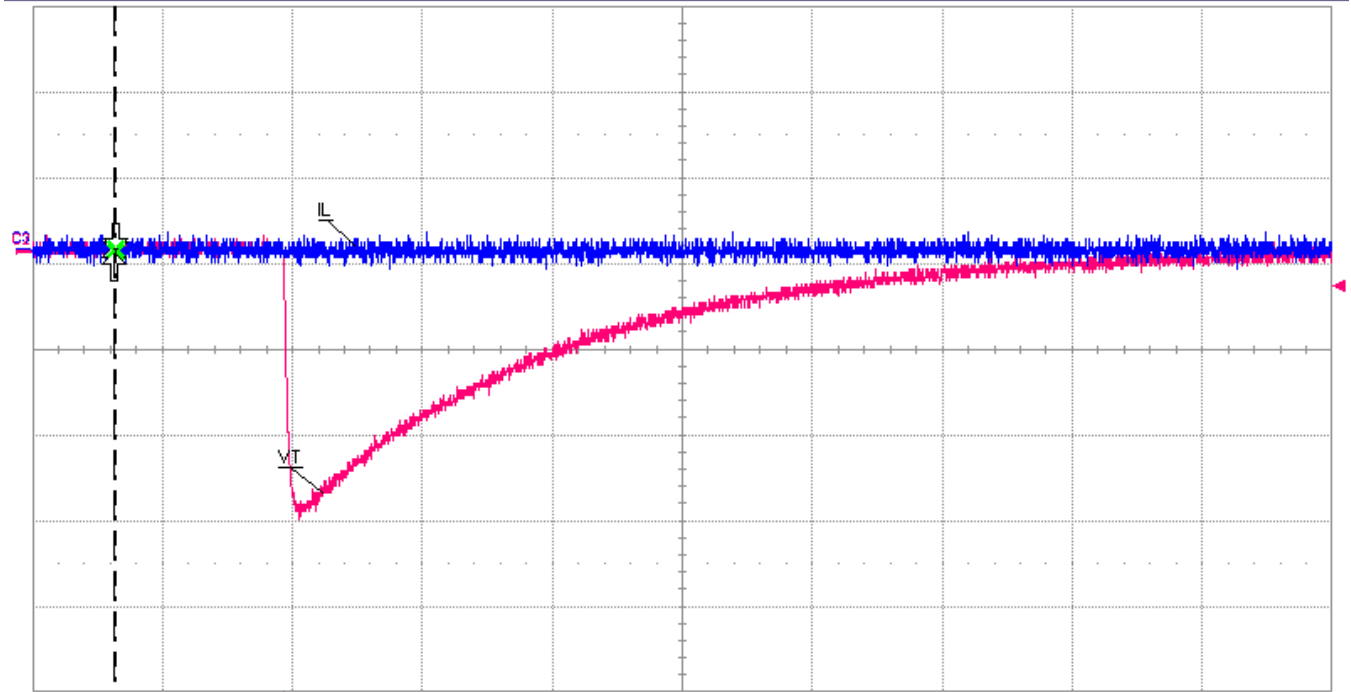
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 User: labadmin
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Pin WF4 Test Neg - Chip SN1 - Sense 1



Holt Integrated Electronics
 Board 1 - Chip SN1
 Pin Inj. WF4 (Direct Injection)
 Level 3 - 300V/60A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	-312 V	-4.4 V						
status	✓	✓						

C2	AC1M	C3	AC1M
100 V/div	20.0 V/div		
113.0 V offset	23.00 V offset		
↓ -700 mV	↓ 170 mV		
↑ 5.4 V	↑ -720 mV		

TELEDYNE LECROY	Timebase	-153 μs	Trigger	C2
	5.00 kS	50.0 μs/div	Stop	-40 V
		10 MS/s	Edge	Negative
		X1= -64.8 μs	ΔX=	-800 ns
		X2= -65.6 μs	1/ΔX=	-1.3 MHz
				12/22/2014 4:03:06 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	113.0 V	23.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-153 μ s
Trigger	Mode	Stop	Slope	Negative
	Type	Edge	Level	-40 V
	Source	C2	Coupling	DC

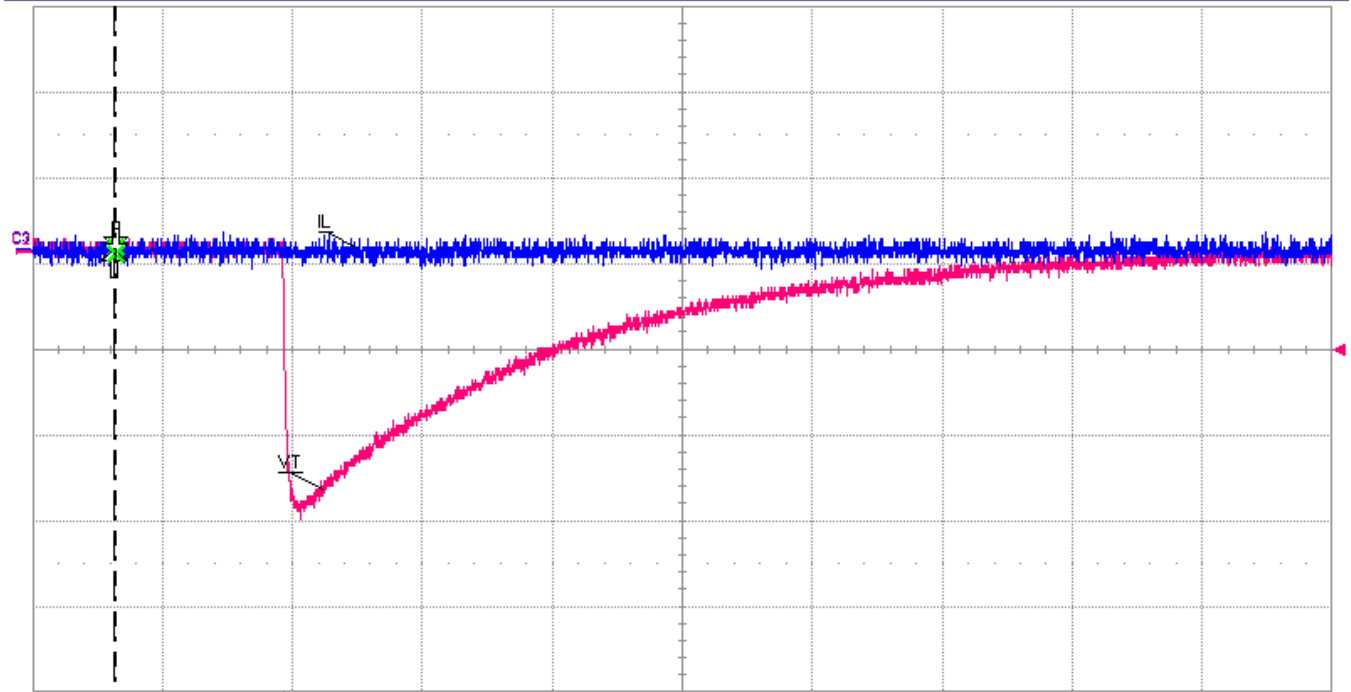
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 User: labadmin
 Time: 12/22/2014 4:06:02 PM

Pin WF4 Test Neg - Chip SN1 - Sense 2



Holt Integrated Electronics
 Board 1 - Chip SN1
 Pin Inj. WF4 (Direct Injection)
 Level 3 - 300V/60A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	-312 V	-4.4 V						
status	✓	✓						

C2 (ACIM)	C3 (ACIM)
100 V/div	20.0 V/div
113.0 V offset	23.00 V offset
↓ 5.7 V	↓ -900 mV
↑ 3.9 V	↑ 110 mV

TELEDYNE LECROY	Timebase -153 μs 50.0 μs/div 5.00 kS X1= -64.8 μs ΔX= -800 ns X2= -65.6 μs 1/ΔX= -1.3 MHz	Trigger C2 Stop -115 V Edge Negative
------------------------	--	---

12/22/2014 4:06:12 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	113.0 V	23.00 V
Vertical Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-153 μ s
Trigger	Mode	Stop	Slope	Negative
	Type	Edge	Level	-115 V
	Source	C2	Coupling	DC

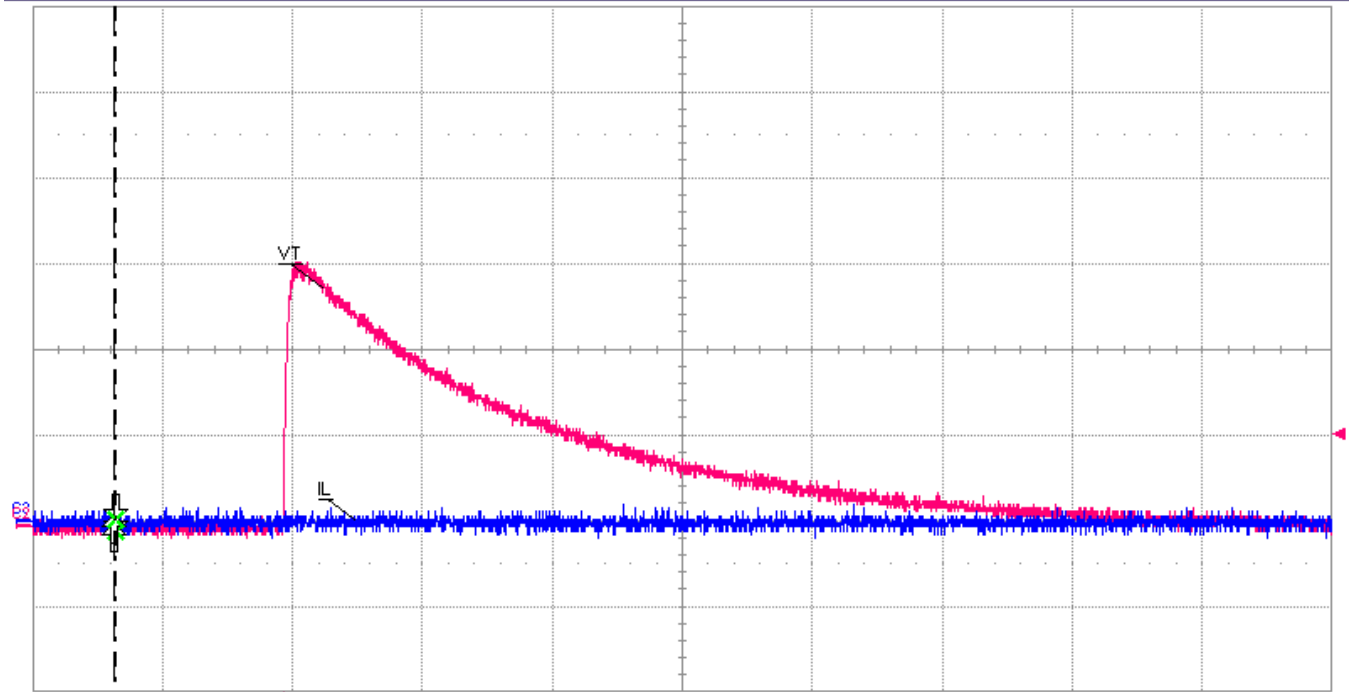
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Pin WF4 Test Pos - Chip SN1 - Sense 1



