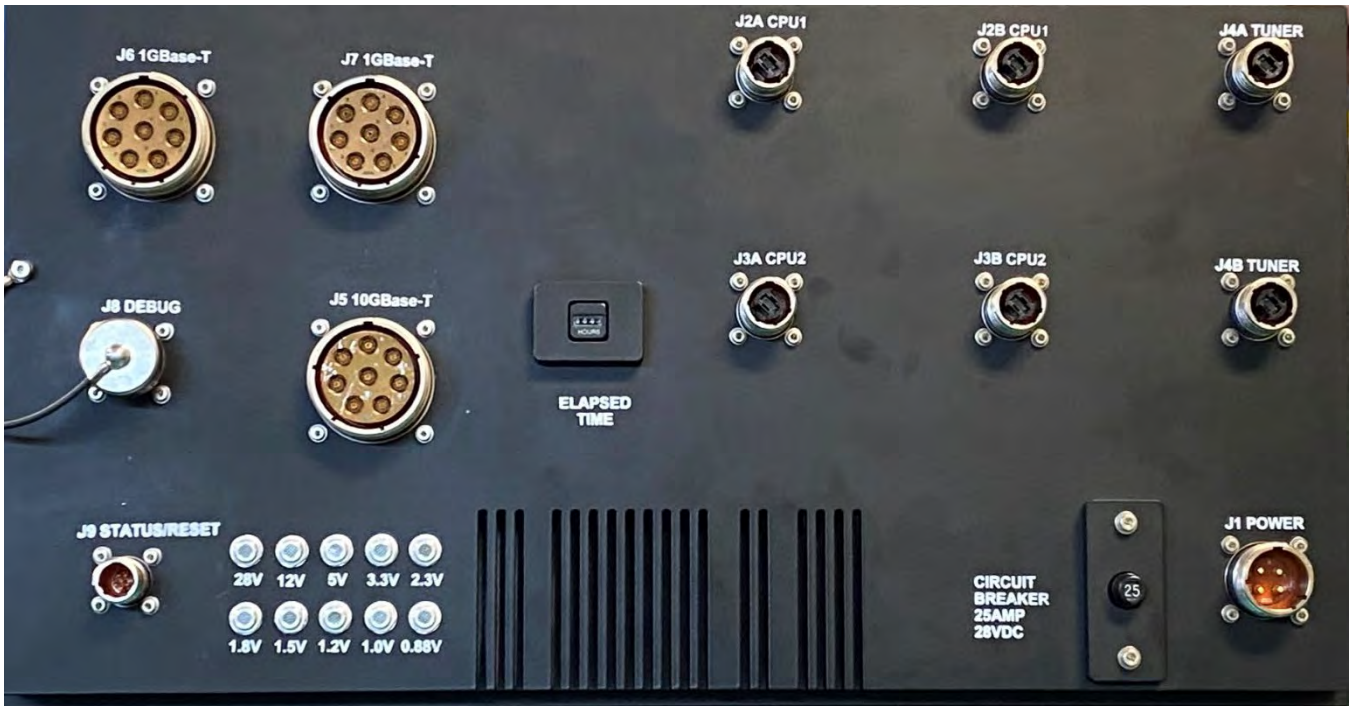
Amphenol

CAGE Code: 77820

QUALIFICATION TEST

MIL-STD-704F Power Supply Testing

PART NO. CF-020011-433



Amphenol

CAGE Code: 77820

QUALIFICATION TEST

MIL-STD-704F Power Supply Testing

PART NO. CF-020011-433

4/14/2021

Approved by: _____

Jared Sibrava
Director of HighSpeed
Amphenol Aerospace

LDC101 (Load Measurements) Data Sheet

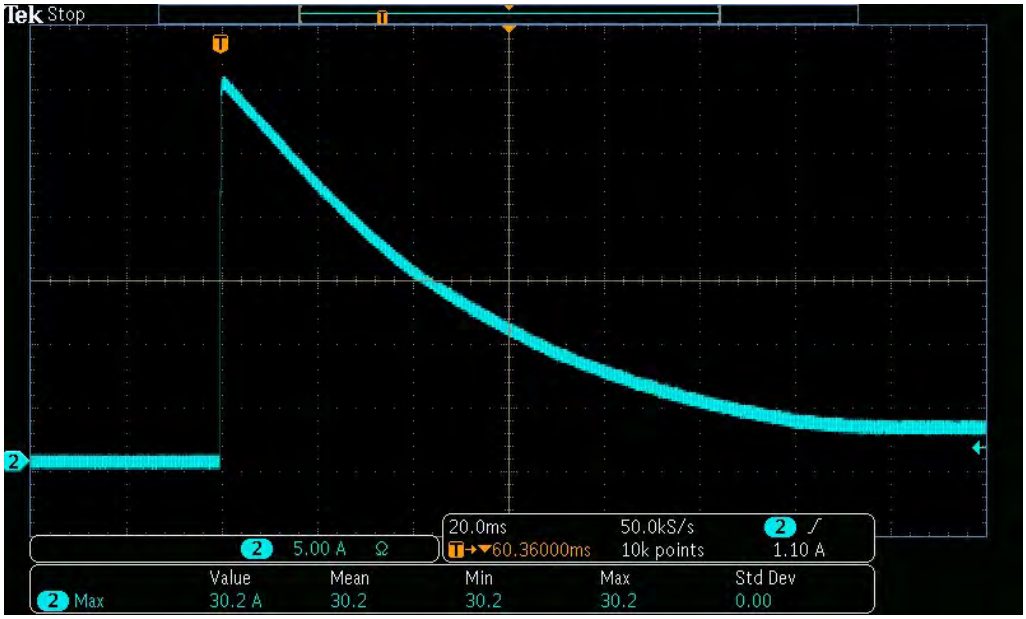
Job Number:	PR131850	**Date:**	3/24/21, 3/25/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC101
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

LDC101 Test Specification:

Test Requirement	Limit
Inrush Current	200% of the nominal current consumption, or 20 amperes, whichever is greater, from a source impedance not exceeding 0.1 ohm at DC.
Load (VA)	290W
Current Distortion Factor	0.035
Current Spectrum	MIL-STD-704F Figure 15

LDC101 Test Results (Inrush Current):

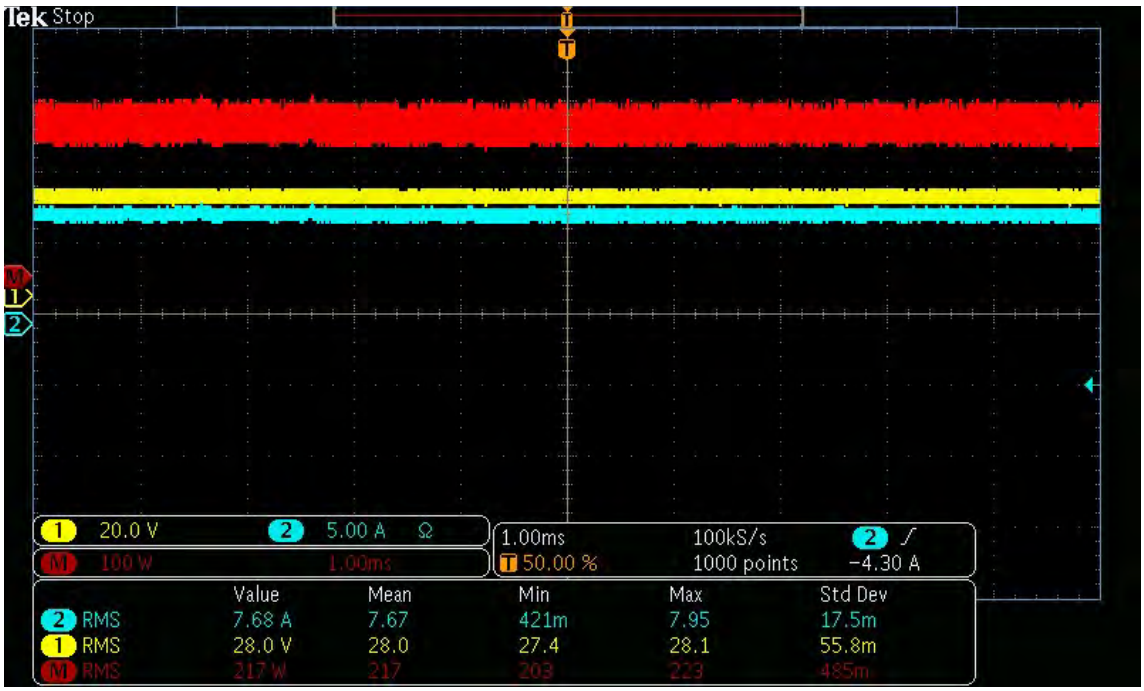
Test Requirement	Steady State Current (A)	Inrush Current Limit (A)	Measured Inrush Current	Result (Over/Under Limit)
200% of Nominal or 20A (whichever is greater)	8.0	20.0	30.2	**Over**



Inrush Current

LDC101 Test Results (Load):

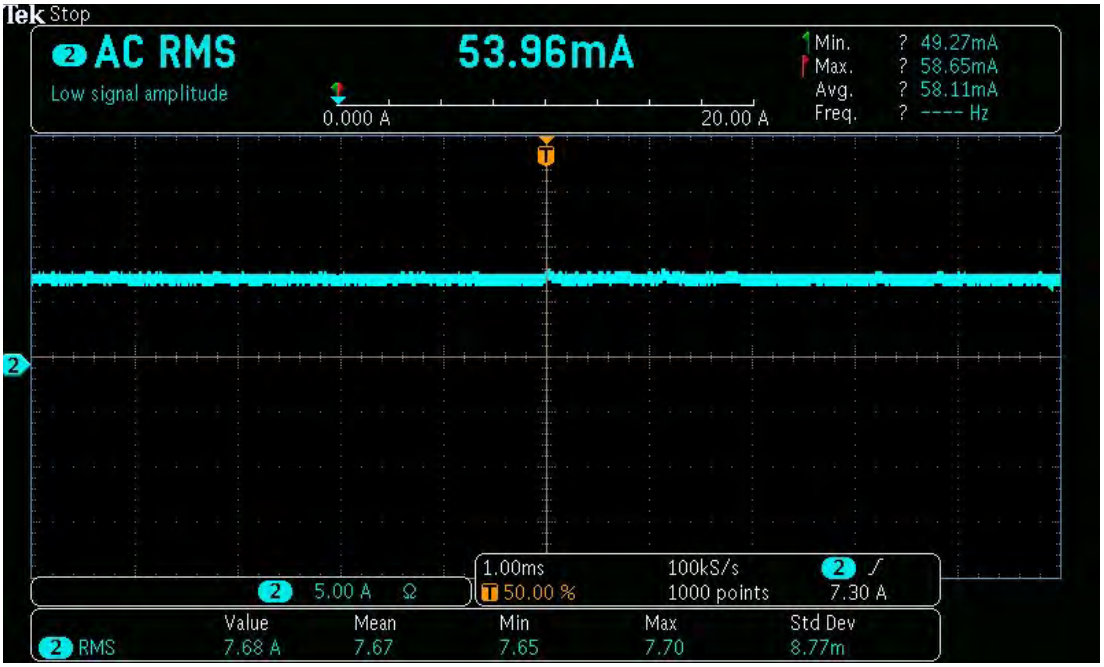
Test Requirement	Steady State Current (A_{RMS})	Steady State Voltage (V_{RMS})	Measured Power (W)	Result (Pass / Fail)
290W	7.68	28.0	217	**PASS**



Load Measurement

LDC101 Test Results (Current Distortion Factor):

Test Requirement	Measured	Result (Pass / Fail)
0.035	0.007026	**PASS**

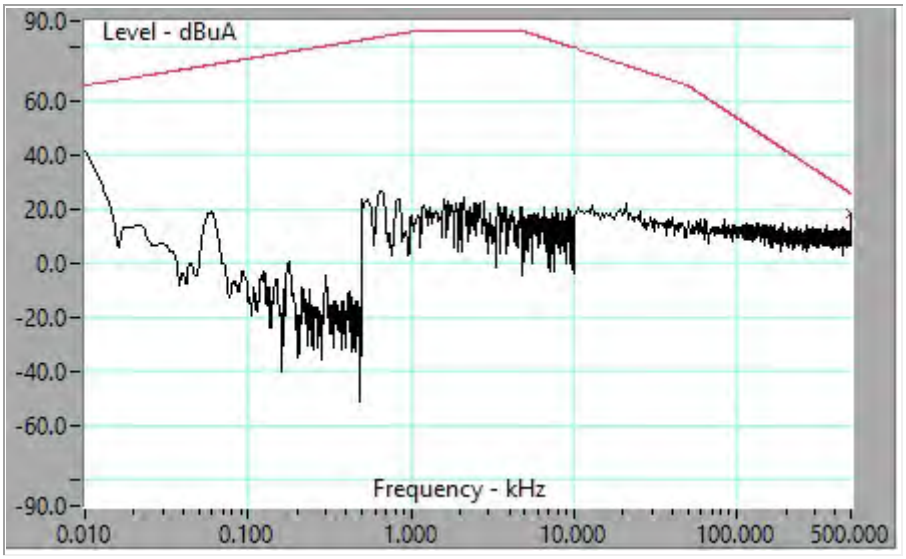


Current Distortion Factor

LDC101 Test Results (Current Spectrum):

Test Requirement	Measured	Result (Pass / Fail)
MIL-STD-704F Figure 15	See Below	**PASS**

Current Spectrum Plots:
System Check: Calibrated Signal = 19dBuA @ 500KHz.



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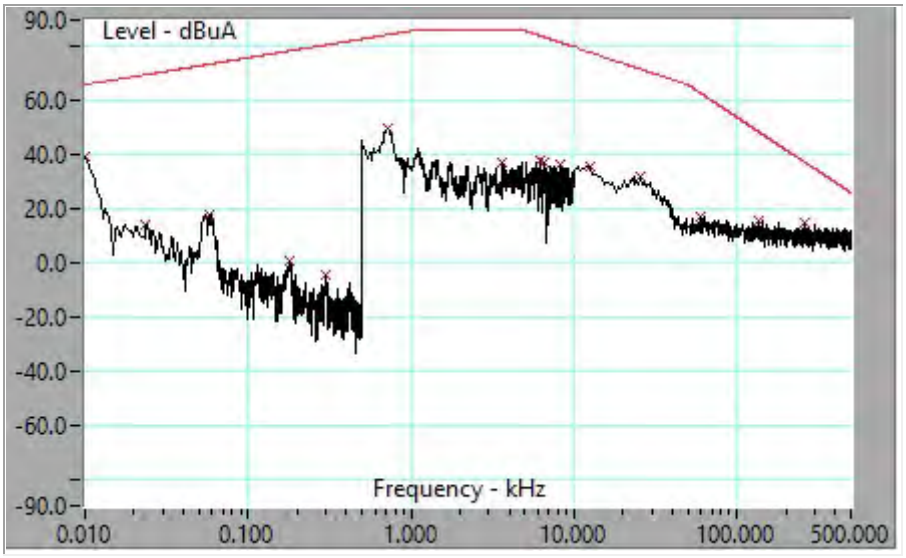
AutoScan 7.4.4.17
Res BW (kHz) 0.01, 0.1
Vid BW (kHz) 50000
AH Systems BCP-510 Probe
Graph # 1

Frequency	Level	Limit	Delta		Raw	Cable	Xducer	All Factors
kHz	dBuA	dBuA	dB		dBuA	dB	dB	dB
500.0000	**18.9**	26.0	-7.1		-44.81	0.01	63.74	-63.75

Ambient Scan: 3 Ohm Resistive Load (9.3 Amps).



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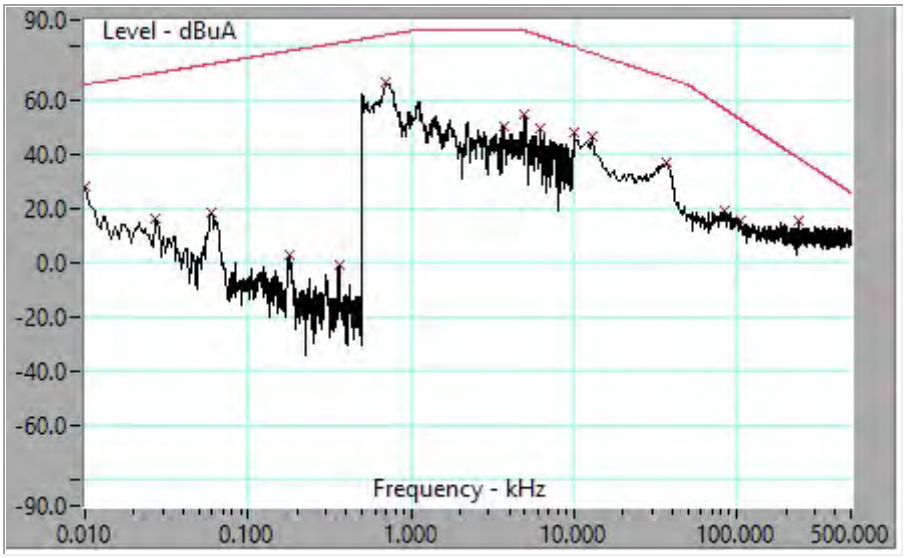
AutoScan 7.4.4.17

Res BW (kHz) 0.01, 0.1
Vid BW (kHz) 50000

AH Systems BCP-510 Probe
Graph # 3

Frequency	Level	Limit	Delta			Raw	Cable	Xducer	All Factors
kHz	dBuA	dBuA	dB			dBuA	dB	dB	dB
0.010	39.2	66.0	-26.8			-49.67	0.00	88.85	-88.85
0.024	14.4	69.8	-55.4			-69.73	0.00	84.09	-84.09
0.059	18.0	73.7	-55.7			-58.40	0.00	76.38	-76.38
0.180	0.4	78.6	-78.1			-68.53	0.00	68.96	-68.96
0.299	-4.5	80.8	-85.3			-70.77	0.00	66.22	-66.22
0.728	50.1	84.6	-34.6			-14.40	0.00	64.46	-64.46
3.6635	37.3	86.0	-48.7			-26.60	0.00	63.87	-63.87
6.1810	38.1	84.2	-46.0			-25.68	0.00	63.83	-63.83
6.5230	37.1	83.7	-46.6			-26.77	0.00	63.82	-63.83
8.2045	36.3	81.7	-45.4			-27.50	0.00	63.81	-63.81
12.4500	35.8	78.1	-42.3			-28.00	0.00	63.79	-63.79
25.6800	31.9	71.8	-39.9			-31.86	0.00	63.77	-63.78
59.9800	16.9	62.8	-45.9			-46.86	0.00	63.77	-63.77
136.4200	15.7	48.6	-32.9			-48.07	0.00	63.74	-63.74
258.9200	14.7	37.4	-22.7			-49.02	0.01	63.73	-63.74

SwitchBox: +28VDC.



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AutoScan 7.4.4.17

Res BW (kHz) 0.01, 0.1
Vid BW (kHz) 50000

AH Systems BCP-510 Probe
Graph # 4

Frequency	Level	Limit	Delta			Raw	Cable	Xducer	All Factors
kHz	dBuA	dBuA	dB			dBuA	dB	dB	dB
0.010	28.2	66.0	-37.8			-60.68	0.00	88.85	-88.85
0.027	16.6	70.3	-53.8			-66.32	0.00	82.90	-82.90
0.059	18.6	73.7	-55.1			-57.63	0.00	76.24	-76.24
0.179	2.8	78.5	-75.8			-66.27	0.00	69.02	-69.02
0.360	-0.8	81.6	-82.4			-66.56	0.00	65.72	-65.72
0.709	66.8	84.5	-17.7			2.29	0.00	64.49	-64.49
3.6730	50.3	86.0	-35.7			-13.56	0.00	63.87	-63.87
5.0125	55.1	86.0	-30.9			-8.76	0.00	63.84	-63.84
6.2000	49.6	84.1	-34.5			-14.23	0.00	63.83	-63.83
10.0000	48.3	80.0	-31.6			-15.44	0.00	63.79	-63.79
12.9400	47.1	77.7	-30.7			-16.73	0.00	63.79	-63.79
36.9500	37.0	68.6	-31.6			-26.74	0.00	63.76	-63.76
84.4800	19.7	56.9	-37.2			-44.05	0.00	63.75	-63.76
104.5700	15.5	53.2	-37.7			-48.24	0.00	63.76	-63.76
241.2800	15.4	38.7	-23.2			-48.31	0.01	63.74	-63.74

LDC102 (Normal Steady State Limits for Voltage) Data Sheet

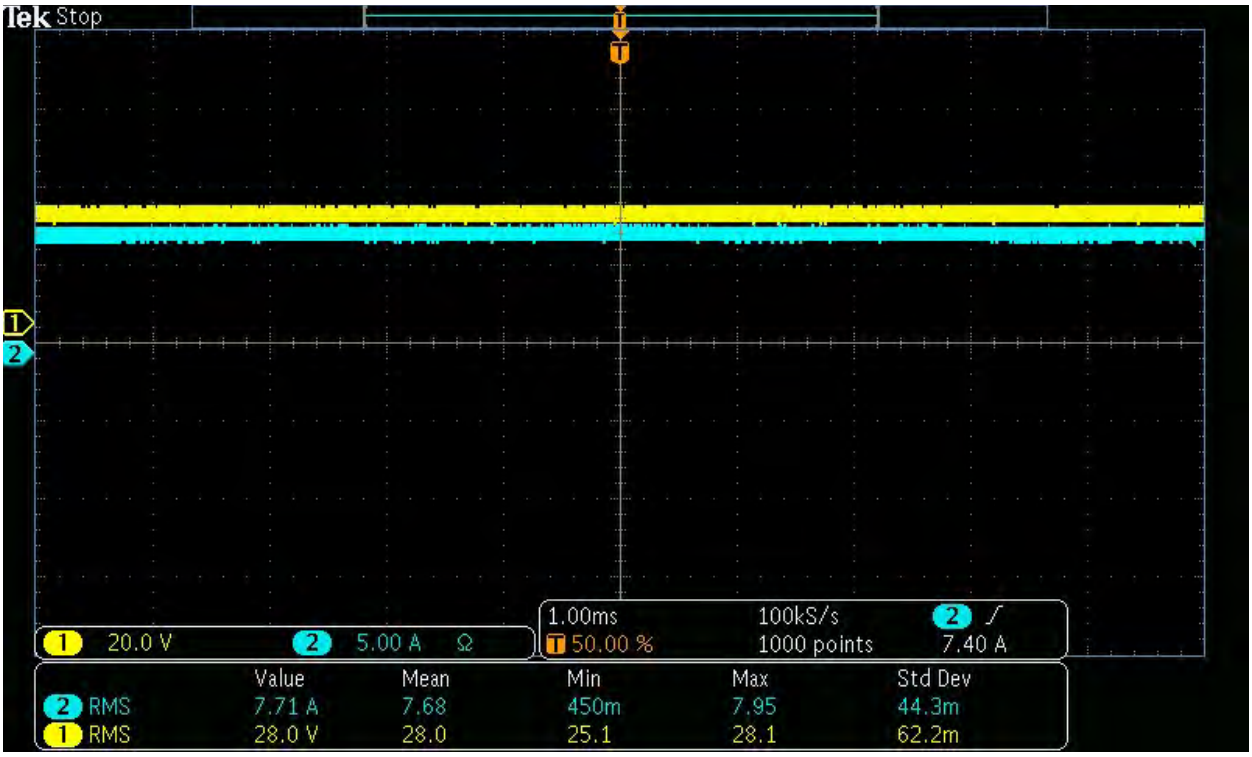
Job Number:	PR131850	**Date:**	3/26/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC101
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

LDC102 Test Specification:

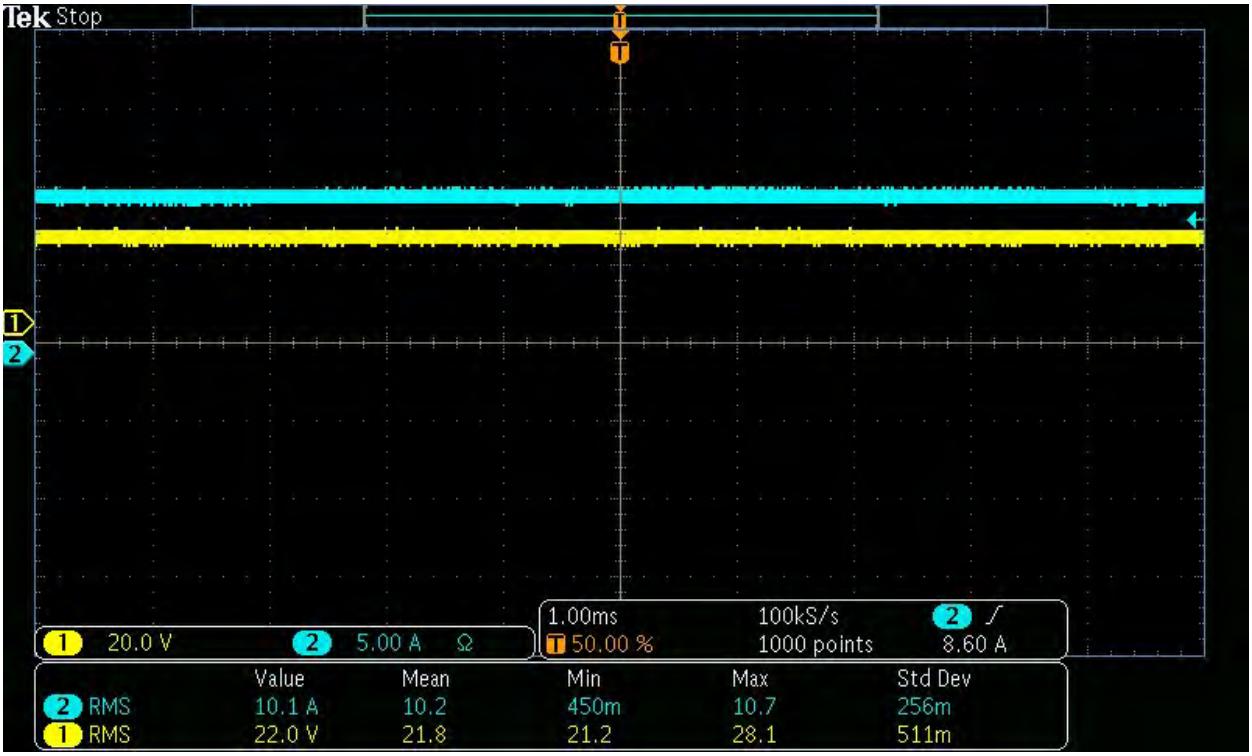
Test Condition	Normal Limit	Voltage (VDC) or Event
A	Nominal	28.0
B	NLSS	22.0
B1	NLSS	22.0V Restart Operation
C	NHSS	29.0
C1	NHSS	29.0V Restart Operation