Holt Integrated Electronics
 Board 1 - Chip SN1
 Pin Inj. WF4 (Direct Injection)
 Level 3 - 300V/60A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	309 V	3.8 V						
status	✓	✓						

C2	ACIM	C3	ACIM
100 V/div	20.0 V/div		
-207.0 V ofst	-40.00 V ofst		
↓ -4.8 V	↓ 170 mV		
↑ 2.8 V	↑ 880 mV		

Timebase	-153 μs	Trigger	C2
	50.0 μs/div	Stop	107 V
5.00 kS	10 MS/s	Edge	Positive
X1=	-64.8 μs	ΔX=	-800 ns
X2=	-65.6 μs	1/ΔX=	-1.3 MHz

TELEDYNE LECROY

12/22/2014 4:01:11 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	-207.0 V	-40.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-153 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	107 V
	Source	C2	Coupling	DC

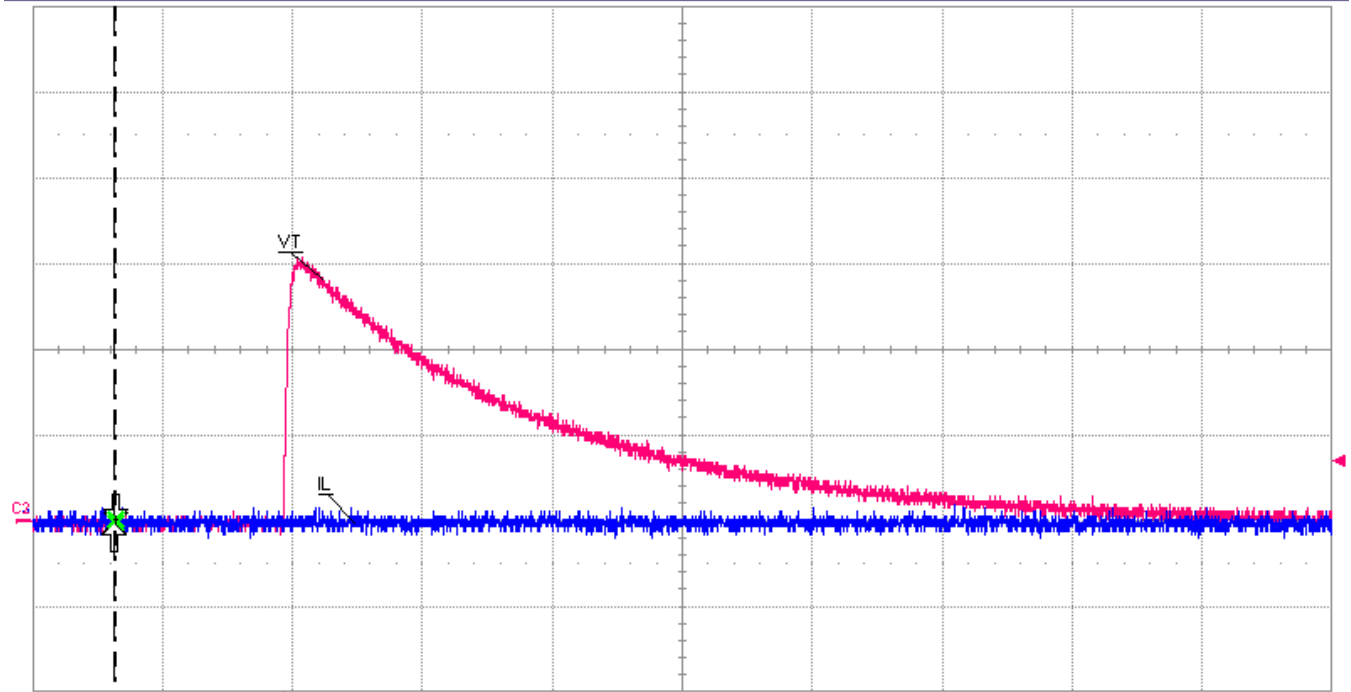
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 User: labadmin
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Pin WF4 Test Pos - Chip SN1 - Sense 2



Holt Integrated Electronics
 Board 1 - Chip SN1
 Pin Inj. WF4 (Direct Injection)
 Level 3 - 300V/60A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	307 V	3.8 V						
status	✓	✓						

C2	ACIM	C3	ACIM
100 V/div	20.0 V/div		
-201.0 V ofst	-40.00 V ofst		
↓ -2.3 V	↓ 40 mV		
↑ -2.3 V	↑ -1.16 V		

Timebase	-153 μs	Trigger	C2
	50.0 μs/div	Stop	70 V
5.00 kS	10 MS/s	Edge	Positive
X1=	-64.6 μs	ΔX=	-800 ns
X2=	-65.6 μs	1/ΔX=	-1.3 MHz

TELEDYNE LECROY 12/22/2014 4:08:37 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	-201.0 V	-40.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-153 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	70 V
	Source	C2	Coupling	DC



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8429
Report Number: 20641
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

SECTION 22

PIN INJECTION TEST DATA SHEETS

WF3 & WF5B

SN 2

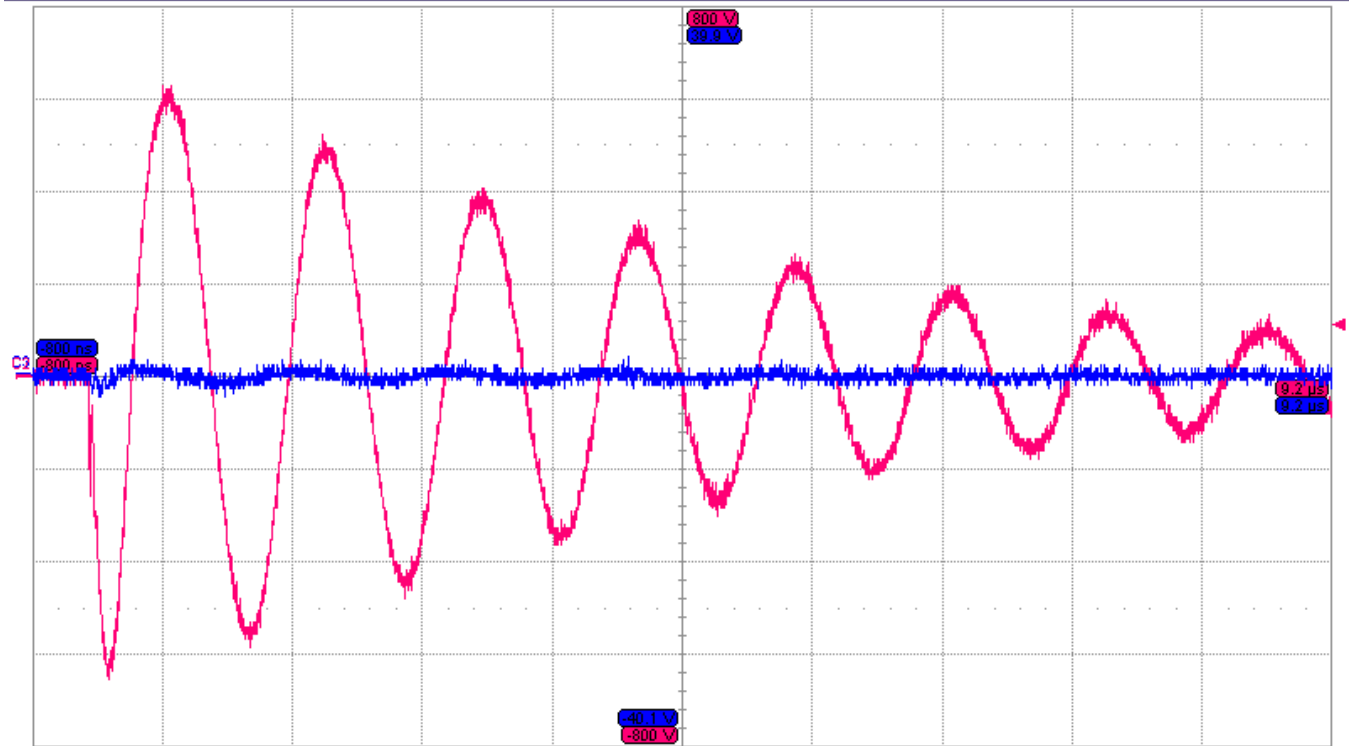
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 DSO S/N:
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Pin WF3 Test Neg - Chip SN2 - Sense 1



Holt Integrated Electronics
 Board 1 - Chip SN2
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	-654 V	-2.3 V					
status	✓	✓					

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

TELEDYNE LECROY

Timebase: -4.20 μ s, 1.00 μ s/div, 5.00 kS
 Trigger: C2, Stop, 112 V, Edge, Positive