LDC102 Test Results:

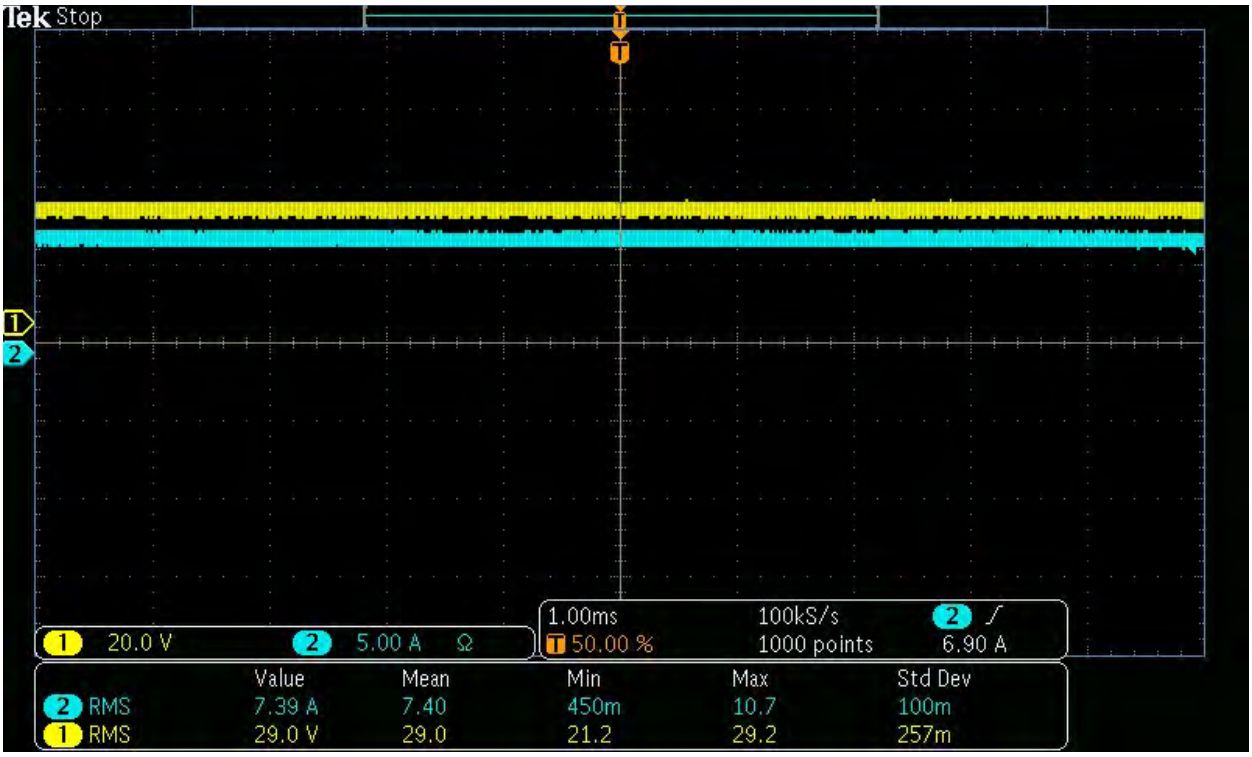
Test Condition	Normal Limit	Measured Voltage (VDC) or Event	Measured Current (A)	Duration (Minutes)	Result (Pass / Fail)
A	Nominal	28.0	7.71	30	**PASS**
B	NLSS	22.0	10.1	30	**PASS**
B1	NLSS	22.0V Restart Operation	-	-	**PASS**
C	NHSS	29.0	7.39	30	**PASS**
C1	NHSS	29.0V Restart Operation	-	-	**PASS**
A	Nominal	28.0	7.76	30	**PASS**



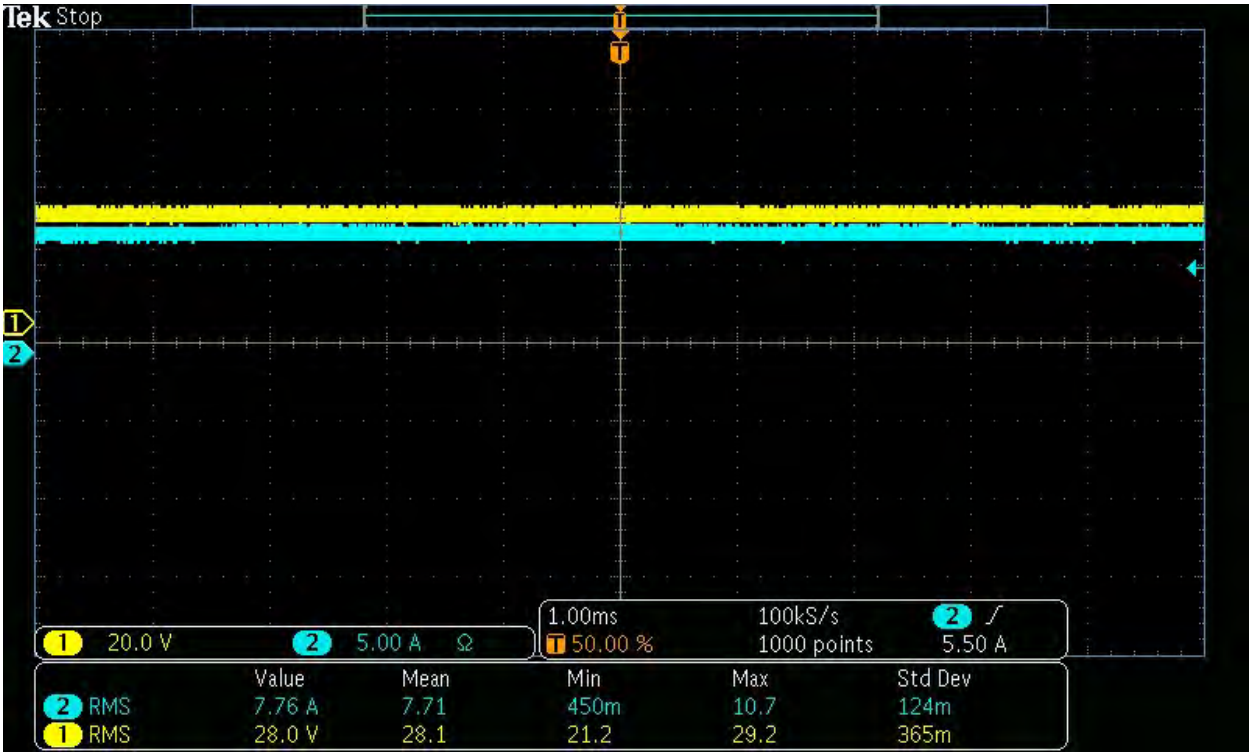
LDC102 28V Nominal



LDC102 22V



LDC102 29V



LDC102 28V Post-Test

LDC103 (Voltage Distortion Spectrum) Data Sheet

Job Number:	PR131850	**Date:**	4/5/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC103
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

LDC103 Test Specification:

Test Condition	Frequency (kHz)	Amplitude (V_{RMS})	Amplitude (dBµV)
A	0.010	0.100	100
B	0.025	0.158	104
C	0.050	0.223	107
D	0.060	0.245	108
E	0.250	0.500	114
F	1.0	1.000	120
G	1.7	1.000	120
H	2.0	1.000	120
I	5.0	1.000	120
J	6.5	0.707	117
K	10.0	0.500	114

LDC103 Calibration (10Hz & 25Hz):

Frequency (Hz)	Test Level (mV_{RMS})	Amp Gain Setting	ARB Waveform AC Setting (dBm)	ARB Waveform DC Setting (mV)	AC Measured (mV_{RMS})	DC Measured (V)
10	100	Max	-38.7	720	100.0	28.0
25	158	Max	-34.83	720	158.0	28.0

LDC103 Test Results (10Hz & 25Hz):

Freq. (Hz)	Test Level (mV_{RMS})	Amp Gain	ARB AC Setting (dBm)	ARB DC Setting (mV)	AC Measured (mV_{RMS})	DC Measured (V)	Dwell Time (Min.)	EUT Observation	Result
10	100	Max	-35.82	727.6	100	28.0	5	None	**PASS**
25	158		-30.64	727.6	158	28.0	5	None	**PASS**

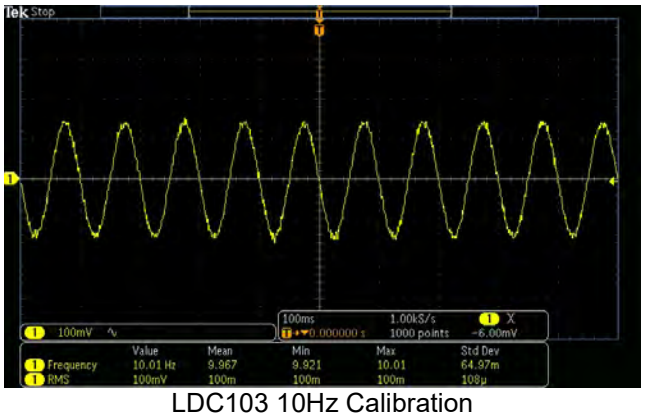
LDC103 Calibration Data (50Hz – 10kHz):

Frequency (kHz)	Limit Level (V_{RMS})	Limit Level (dBµV)	Calibrated Level (dBµV)	Signal Generator Level (dBm)
0.05	0.223	107	107.3327	-37.9897
0.06	0.245	108	108.8817	-36.4897
0.25	0.5	114	114.1157	-29.2543
1.0	1	120	120.2497	-23.2543
1.7	1	120	120.0337	-23.2543
2.0	1	120	120.5107	-22.696
5.0	1	120	120.5057	-22.0697
6.5	0.707	117	117.8347	-24.5239
10	0.5	114	114.6827	-26.5976

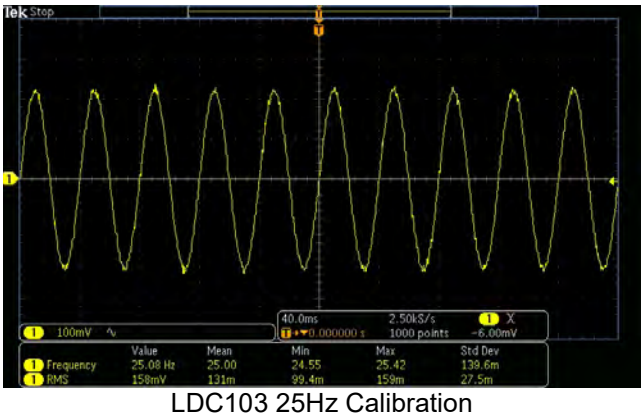
LDC103 Test Results Summary (50Hz – 10kHz):

Frequency (kHz)	Limit Level (dBµV)	Measured Level During Test (dBµV)	Calibrated Signal Generator Level (dBm)	Signal Generator Level During Test (dBm)	EUT Observation	Result
0.05	107	107.5307	-37.9897	-37.9897	None	**PASS**
0.06	108	107.7527	-36.4897	-36.4897	None	**PASS**
0.25	114	114.5567	-29.2543	-29.8766	None	**PASS**
1.0	120	120.7537	-23.2543	-25.488	None	**PASS**
1.7	120	120.7167	-23.2543	-25.4615	None	**PASS**
2.0	120	120.8237	-22.696	-25.1282	None	**PASS**
5.0	120	120.4797	-22.0697	-22.0697	None	**PASS**
6.5	117	116.5207	-24.5239	-24.5239	None	**PASS**
10	114	114.5717	-26.5976	-26.5976	None	**PASS**

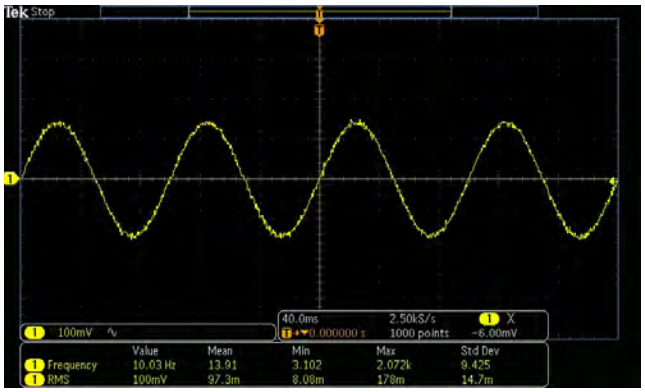
LDC103 10Hz & 25Hz Waveforms



LDC103 10Hz Calibration



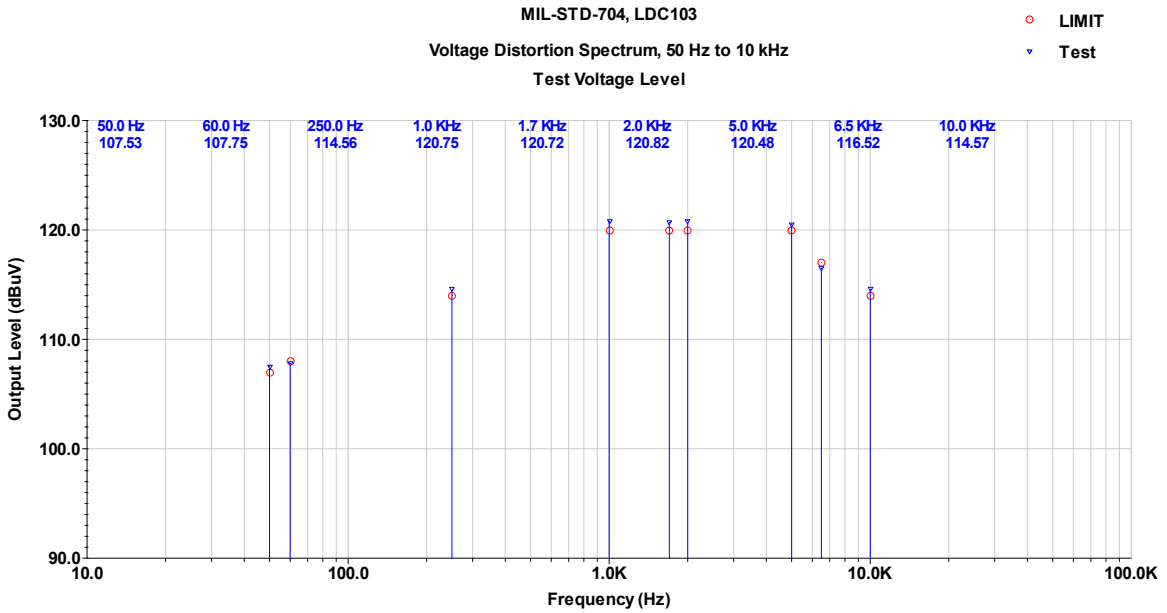
LDC103 25Hz Calibration

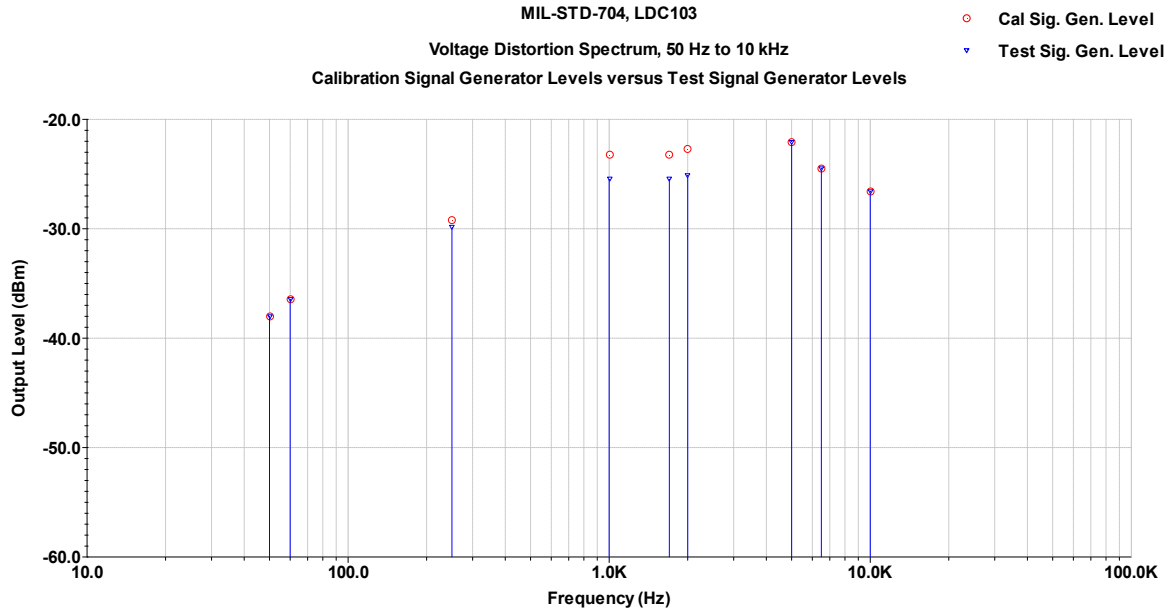


LDC103 10Hz Test

LDC103 25Hz Test

LDC103 50Hz - 10kHz Graphs





LDC104 (Total Ripple) Data Sheet

Job Number:	PR131850	**Date:**	4/6/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC104
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

LDC104 Test Specification:

Test Condition	Ripple Frequency Components (Hz)	Amplitude (V_{RMS})	Amplitude (dBµV)
Condition A	1200	0.8	118.06
	2400	0.16	104.08
	3600	0.26	108.30
	4800	0.08	98.06
	6000	0.13	102.28
	7200	0.04	92.04
	8400	0.06	95.56
Condition B	2400	0.8	118.06
	4800	0.16	104.08
	7200	0.26	108.30
	9600	0.08	98.06
	12000	0.13	102.28
	14400	0.04	92.04
	16800	0.06	95.56

LDC104 Calibration Data:

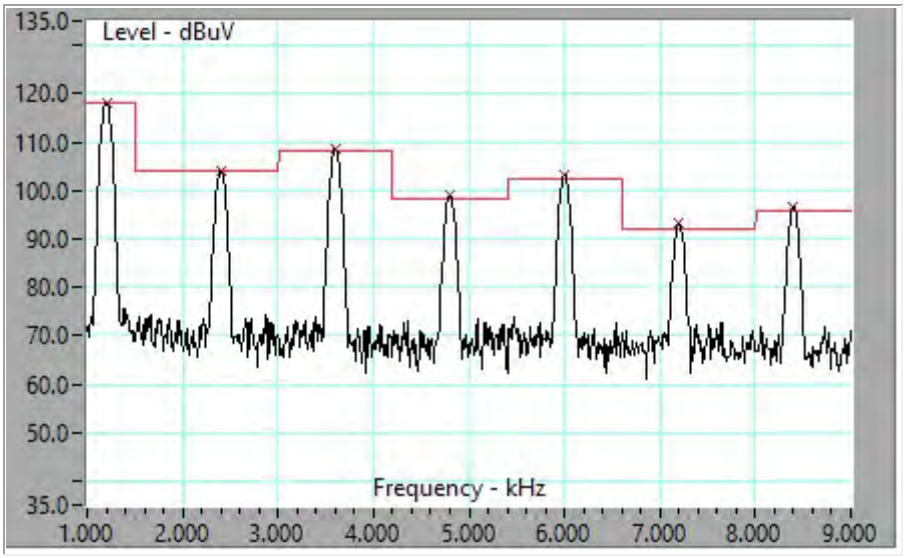
Test Condition	Amp Gain Setting	Fundamental Frequency (Hz)	ARB Waveform AC Setting (mVpp)	ARB Waveform DC Setting (mV)
A	Max	1200	70.00	714.5
B	Max	2400	70.00	714.5

LDC104 Test Results Summary:

Test Condition	Frequency (Hz)	Calibrated Amplitude (V_{RMS})	Calibrated Amplitude (dBµV)	Test Time (Minutes)	EUT Observation	Result
A	1200	0.800	118.06	30	None	**PASS**
	2400	0.160	104.08			
	3600	0.260	108.30			
	4800	0.080	98.06			
	6000	0.130	102.28			
	7200	0.040	92.04			
	8400	0.060	95.56			
B	2400	0.800	118.06	30	None	**PASS**
	4800	0.160	104.08			
	7200	0.260	108.30			
	9600	0.080	98.06			
	12000	0.130	102.28			
	14400	0.040	92.04			
	16800	0.060	95.56			

LDC104 Data

LDC104 Calibration: Test Condition A



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AutoScan 7.4.4.17

Res BW (kHz) 0.10
Vid BW (kHz) 50000

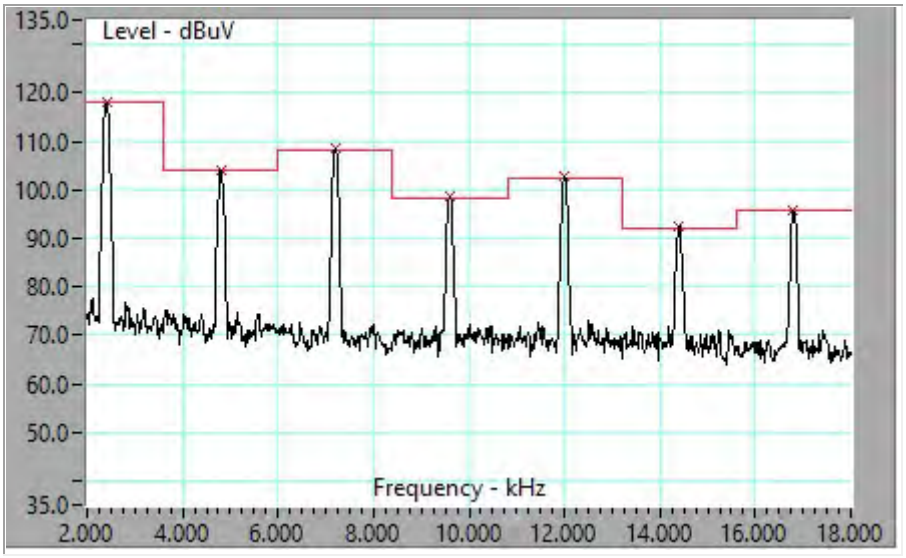
PRD-240

Graph # 1

Scan Data

Frequency	Level	Limit	Delta			Raw	PRD	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB			dBuV	dB	dB	dB	dB
1.2000	118.0	118.1	-0.0			38.55	79.47	0.01	0.00	-79.48
2.4000	104.1	104.1	-0.0			24.65	79.40	0.01	0.00	-79.41
3.6000	108.6	108.3	0.3			29.15	79.40	0.01	0.00	-79.42
4.8000	98.9	98.1	0.8			19.47	79.40	0.01	0.00	-79.41
6.0000	103.2	102.3	0.9			23.76	79.38	0.02	0.00	-79.40
7.2000	93.2	92.0	1.1			13.72	79.41	0.02	0.00	-79.43
8.3920	96.5	95.6	1.0			17.07	79.44	0.02	0.00	-79.46

LDC104 Calibration: Test Condition B



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AutoScan 7.4.4.17
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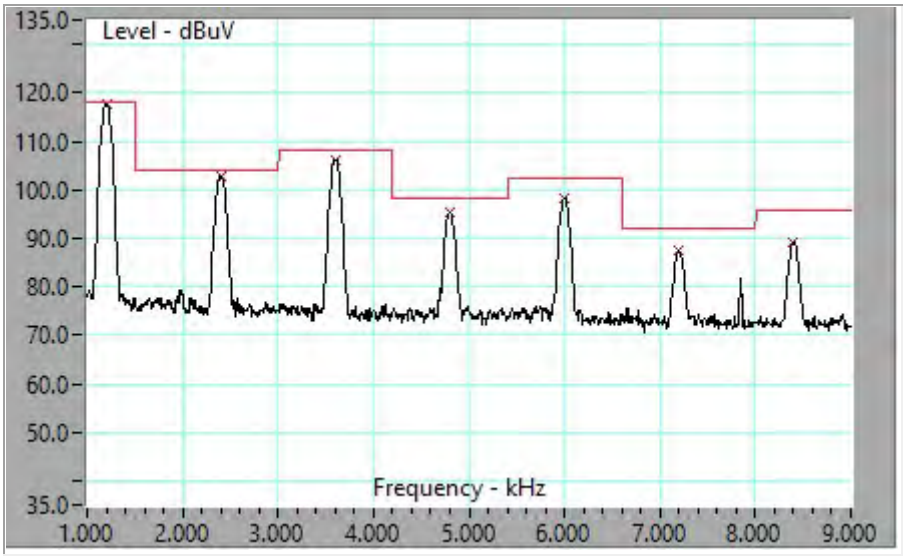
Vid BW (kHz) 50000
PRD-240
Graph # 2

Scan Data

Frequency	Level	Limit	Delta			Raw	PRD	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB			dBuV	dB	dB	dB	dB
2.4000	118.1	118.1	0.1			38.73	79.40	0.01	0.00	-79.41
4.8000	104.1	104.1	-0.0			24.64	79.40	0.01	0.00	-79.41
7.2000	108.4	108.3	0.1			29.00	79.41	0.02	0.00	-79.43
9.6000	98.6	98.1	0.6			19.19	79.41	0.02	0.00	-79.43
12.0000	102.6	102.3	0.3			23.16	79.42	0.02	0.00	-79.44
14.4000	92.5	92.0	0.5			13.08	79.40	0.02	0.00	-79.42
16.8000	95.6	95.6	0.1			16.19	79.40	0.02	0.00	-79.43

LDC104 Test: Test Condition A



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AutoScan 7.4.4.17
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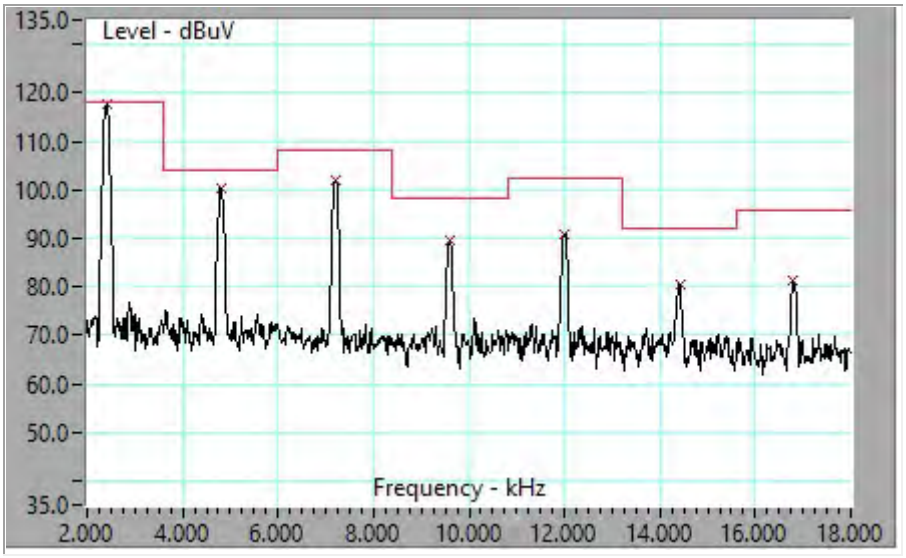
Vid BW (kHz) 50000
PRD-240
Graph # 3