12/22/2014 1:22:01 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

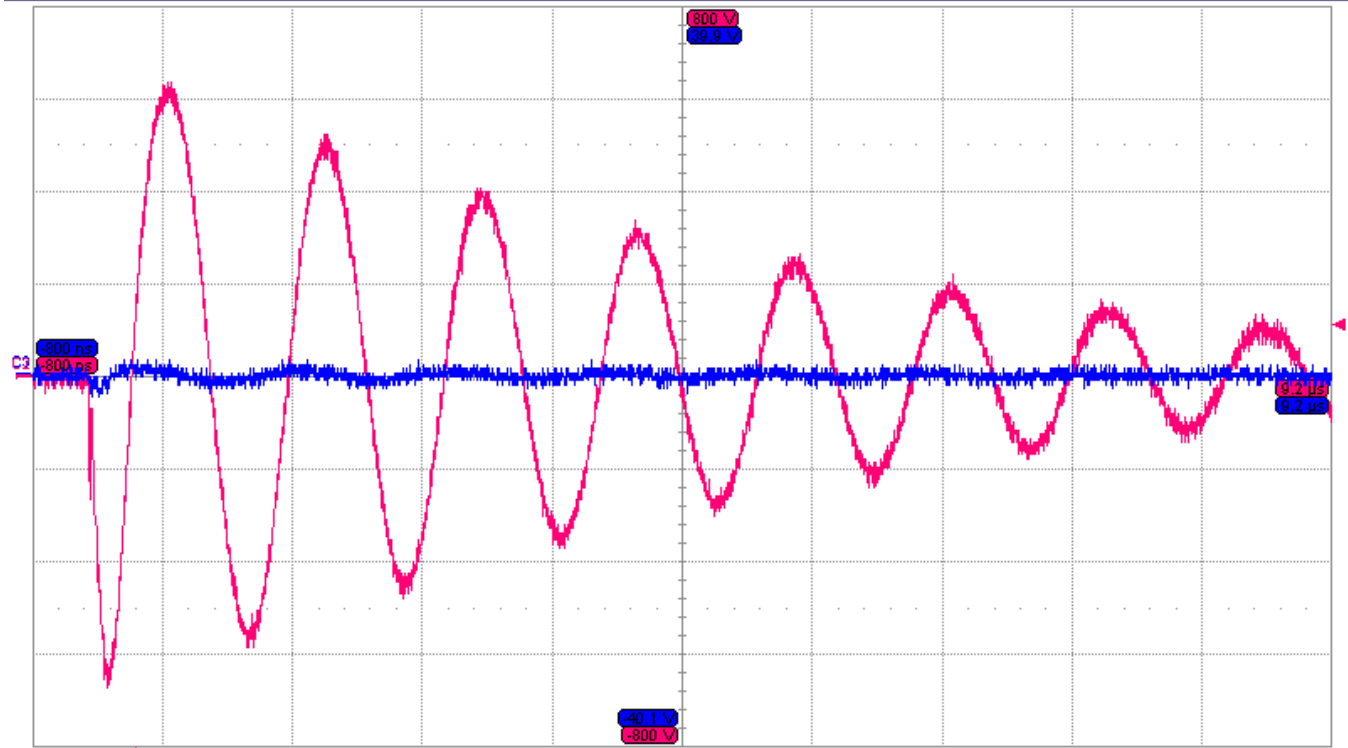
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 DSO S/N:
 User: labadmin
 Time: 12/22/2014 1:23:41 PM

Pin WF3 Test Neg - Chip SN2 - Sense 2



Holt Integrated Electronics
 Board 1 - Chip SN2
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	-672 V	-2.3 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	10.0 V/div		
0.0 V offset	100 mV offset		

TELEDYNE LECROY	Timebase	-4.20 μ s	Trigger	C2
		1.00 μ s/div	Stop	112 V
		5.00 kS	Edge	Positive
				12/22/2014 1:23:50 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

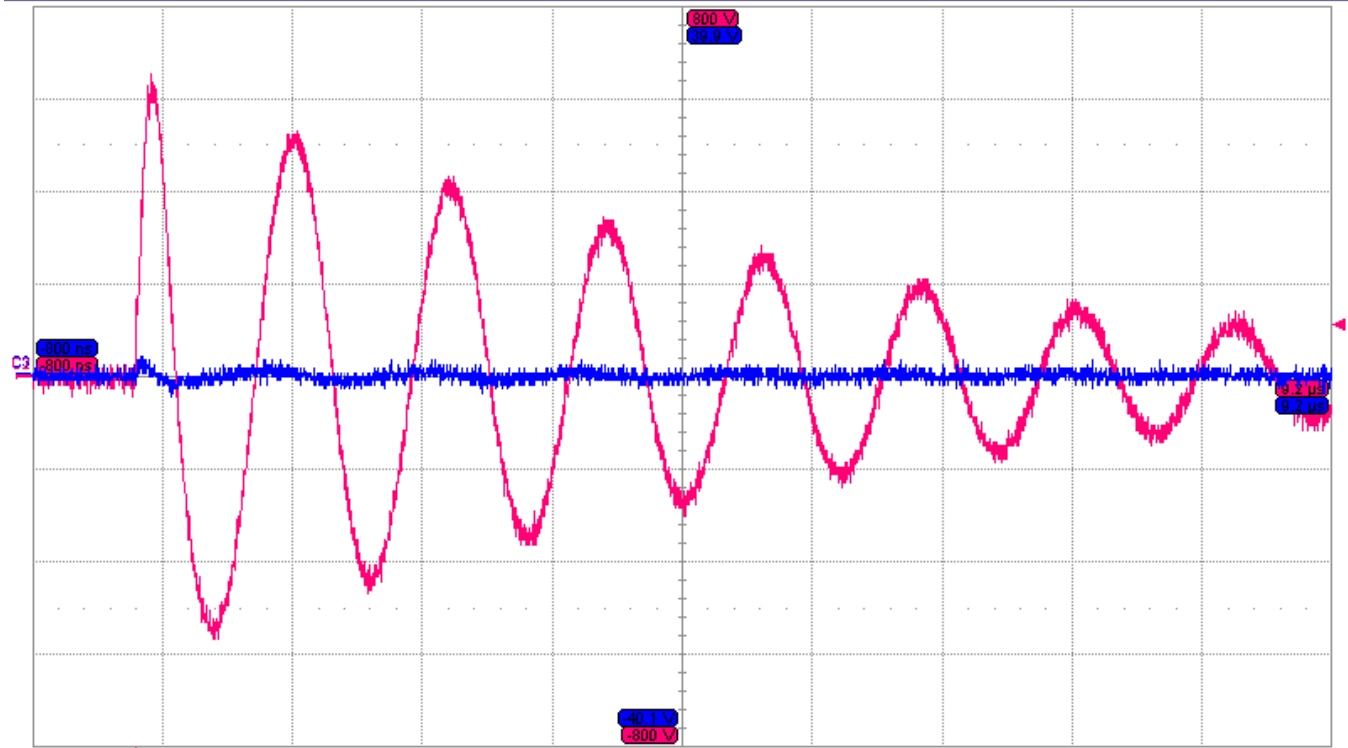
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 User: labadmin
 Time: 12/22/2014 1:17:31 PM

Pin WF3 Test Pos - Chip SN2 - Sense 1



Holt Integrated Electronics
 Board 1 - Chip SN2
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	654 V	2.1 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	10.0 V/div		
0.0 V offset	100 mV offset		

TELEDYNE LECROY	Timebase	-4.20 μ s	Trigger	C2
	1.00 μ s/div	500 MS/s	Stop	112 V
	5.00 kS		Edge	Positive

12/22/2014 1:17:50 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

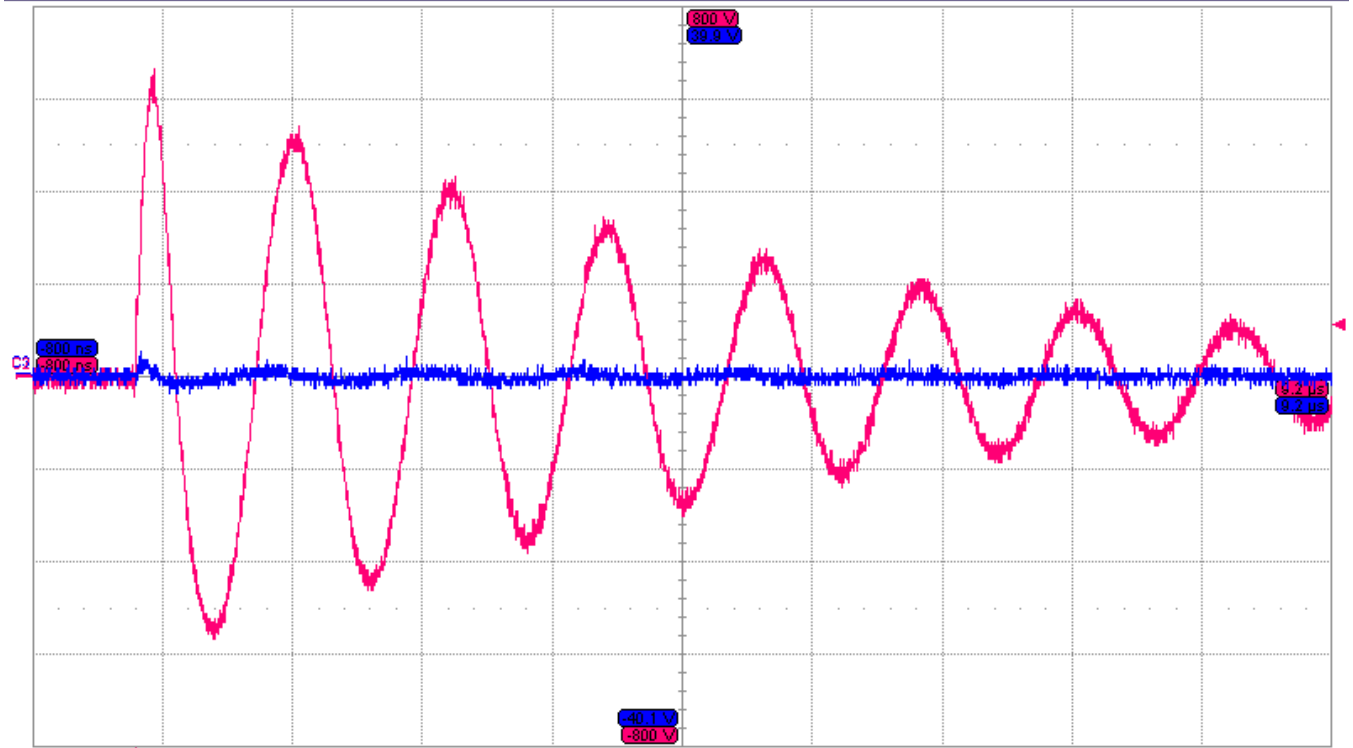
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Pin WF3 Test Pos - Chip SN2 - Sense 2