Scan Data

Frequency	Level	Limit	Delta			Raw	PRD	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB			dBuV	dB	dB	dB	dB
1.2000	117.6	118.1	-0.5			38.11	79.47	0.01	0.00	-79.48
2.4000	102.9	104.1	-1.2			23.51	79.40	0.01	0.00	-79.41
3.6000	106.3	108.3	-2.0			26.84	79.40	0.01	0.00	-79.42
4.8000	95.5	98.1	-2.5			16.11	79.40	0.01	0.00	-79.41
6.0000	98.3	102.3	-4.0			18.93	79.38	0.02	0.00	-79.40
7.1920	87.5	92.0	-4.6			8.05	79.41	0.02	0.00	-79.43
8.4000	89.2	95.6	-6.3			9.76	79.44	0.02	0.00	-79.46

LDC104 Test: Test Condition B



Tue, Apr 6, 2021
12:51:37 PM
AutoScan 7.4.4.17
Res BW (kHz) 0.10
Vid BW (kHz) 50000
PRD-240
Graph # 4

Scan Data

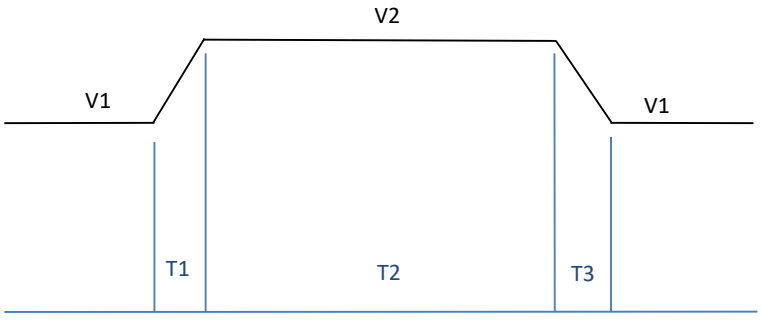
Frequency	Level	Limit	Delta			Raw	PRD	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB			dBuV	dB	dB	dB	dB
2.4000	117.6	118.1	-0.5			38.18	79.40	0.01	0.00	-79.41
4.8000	100.4	104.1	-3.7			21.01	79.40	0.01	0.00	-79.41
7.2000	101.9	108.3	-6.4			22.51	79.41	0.02	0.00	-79.43
9.6000	89.4	98.1	-8.7			9.95	79.41	0.02	0.00	-79.43
12.0000	91.0	102.3	-11.3			11.54	79.42	0.02	0.00	-79.44
14.4160	80.3	92.0	-11.7			0.87	79.40	0.02	0.00	-79.42
16.8000	81.4	95.6	-14.2			1.98	79.40	0.02	0.00	-79.43

LDC105 (Normal Voltage Transients) Data Sheet

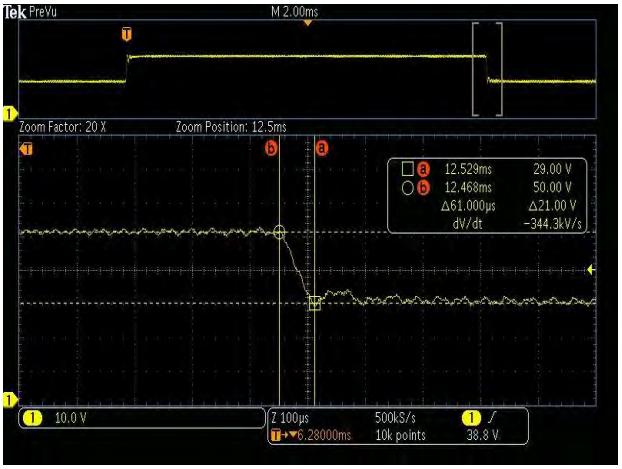
Job Number:	PR131850	**Date:**	4/9/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC201
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

Test Specification (Overvoltage Transients AA - JJ):

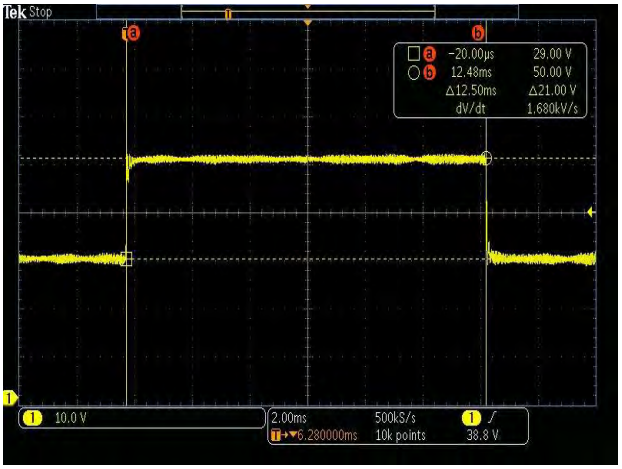
Overvoltage Transient #	V1	T1 (mS)	V2	V2 Reps.	Rep. Separation (S)	T2 (mS)	T3 (mS)	Transient Reps.
AA	29	<1	50	1	-	12.5	<1	5
BB	29	<1	50	1	-	12.5	70	5
CC	29	<1	40	1	-	45	<1	5
DD	29	<1	40	1	-	45	37.5	5
EE	29	<1	50	3	0.5	10	<1	5
FF	22	<1	50	1	-	12.5	<1	5
GG	22	<1	50	1	-	12.5	95	5
HH	22	<1	40	1	-	45	<1	5
II	22	<1	40	1	-	45	62.5	5
JJ	22	<1	50	3	0.5	10	<1	5



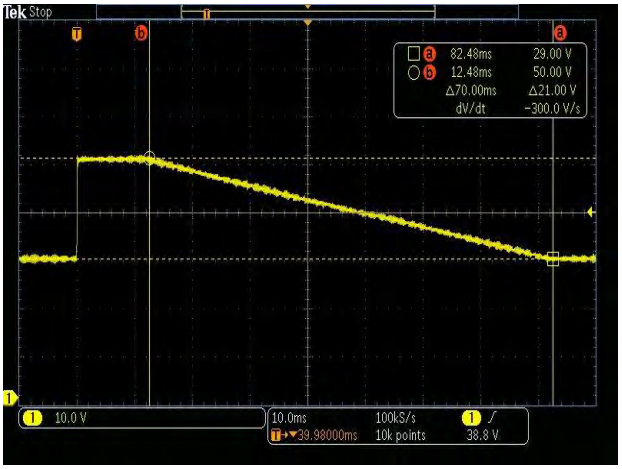
Calibration Waveforms (Overvoltage Transients AA - JJ):