Holt Integrated Electronics
 Board 1 - Chip SN2
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	663 V	2.6 V						
status	✓	✓						

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

Timebase	-4.20 μ s	Trigger	C2
	1.00 μ s/div	Stop	112 V
5.00 kS	500 MS/s	Edge	Positive

TELEDYNE LECROY

12/22/2014 1:28:03 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

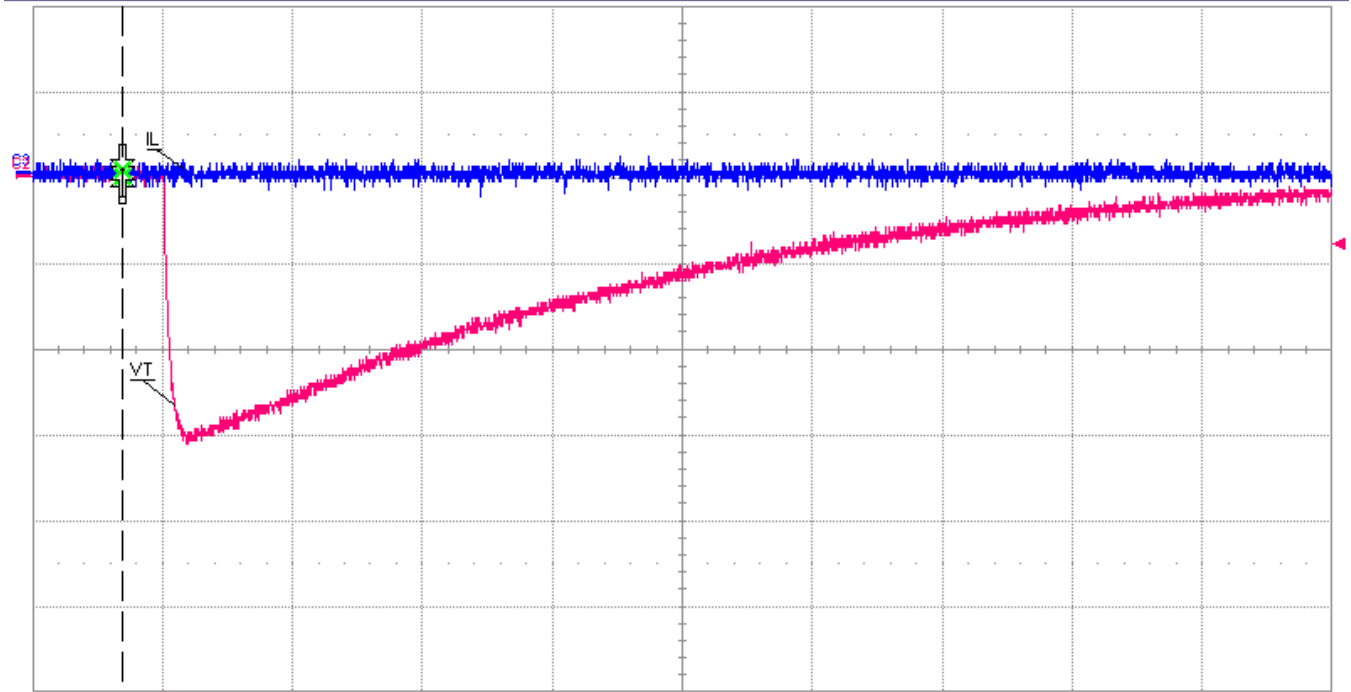
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Pin WF5B Test Neg - Chip SN2 - Sense 1



Holt Integrated Electronics
 Board 1 - Chip SN2
 Pin Inj. WF5B (Direct Injection)
 Level 3 - 300V/300A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	-311 V	-5.6 V						
status	✓	✓						

C2	ACIM	C3	ACIM
100 V/div	20.0 V/div	201.0 V offset	41.00 V offset
↓ 400 mV	↓ 780 mV	↑ 400 mV	↑ 680 mV

Timebase	-796 μs	Trigger	C2
5.00 kS	200 μs/div	Stop	-79 V
	2.5 MS/s	Edge	Negative
X1= -64.6 μs	ΔX= -800 ns		
X2= -65.6 μs	1/ΔX= -1.3 MHz		

TELEDYNE LECROY

12/22/2014 4:18:12 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	201.0 V	41.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 200 μs
Sampling Rate 2.5 MS/s

Horizontal	Time / Pt	400.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-796 μ s
Trigger	Mode	Stop	Slope	Negative
	Type	Edge	Level	-79 V
	Source	C2	Coupling	DC

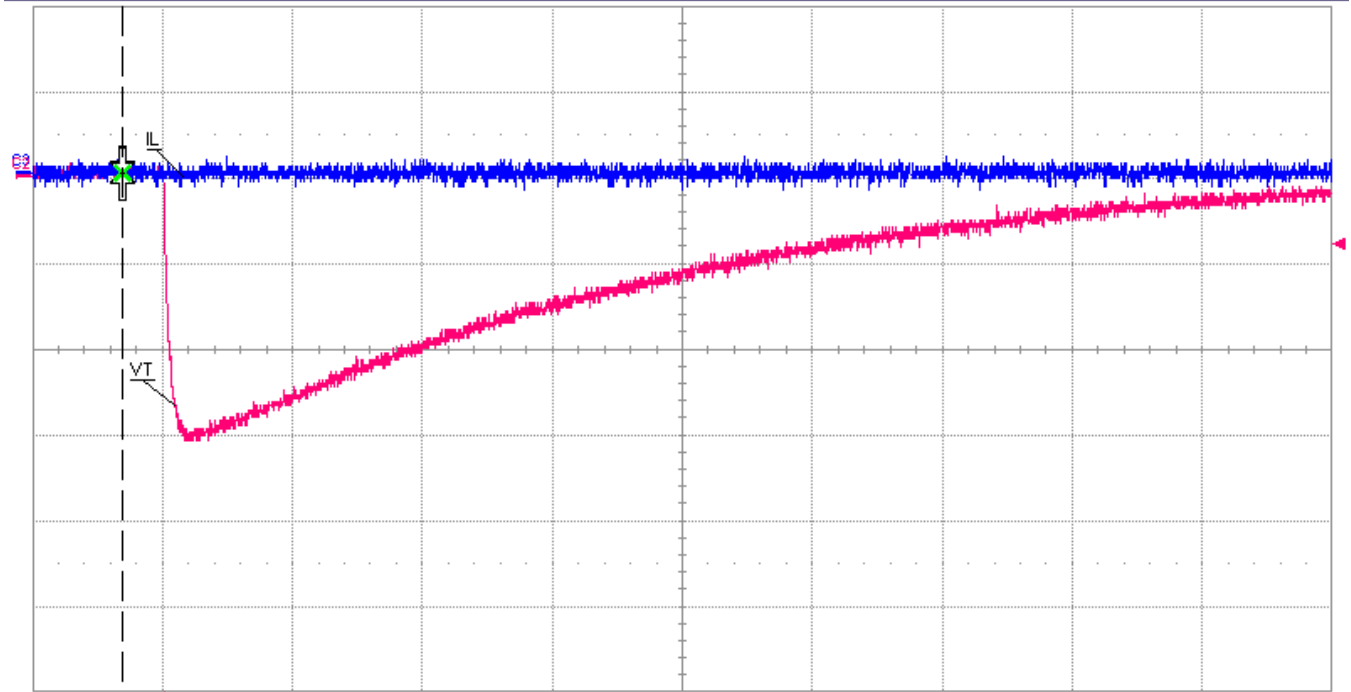
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Pin WF5B Test Neg - Chip SN2 - Sense 2



Holt Integrated Electronics
 Board 1 - Chip SN2
 Pin Inj. WF5B (Direct Injection)
 Level 3 - 300V/300A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	-307 V	-3.9 V						
status	✓	✓						

C2	ACIM	C3	ACIM
100 V/div	20.0 V/div		
201.0 V offset	41.00 V offset		
↓ 6.7 V	↓ -150 mV		
↑ 6.7 V	↑ -150 mV		

Timebase	-796 μs	Trigger	C2
5.00 kS	200 μs/div	Stop	-79 V
	2.5 MS/s	Edge	Negative
X1=	-64.6 μs	ΔX=	-800 ns
X2=	-65.6 μs	1/ΔX=	-1.3 MHz

TELEDYNE LECROY 12/22/2014 4:21:51 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	201.0 V	41.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 200 μs Sampling Rate 2.5 MS/s

Horizontal	Time / Pt	400.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-796 μ s
Trigger	Mode	Stop	Slope	Negative
	Type	Edge	Level	-79 V
	Source	C2	Coupling	DC

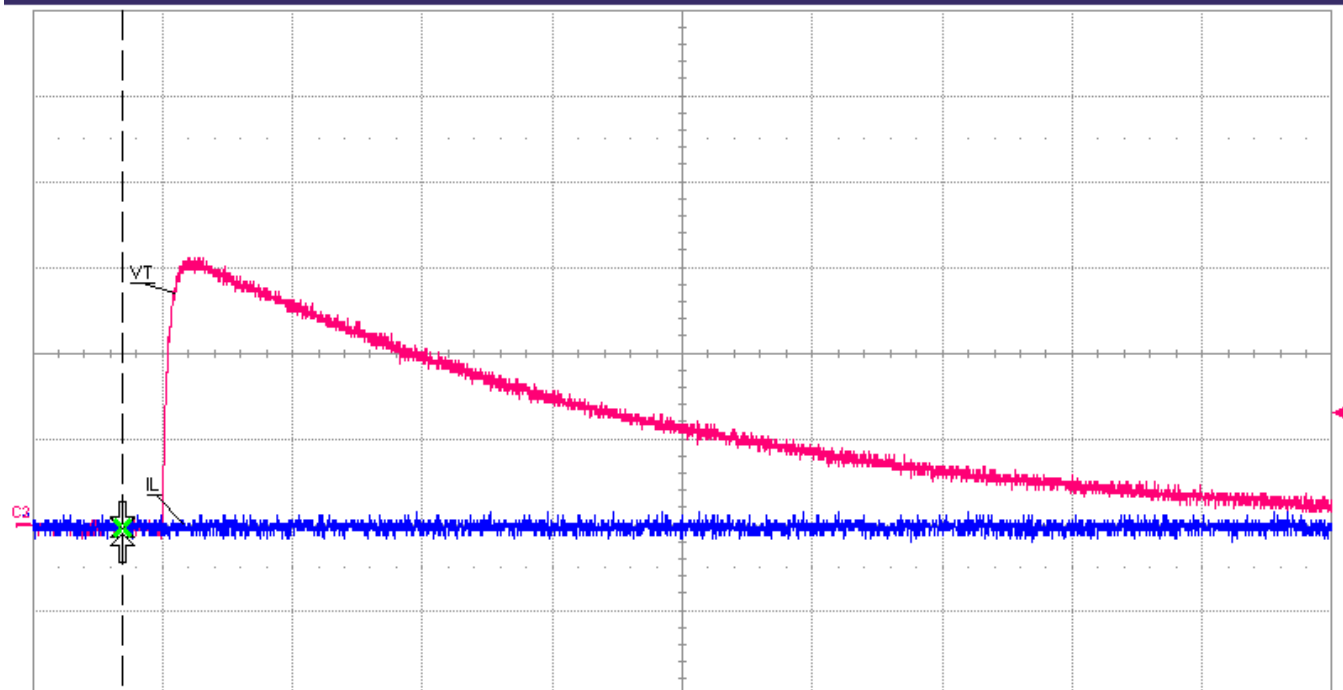
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Pin WF5B Test Pos - Chip SN2 - Sense 1



Holt Integrated Electronics
 Board 1 - Chip SN2
 Pin Inj. WF5B (Direct Injection)
 Level 3 - 300V/300A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	311 V	2.9 V						
status	✓	✓						

C2	ACIM	C3	ACIM
100 V/div	20.0 V/div		
-201.0 V orst	-40.00 V orst		
↓ -4.3 V	↓ -750 mV		
↑ -2.3 V	↑ -2.52 V		

Timebase	-796 μs	Trigger	C2
5.00 kS	200 μs/div	Stop	1.31 V
	2.5 MS/s	Edge	Positive
X1=	-64.6 μs	ΔX=	-800 ns
X2=	-65.6 μs	1/ΔX=	-1.3 MHz

TELEDYNE LECROY 12/22/2014 4:14:48 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	-201.0 V	-40.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 200 μs Sampling Rate 2.5 MS/s

Horizontal	Time / Pt	400.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-796 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	131 V
	Source	C2	Coupling	DC

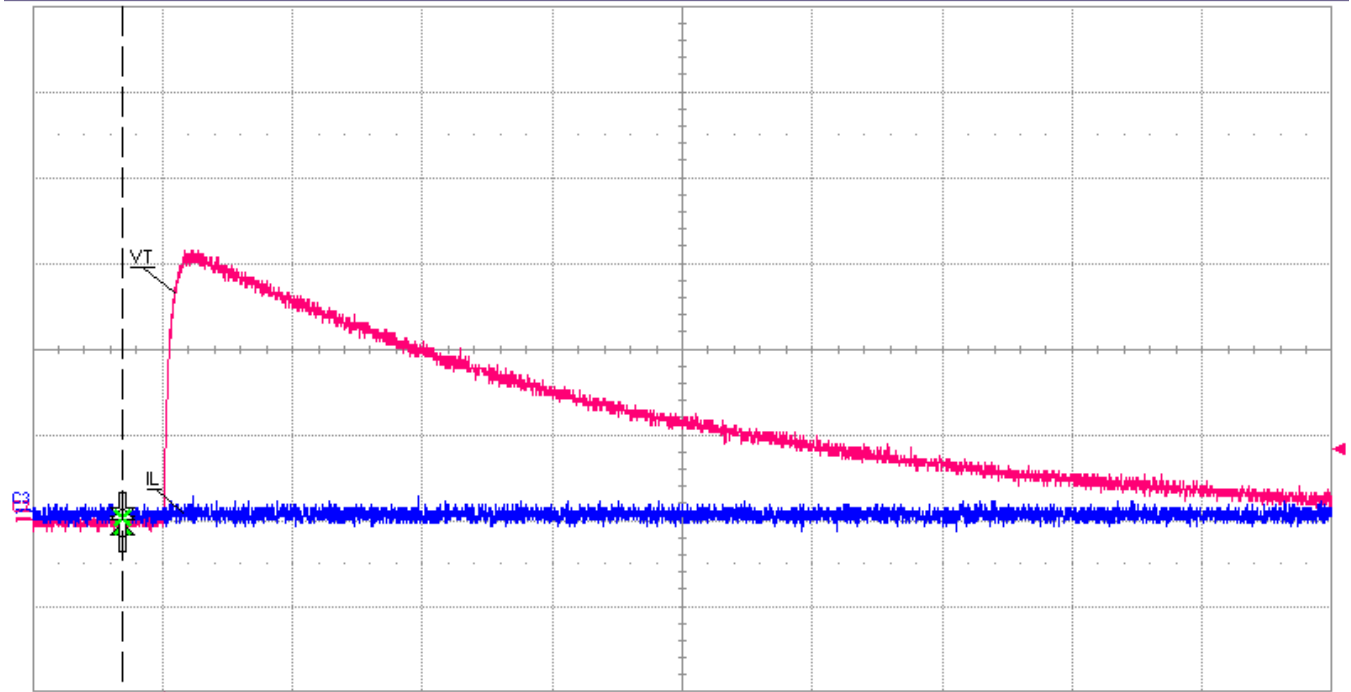
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Pin WF5B Test Pos - Chip SN2 - Sense 2



Holt Integrated Electronics
 Board 1 - Chip SN2
 Pin Inj. WF5B (Direct Injection)
 Level 3 - 300V/300A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	314 V	3.5 V						
status	✓	✓						

C2	ACIM	C3	ACIM
100 V/div		20.0 V/div	
-199.0 V ofst		-38.00 V ofst	
↓ -7.6 V	↓ -1.32 V		
↑ -6.6 V	↑ 420 mV		

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

Timebase	-796 μs	Trigger	C2
	200 μs/div	Stop	81 V
5.00 kS	2.5 MS/s	Edge	Positive
X1=	-64.6 μs	ΔX=	-800 ns
X2=	-65.6 μs	1/ΔX=	-1.3 MHz

12/22/2014 4:26:25 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	-199.0 V	-38.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 200 μs Sampling Rate 2.5 MS/s

Horizontal	Time / Pt	400.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-796 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	81 V
	Source	C2	Coupling	DC



1250 Peterson Dr., Wheeling, IL 60090

Company: Holt Integrated Circuits, Inc.
Model Tested: HI-8429
Report Number: 20641
Standard: RTCA/DO-160G Section 22 Lightning Induced Transient

Appendix A

SECTION 22

PIN INJECTION TEST DATA SHEETS

WF3 & WF5A SN3

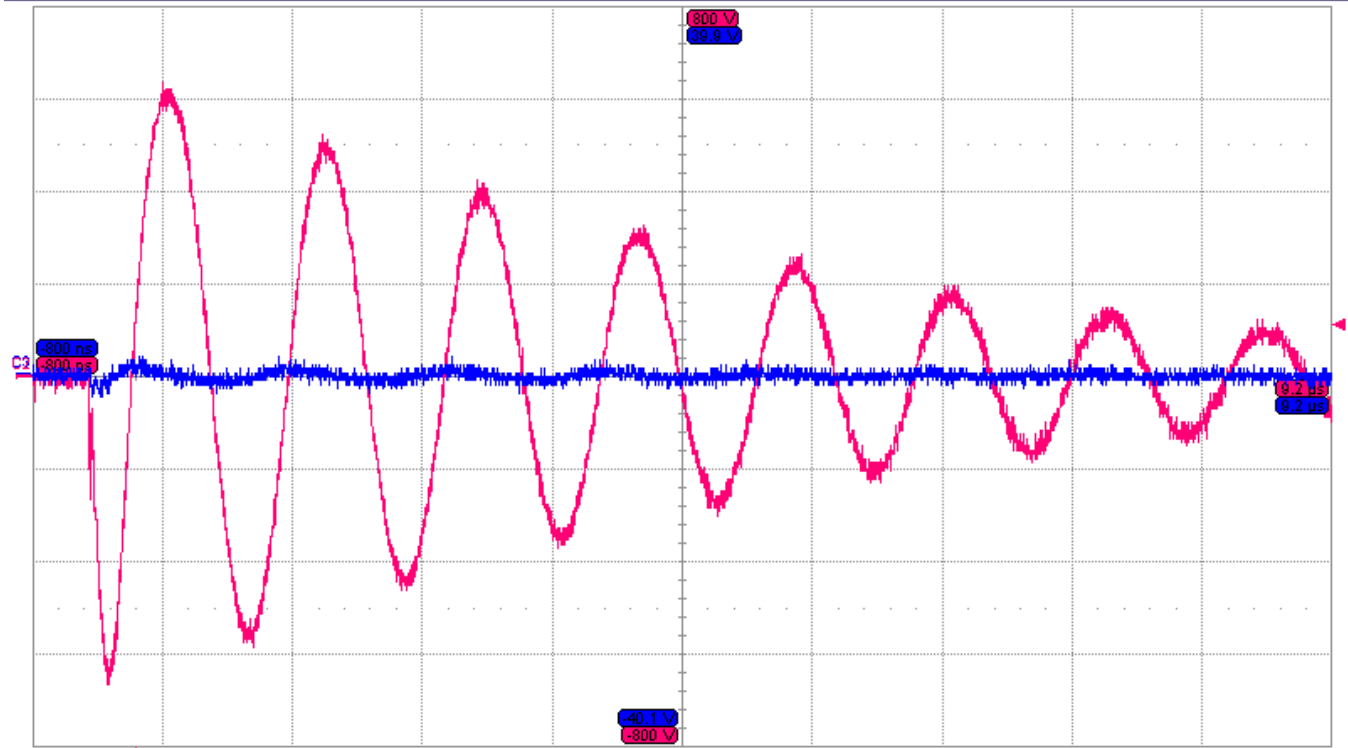
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Pin WF3 Test Neg - Chip SN3 - Sense 1