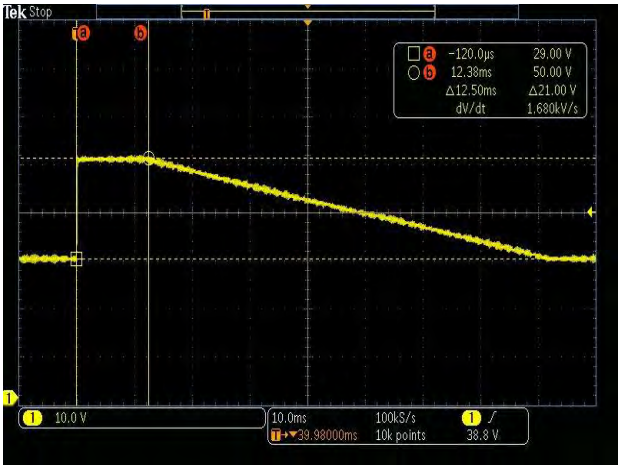
AA - T3



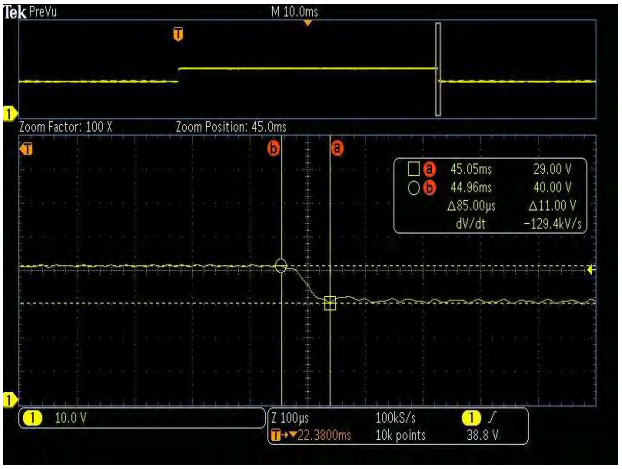
AA - V2 & T2



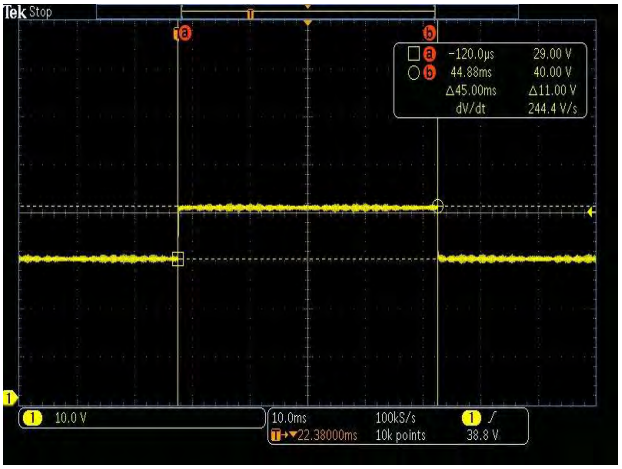
BB - T3



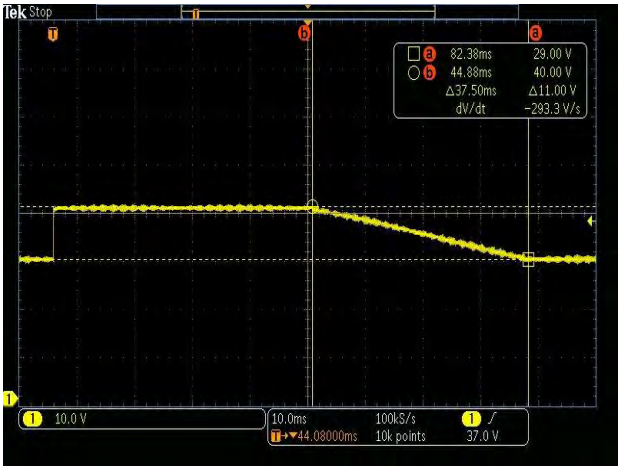
BB - V2 & T2



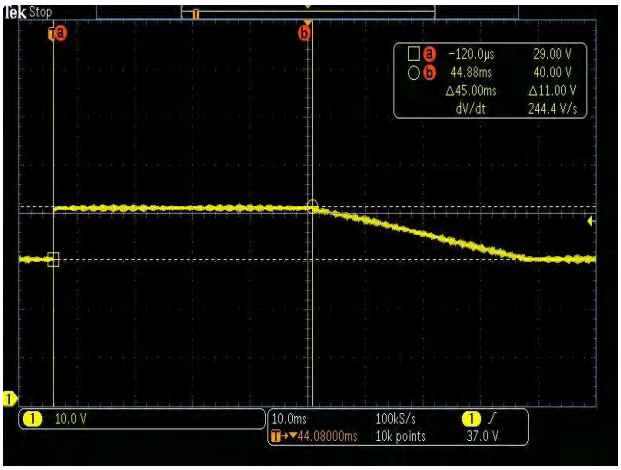
CC - T3



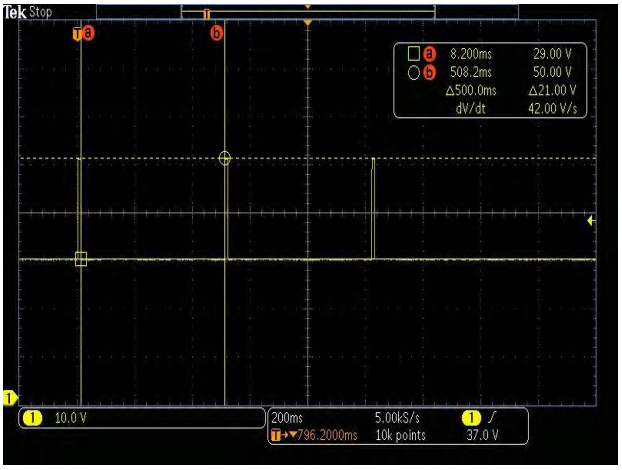
CC - V2 & T2



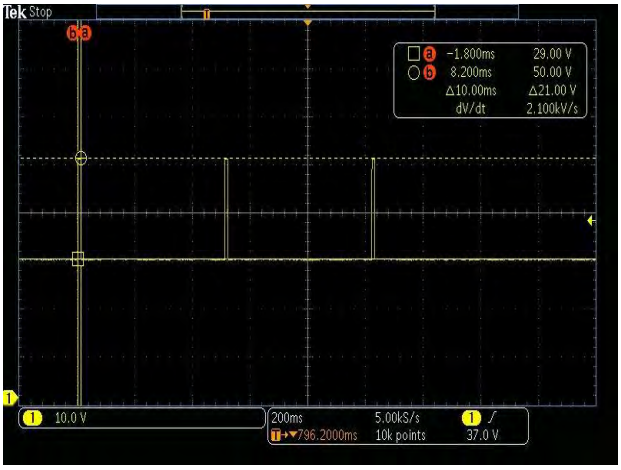
DD - T3



DD - V2 & T2

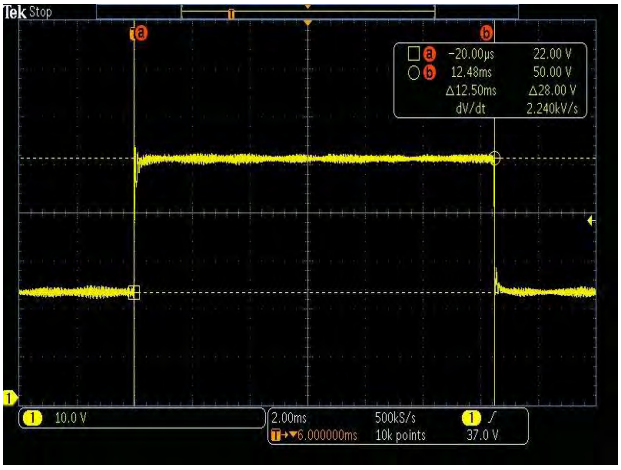


EE - Rep Separation

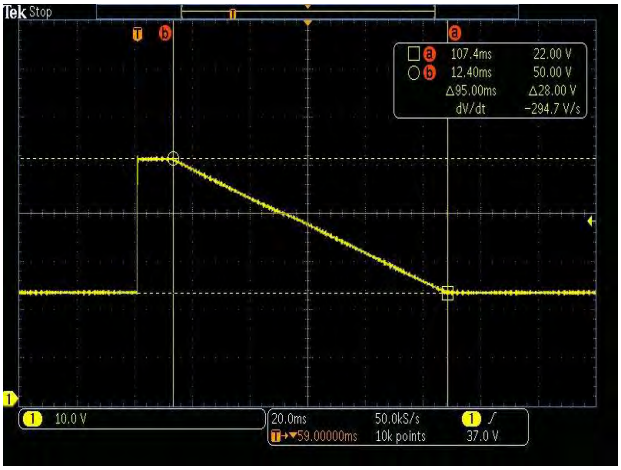


EE - V2 & T2

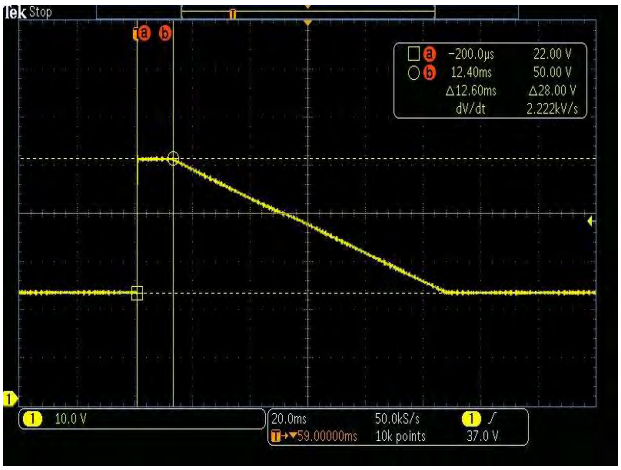
FF - T3



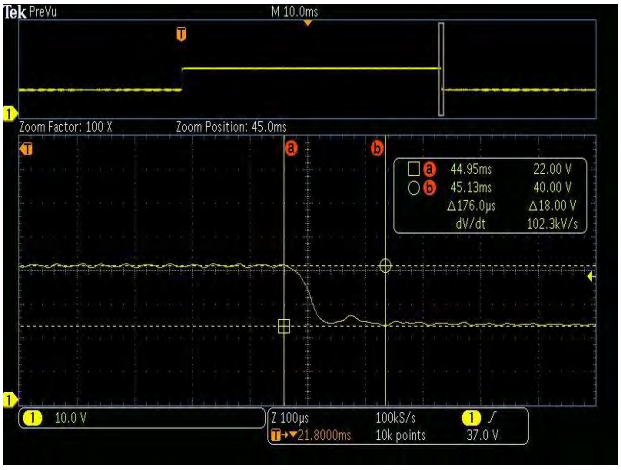
FF - V2 & T2



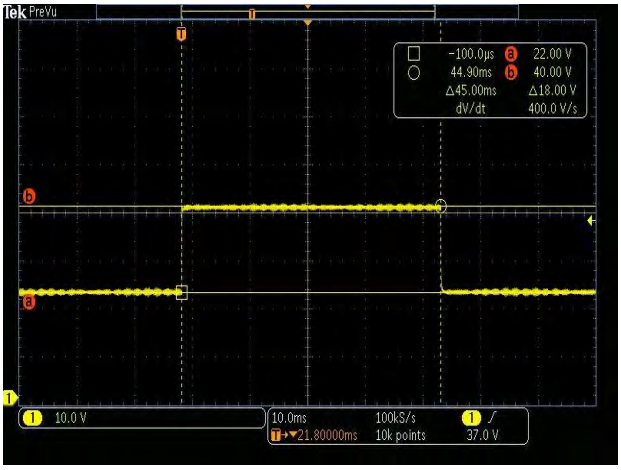
GG - T3



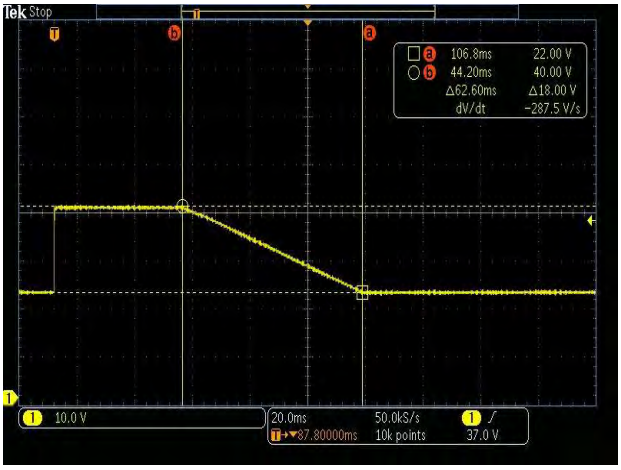
GG - V2 & T2



HH - T3

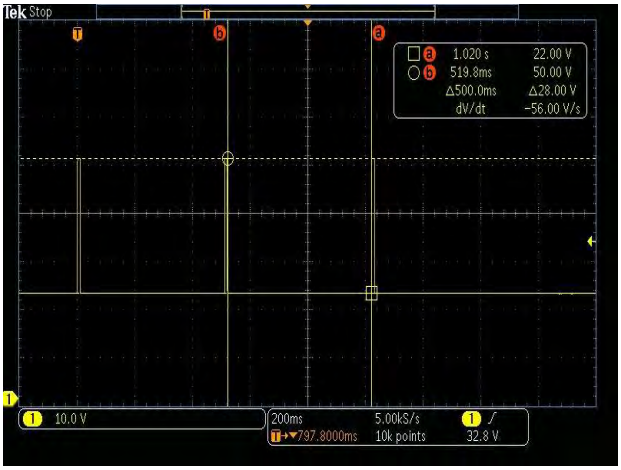


HH - V2 & T2

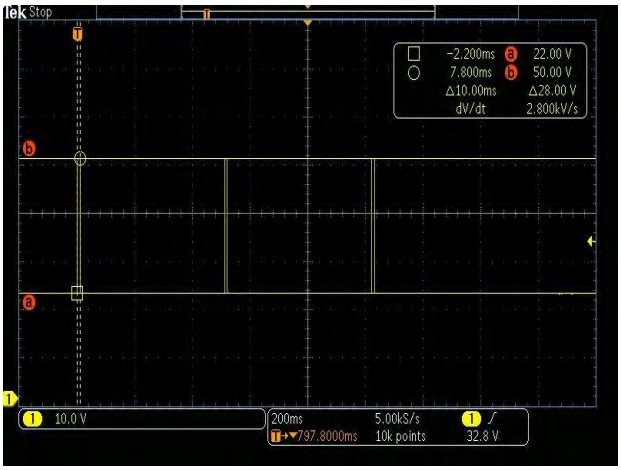


II - T3

II - V2 & T2



JJ - Rep Sep

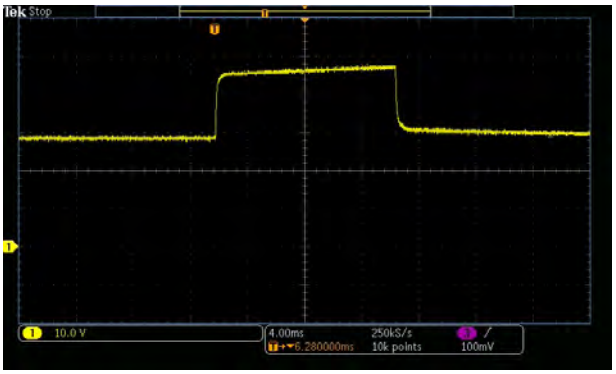


JJ - V2 & T2

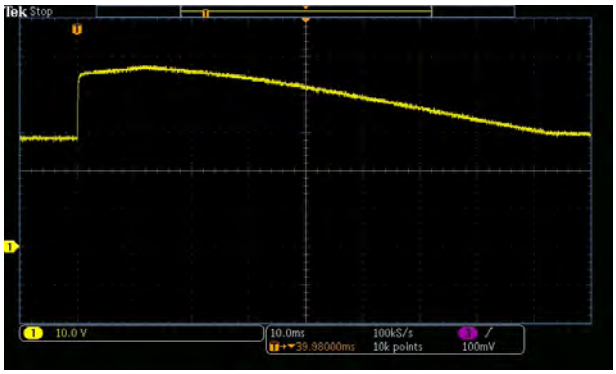
Test Results (Overvoltage Transients AA - JJ):

Overvoltage Transient #	V1	V2	V2 Reps.	Rep. Separation (S)	T2 (mS)	T3 (mS)	Transient Reps.	EUT Observation	Result
AA	29	50	1	-	12.5	<1	5	None	**PASS**
BB	29	50	1	-	12.5	70	5	None	**PASS**
CC	29	40	1	-	45	<1	5	None	**PASS**
DD	29	40	1	-	45	37.5	5	None	**PASS**
EE	29	50	3	0.5	10	<1	5	None	**PASS**
FF	22	50	1	-	12.5	<1	5	None	**PASS**
GG	22	50	1	-	12.5	95	5	None	**PASS**
HH	22	40	1	-	45	<1	5	None	**PASS**
II	22	40	1	-	45	62.5	5	None	**PASS**
JJ	22	50	3	0.5	10	<1	5	None	**PASS**

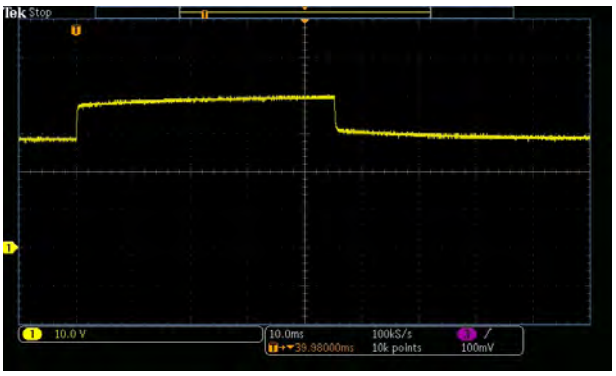
Test Waveforms (Overvoltage Transients AA - JJ):