Holt Integrated Electronics
 Board 2 - Chip SN3
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	-663 V	-2.3 V					
status	✓	✓					

C2 DC1M 200 V/div 0.0 V offset
C3 DC1M 10.0 V/div 100 mV offset

TELEDYNE LECROY

Timebase: -4.20 μ s, 5.00 kS
 Trigger: C2, Stop 112 V, Edge Positive

12/22/2014 1:55:22 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div: 1.00 μ s Sampling Rate: 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

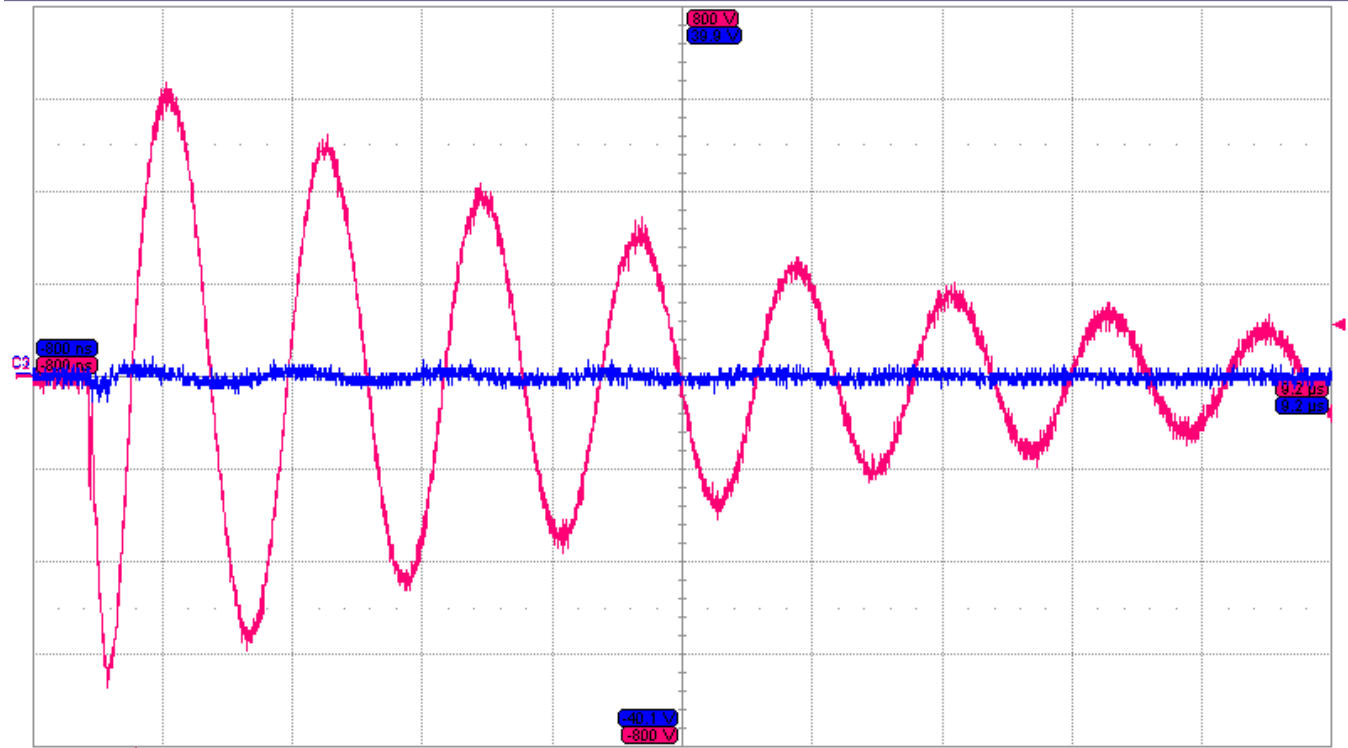
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Pin WF3 Test Neg - Chip SN3 - Sense 2



Holt Integrated Electronics
 Board 2 - Chip SN3
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	-672 V	-2.8 V					
status	✓	✓					

C2 DC1M 200 V/div 0.0 V offset
C3 DC1M 10.0 V/div 100 mV offset

TELEDYNE LECROY

Timebase: -4.20 μ s, 1.00 μ s/div, 5.00 kS
 Trigger: C2, Stop, 112 V, Edge, Positive

12/22/2014 1:59:07 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

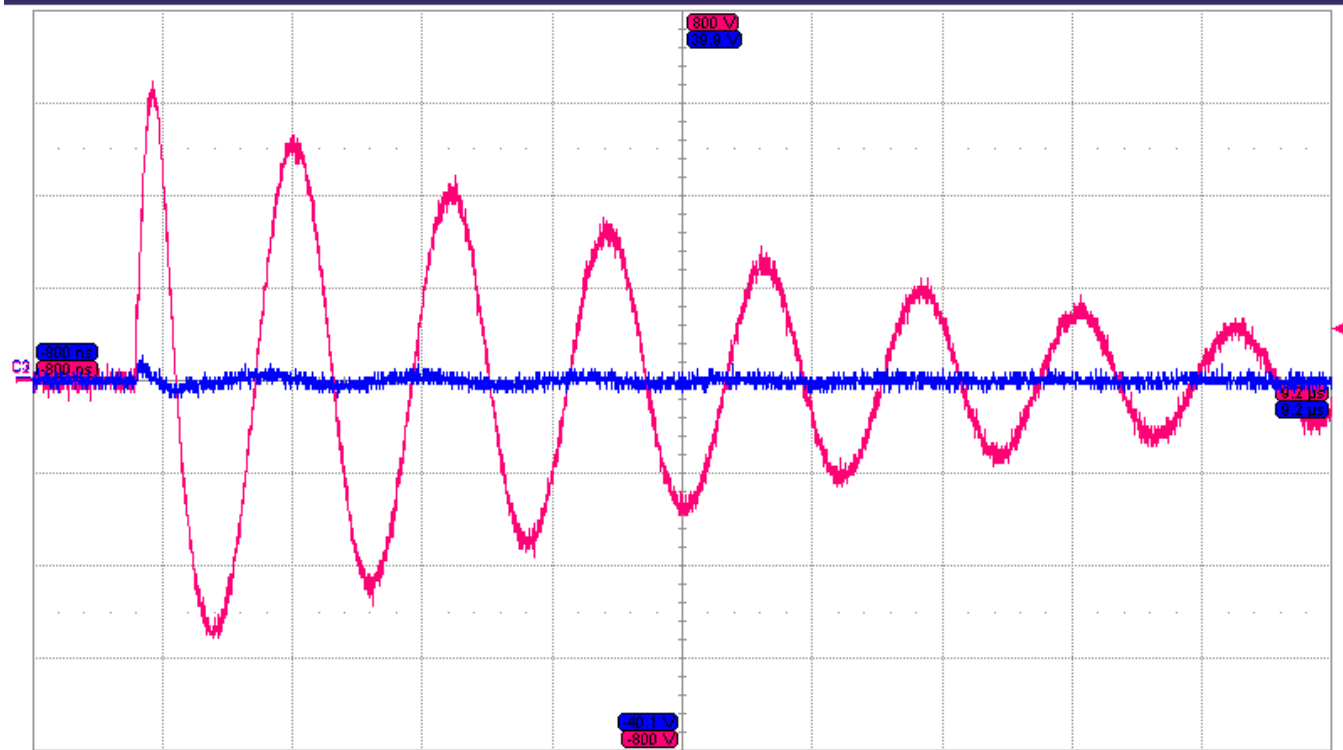
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Pin WF3 Test Pos - Chip SN3 - Sense 1



Holt Integrated Electronics
 Board 2 - Chip SN3
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	645 V	2.6 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	10.0 V/div		
0.0 V offset	100 mV offset		

Timebase	-4.20 μ s	Trigger	C2
	1.00 μ s/div	Stop	112 V
5.00 kS	500 MS/s	Edge	Positive

TELEDYNE LECROY 12/22/2014 1:52:08 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