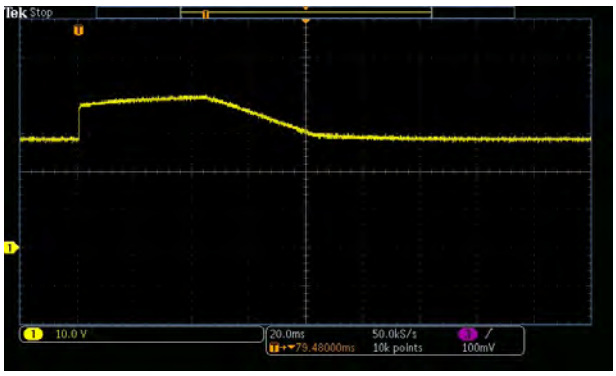
AA - Test



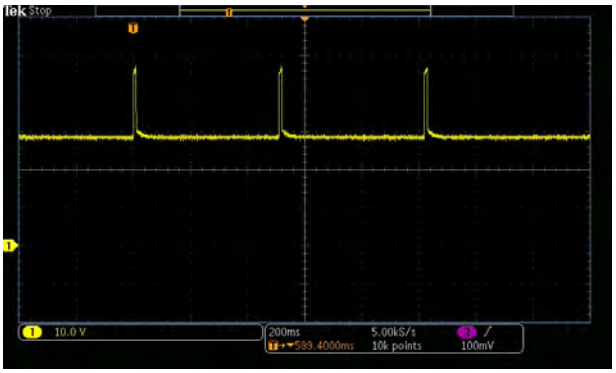
BB - Test



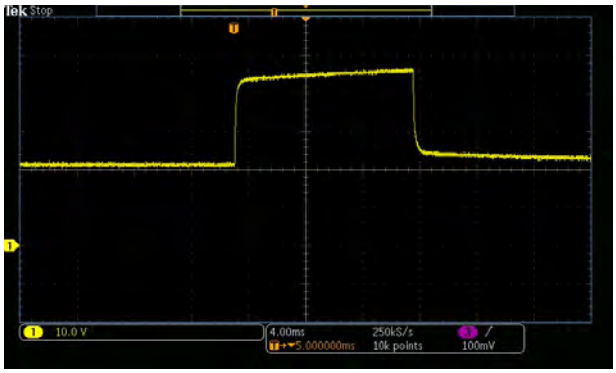
CC - Test



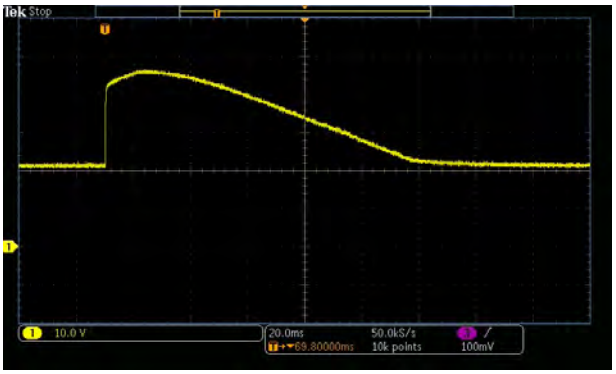
DD - Test



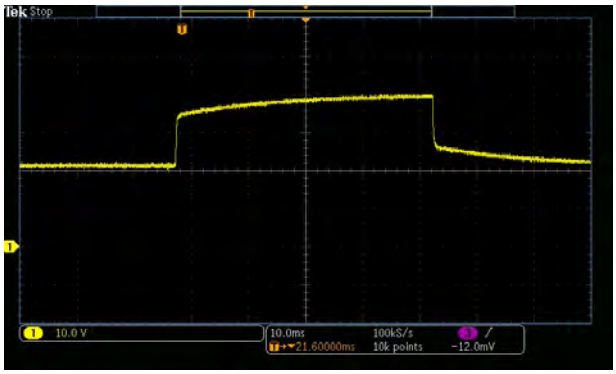
EE - Test



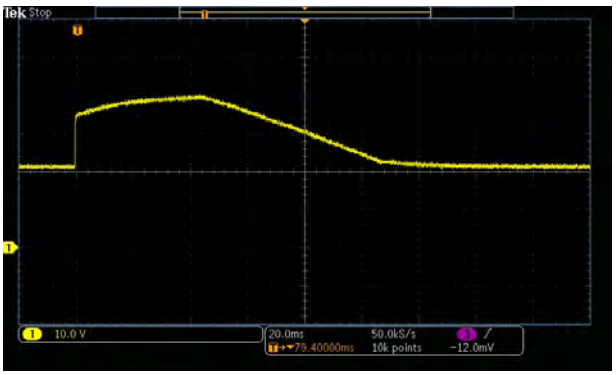
FF - Test



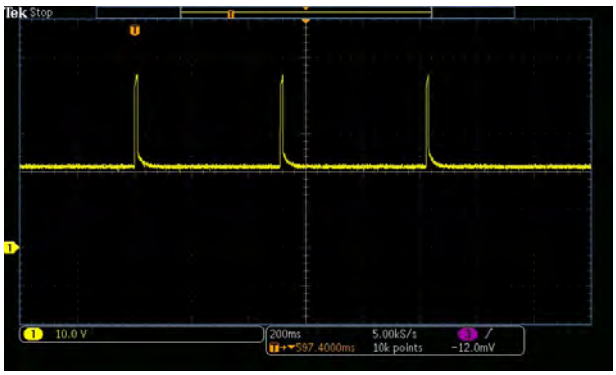
GG - Test



HH - Test



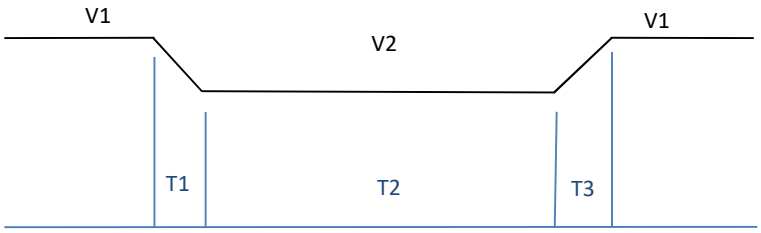
II - Test



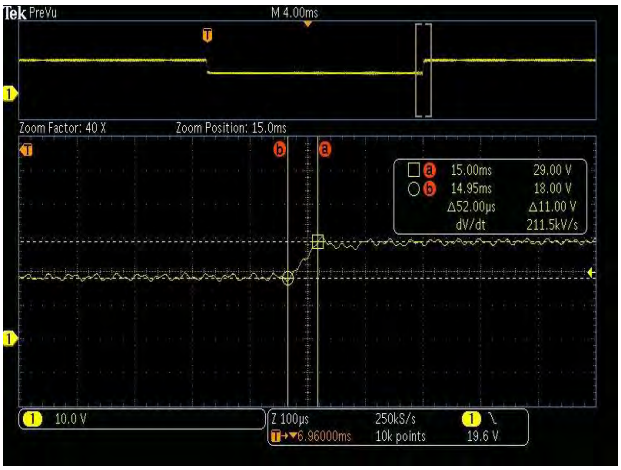
JJ - Test

Test Specification (Undervoltage Transients KK - PP):

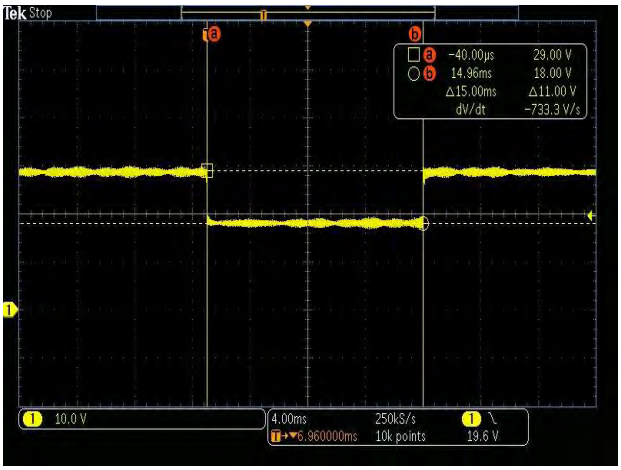
Overvoltage Transient #	V1	T1 (mS)	V2	V2 Reps.	Rep. Separation (S)	T2 (mS)	T3 (mS)	Transient Reps.
KK	29	<1	18	1	-	15	<1	5
LL	29	<1	18	1	-	15	234	5
MM	29	<1	18	3	0.5	10	<1	5
NN	22	<1	18	1	-	15	<1	5
OO	22	<1	18	1	-	15	85	5
PP	22	<1	18	3	0.5	10	<1	5



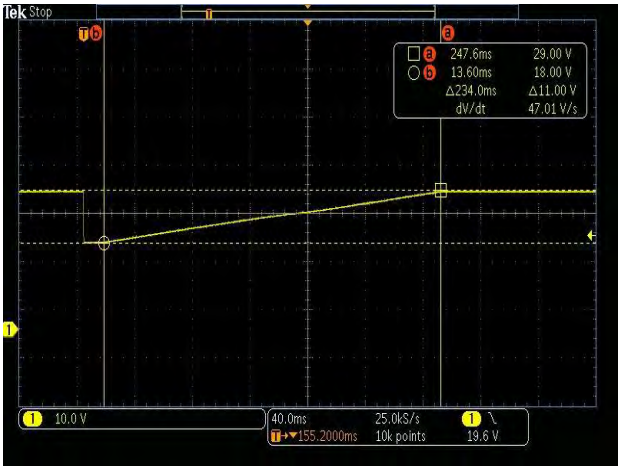
Calibration Waveforms (Undervoltage Transients KK - PP):