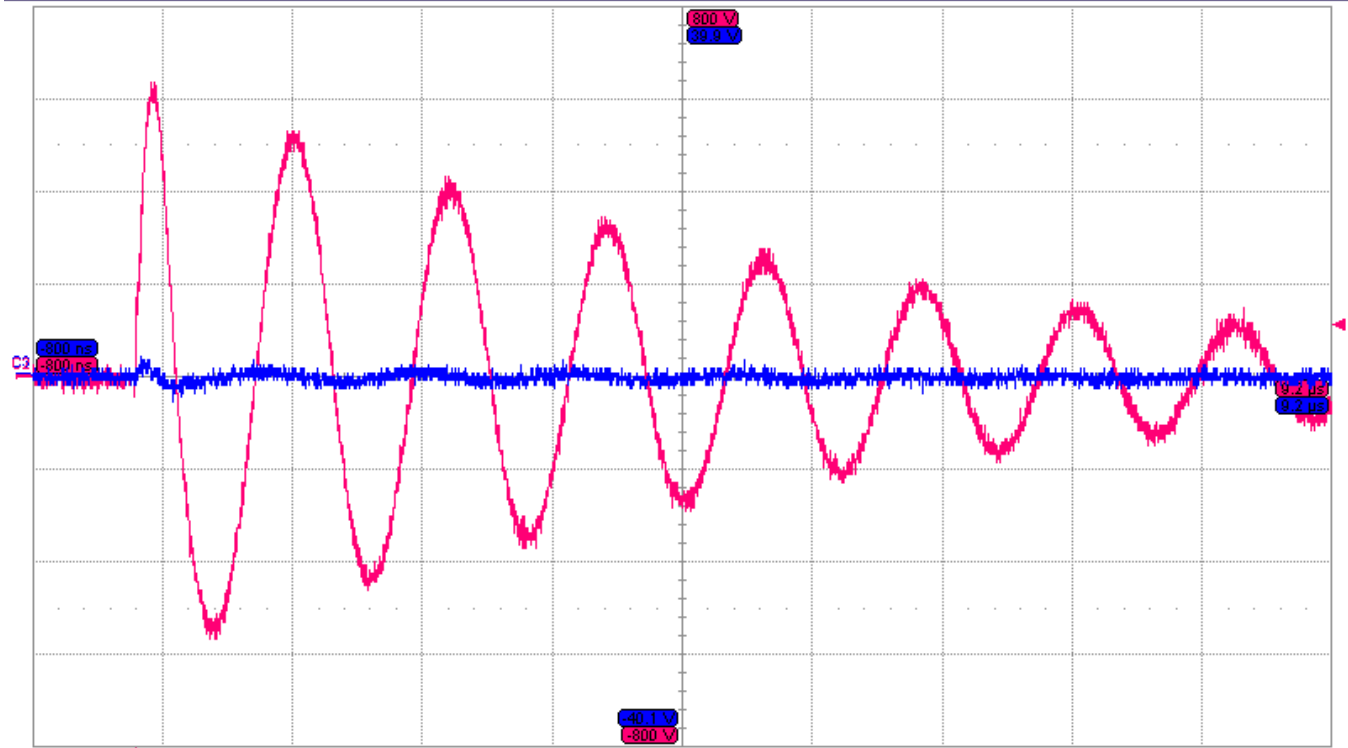
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Pin WF3 Test Pos - Chip SN3 - Sense 2



Holt Integrated Electronics
 Board 2 - Chip SN3
 Pin Inj. WF3 (Direct Injection)
 Level 3 - 600V/24A
 Gen 670

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	636 V	2.1 V						
status	✓	✓						

C2	DC1M	C3	DC1M
200 V/div	10.0 V/div		
0.0 V offset	100 mV offset		

TELEDYNE LECROY	Timebase	-4.20 μ s	Trigger	C2
	1.00 μ s/div	500 MS/s	Stop	112 V
	5.00 kS		Edge	Positive

12/22/2014 2:01:11 PM

Channel Status

	C2	C3
V / Div	200 V	10.0 V
Offset	0.0 V	100 mV
Coupling	DC1M Ω	DC1M Ω
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 1.00 μ s Sampling Rate 500 MS/s

Horizontal	Time / Pt	2.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-4.20 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	112 V
	Source	C2	Coupling	DC

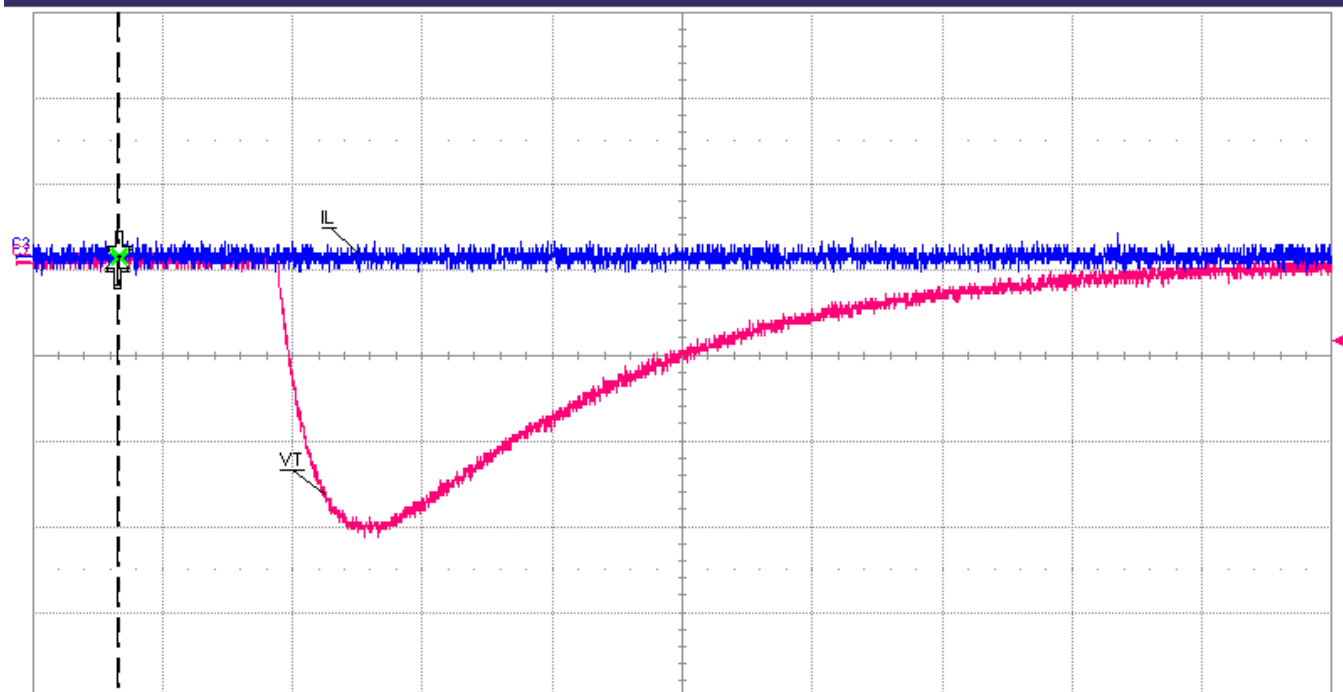
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Pin WF5a Test Neg - Chip SN3 - Sense 1



Holt Integrated Electronics
 Board 2 - Chip SN3
 Pin Inj. WF5A (Direct Injection)
 Level 3 - 300V/300A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	-319 V	-3.6 V						
status	✓	✓						

C2	ACIM	C3	ACIM
100 V/div	20.0 V/div		
107.0 V offset	23.00 V offset		
↓ 3.5 V	↓ 50 mV		
↑ 1.1 V	↑ -560 mV		

Timebase	-152 μs	Trigger	C2
	50.0 μs/div	Stop	-91 V
5.00 kS	10 MS/s	Edge	Negative
X1=	-64.8 μs	ΔX=	-800 ns
X2=	-65.6 μs	1/ΔX=	-1.3 MHz

TELEDYNE LECROY

12/22/2014 3:44:42 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	107.0 V	23.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-152 μ s
Trigger	Mode	Stop	Slope	Negative
	Type	Edge	Level	-91 V
	Source	C2	Coupling	DC

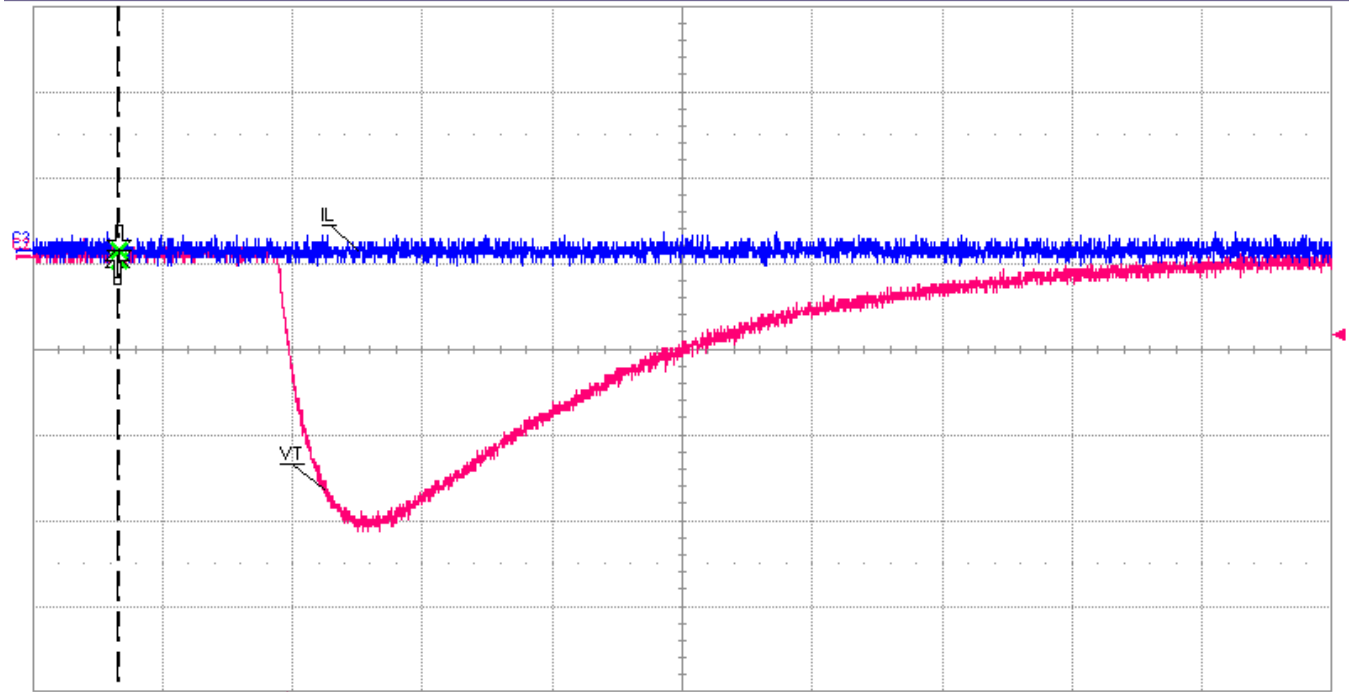
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Pin WF5a Test Neg - Chip SN3 - Sense 2



Holt Integrated Electronics
 Board 2 - Chip SN3
 Pin Inj. WF5A (Direct Injection)
 Level 3 - 300V/300A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:min(C2)	P2:min(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	-319 V	-3.6 V						
status	✓	✓						

C2	ACIM	C3	ACIM
100 V/div	20.0 V/div		
107.0 V offset	23.00 V offset		
↓ -5.0 V	↓ -160 mV		
↑ -600 mV	↑ -20 mV		

Timebase	-152 μs	Trigger	C2
	50.0 μs/div	Stop	-91 V
5.00 kS	10 MS/s	Edge	Negative
X1=	-64.8 μs	ΔX=	-800 ns
X2=	-65.6 μs	1/ΔX=	-1.3 MHz

TELEDYNE LECROY

12/22/2014 3:50:29 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	107.0 V	23.00 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-152 μ s
Trigger	Mode	Stop	Slope	Negative
	Type	Edge	Level	-91 V
	Source	C2	Coupling	DC

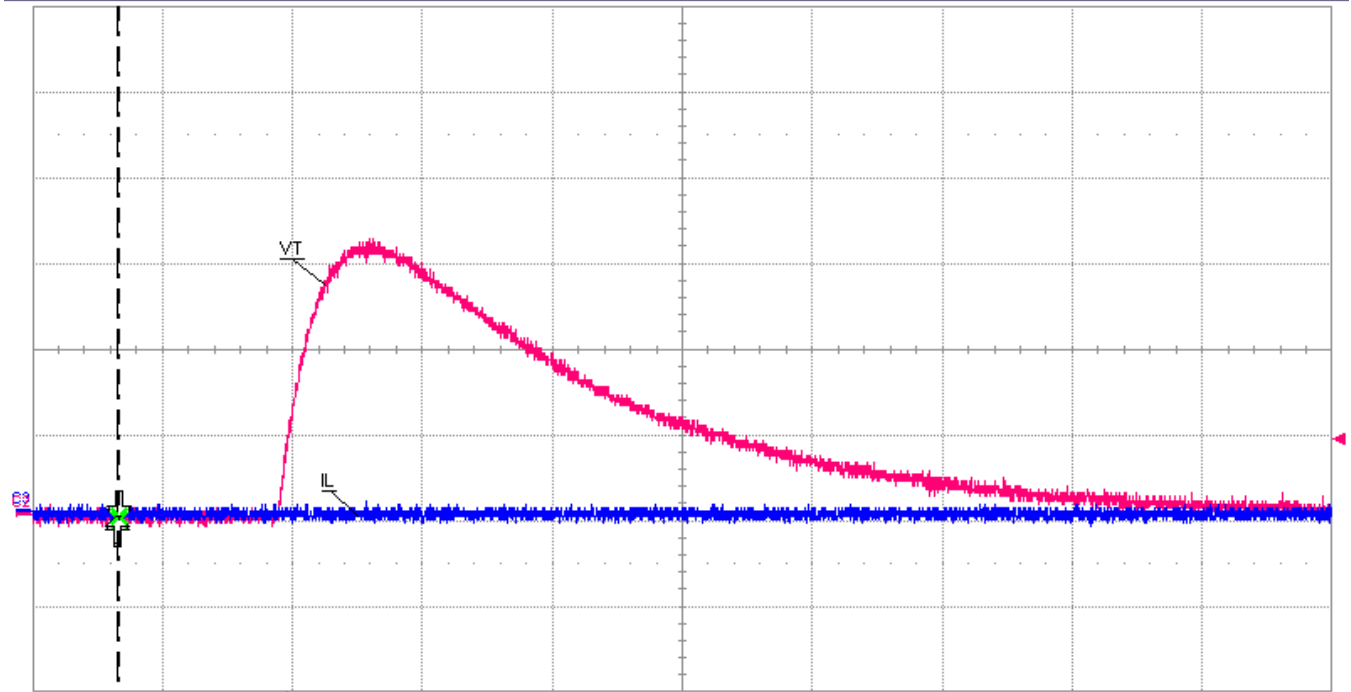
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:40:29 PM

Pin WF5a Test Pos - Chip SN3 - Sense 1



Holt Integrated Electronics
 Board 2 - Chip SN3
 Pin Inj. WF5A (Direct Injection)
 Level 3 - 300V/300A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	321 V	12 V						
status	✓	✓						

C2	AC1M	C3	AC1M
100 V/div	100 V/div	100 V/div	100 V/div
-193.0 V ofst	-189.0 V ofst	-193.0 V ofst	-189.0 V ofst
↓ -5.7 V	↓ -5.6 V	↓ -5.7 V	↓ -5.6 V
↑ -5.9 V	↑ -5.5 V	↑ -5.9 V	↑ -5.5 V

Timebase	-152 μs	Trigger	C2
5.00 kS	50.0 μs/div	Stop	87 V
	10 MS/s	Edge	Positive
X1=	-64.8 μs	ΔX=	-800 ns
X2=	-65.6 μs	1/ΔX=	-1.3 MHz

TELEDYNE LECROY 12/22/2014 3:40:39 PM

Channel Status

	C2	C3
V / Div	100 V	100 V
Offset	-193.0 V	-189.0 V
Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-152 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	87 V
	Source	C2	Coupling	DC

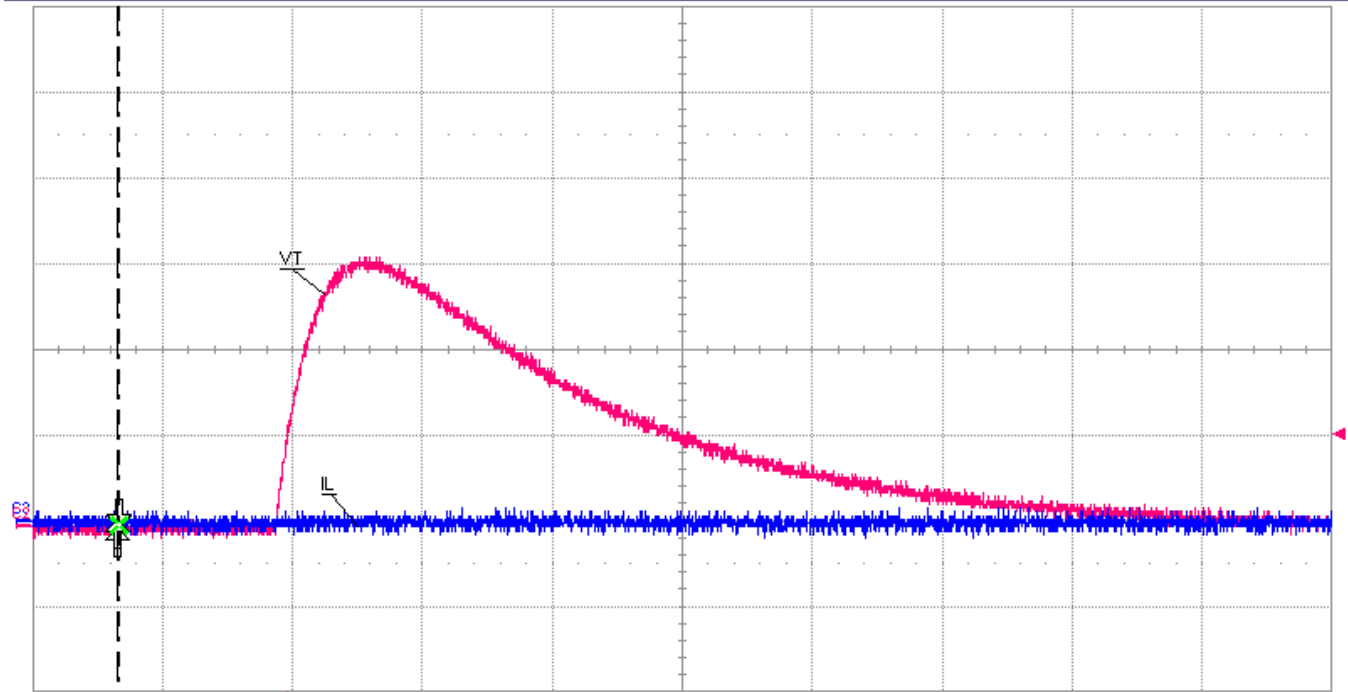
Lab Notebook Entry from LeCroy DSO
 DSO S/N:
 User: labadmin
 Time: 12/22/2014 3:53:00 PM

Pin WF5a Test Pos - Chip SN3 - Sense 2



Holt Integrated Electronics
 Board 2 - Chip SN3
 Pin Inj. WF5A (Direct Injection)
 Level 3 - 300V/300A
 Gen 300

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:max(C2)	P2:max(C3)	P3:min(F3)	P4:min(F4)	P5:---	P6:---	P7:---	P8:---
value	313 V	2.9 V						
status	✓	✓						

C2 (ACIM)	C3 (ACIM)
100 V/div	20.0 V/div
-207.0 V ofst	-40.00 V ofst
↓ 600 mV	↓ -970 mV
↑ -3.6 V	↑ -130 mV

TELEDYNE LECROY	Timebase -152 μs 50.0 μs/div 5.00 kS X1= -64.8 μs X2= -65.6 μs	Trigger C2 Stop 107 V Edge Positive ΔX= -800 ns 1/ΔX= -1.3 MHz
------------------------	---	---

12/22/2014 3:53:08 PM

Channel Status

	C2	C3
V / Div	100 V	20.0 V
Offset	-207.0 V	-40.00 V
Vertical Coupling	AC1MΩ	AC1MΩ
BW	Full	Full
Probe	1.000e+3	100.000
Sweeps	1 #	1 #

Acquisition Status

Time / Div 50.0 μs Sampling Rate 10 MS/s

Horizontal	Time / Pt	100.000 ns	Sampling Mode	RealTime
	Pts / Div	500.0 S	Trigger Delay	-152 μ s
Trigger	Mode	Stop	Slope	Positive
	Type	Edge	Level	107 V
	Source	C2	Coupling	DC