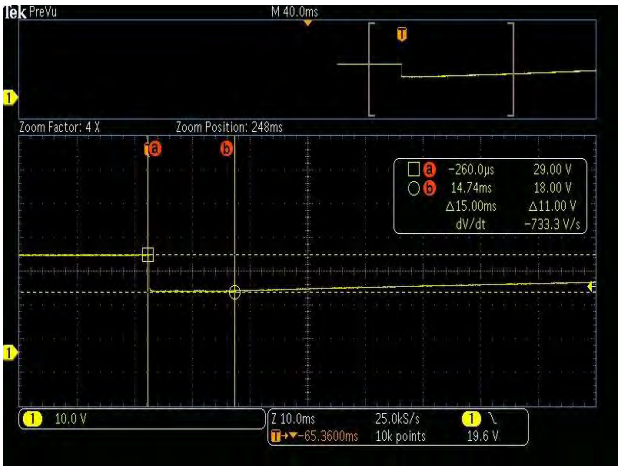
KK - T3



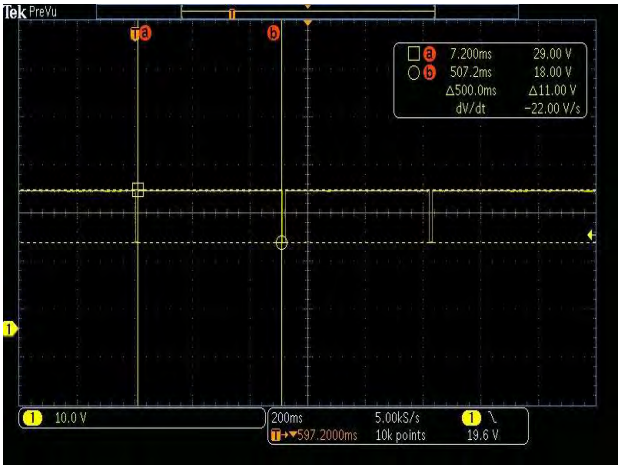
KK - V2 & T2



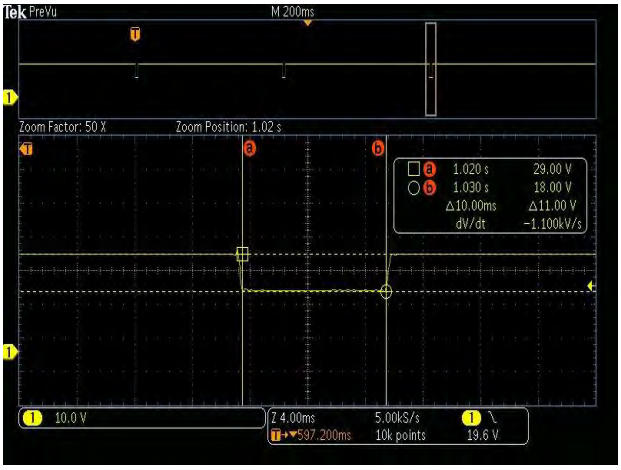
LL - T3



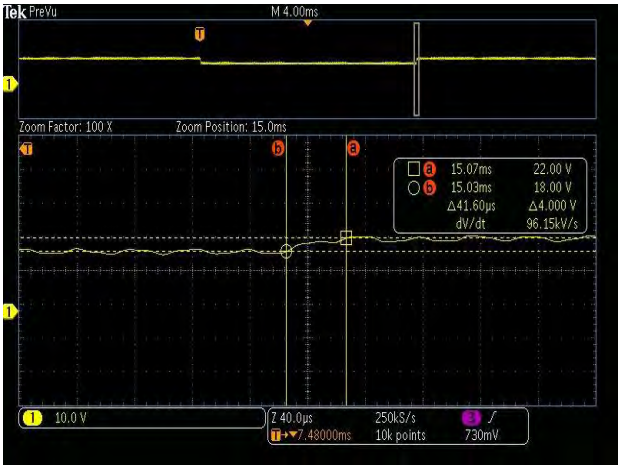
LL - V2 & T2



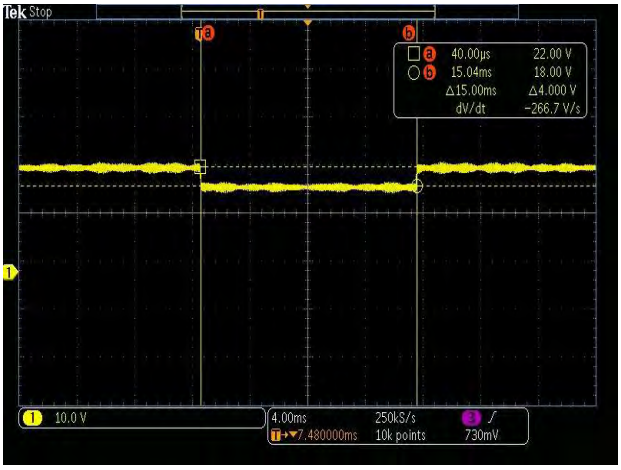
MM - Rep Sep



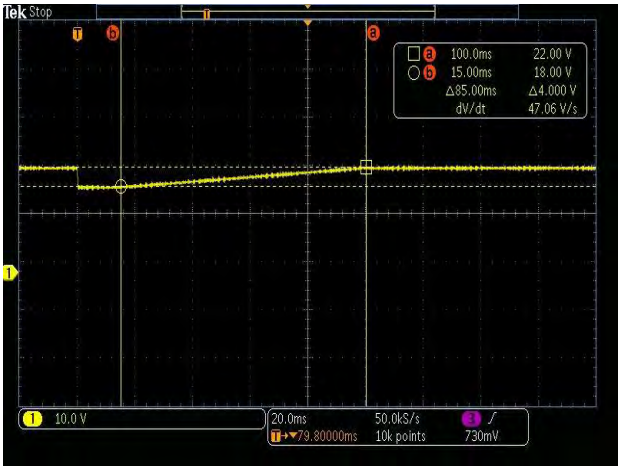
MM - V2 & T2



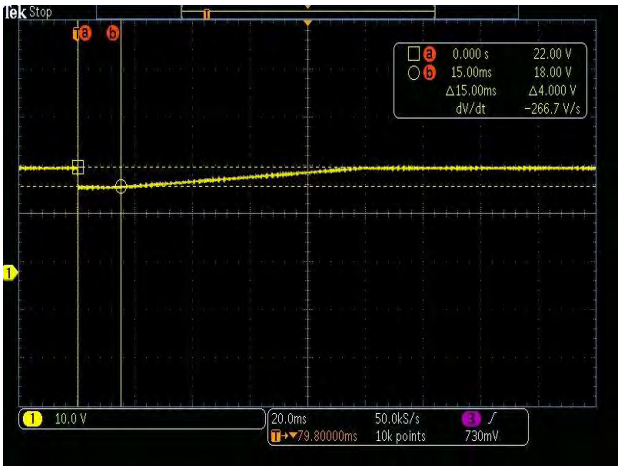
NN - T3



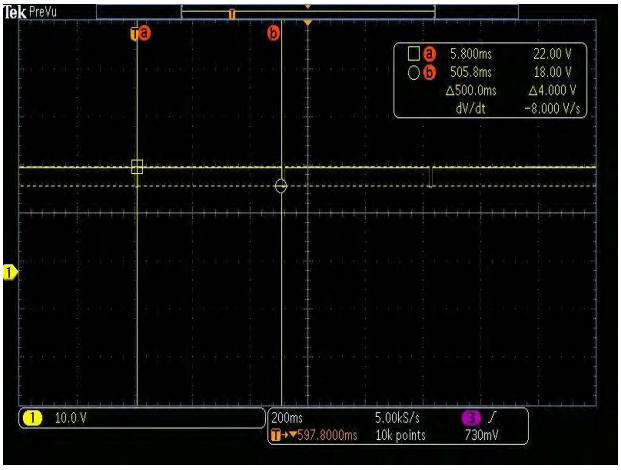
NN - V2 & T2



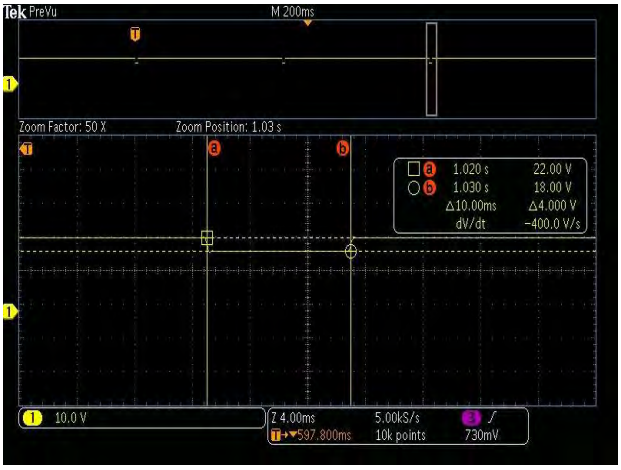
OO - T3



OO - V2 & T2



PP - Rep Sep

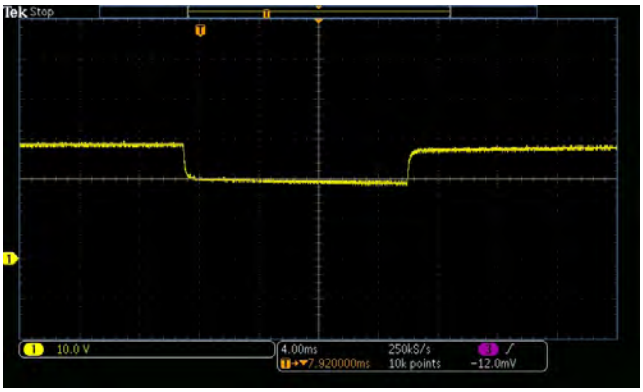


PP - V2 & T2

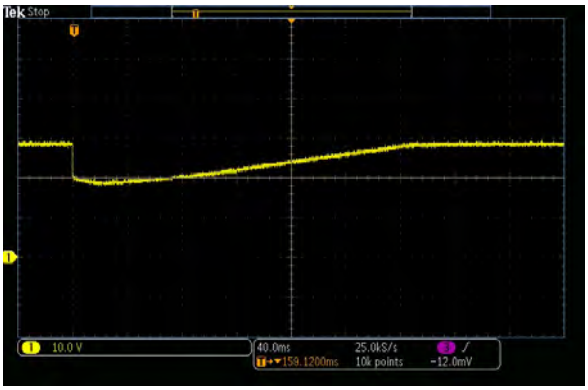
Test Results (Undervoltage Transients KK - PP):

Overvoltage Transient #	V1	V2	V2 Reps.	Rep. Separation (S)	T2 (mS)	T3 (mS)	Transient Reps.	EUT Observation	Result
KK	29	18	1	-	15	<1	5	None	**PASS**
LL	29	18	1	-	15	234	5	None	**PASS**
MM	29	18	3	0.5	10	<1	5	None	**PASS**
NN	22	18	1	-	15	<1	5	None	**PASS**
OO	22	18	1	-	15	85	5	None	**PASS**
PP	22	18	3	0.5	10	<1	5	None	**PASS**

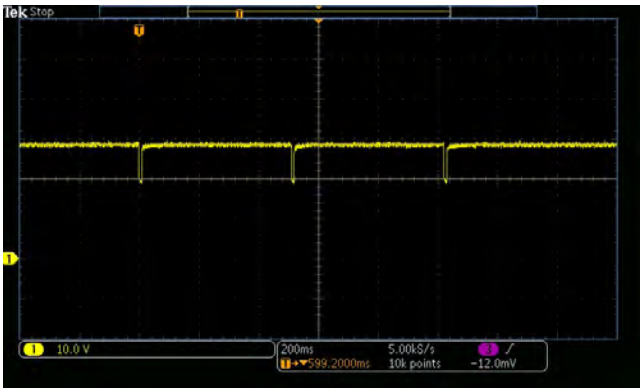
Test Waveforms (Undervoltage Transients KK - PP):



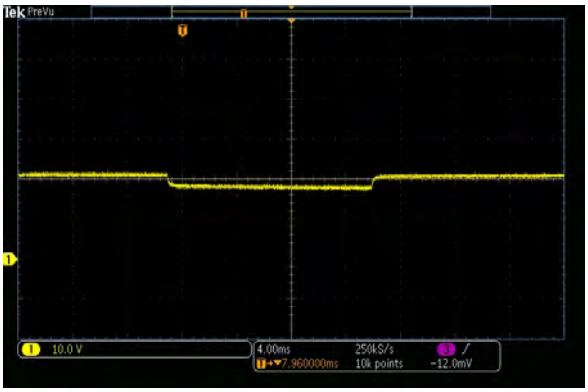
KK - Test



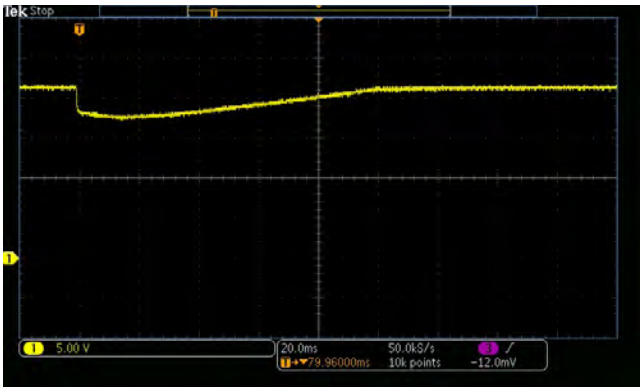
LL - Test



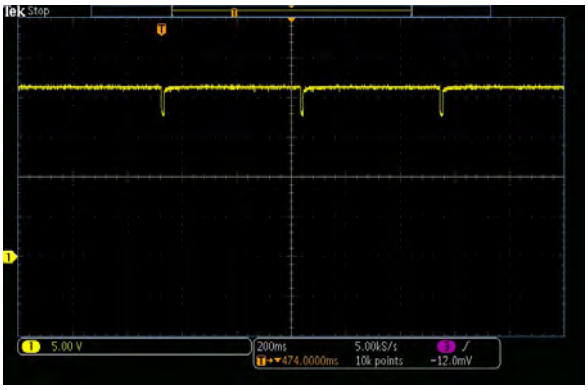
MM - Test



NN - Test



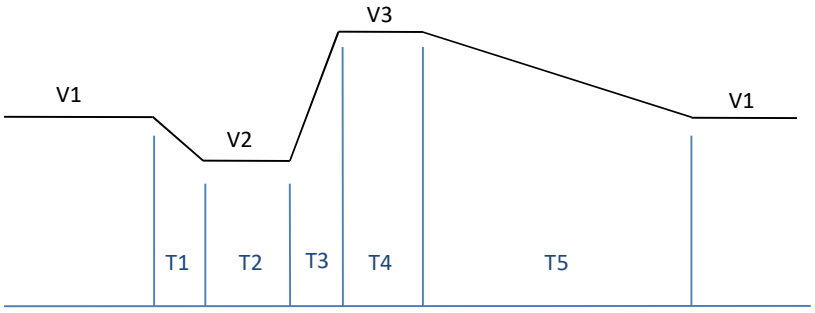
OO - Test



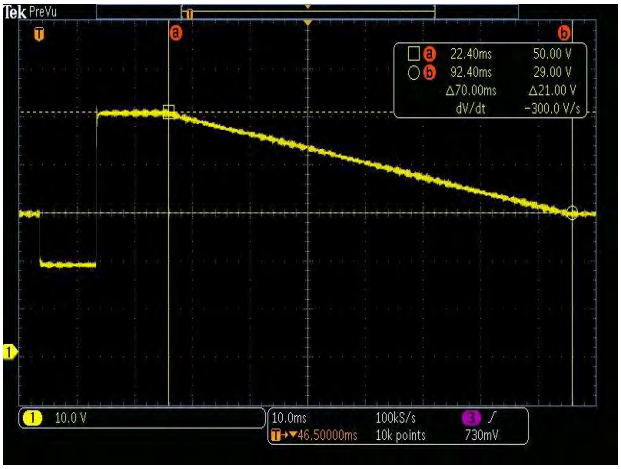
PP - Test

Test Specification (Combined Transients QQ & RR):

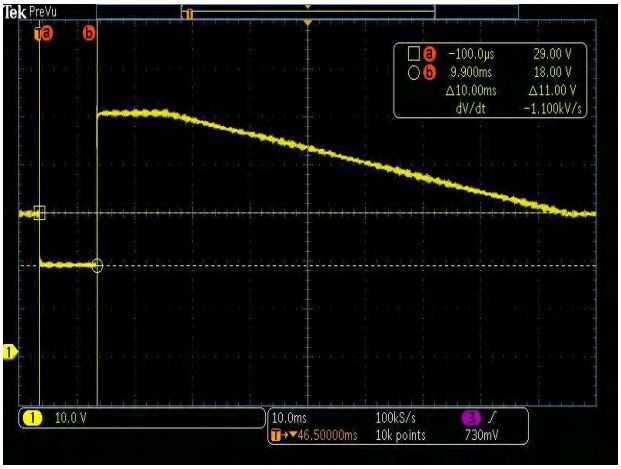
Combined Transient #	V1	T1 (mS)	V2	T2 (mS)	T3 (mS)	V3	T4 (mS)	T5 (mS)
QQ	29	<1	18	10	<1	50	12.5	70
RR	22	<1	18	10	<1	50	12.5	62.5



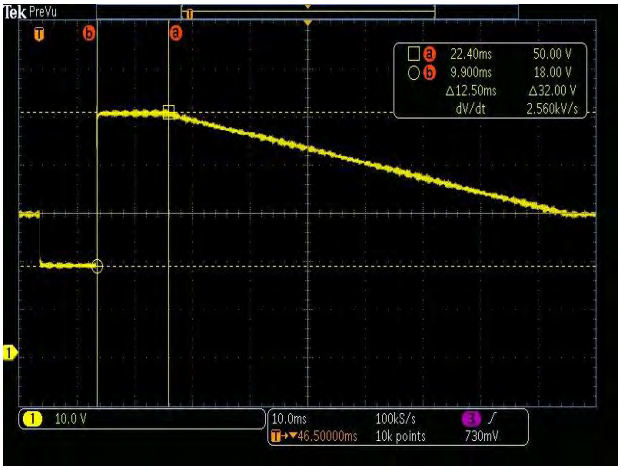
Calibration Waveforms (Combined Transients QQ & RR):



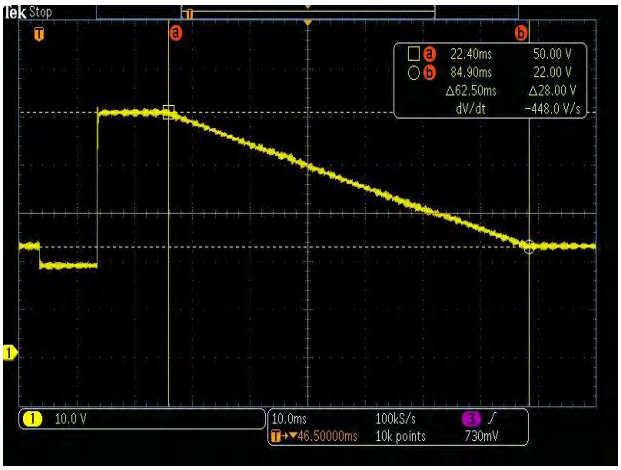
QQ - T5



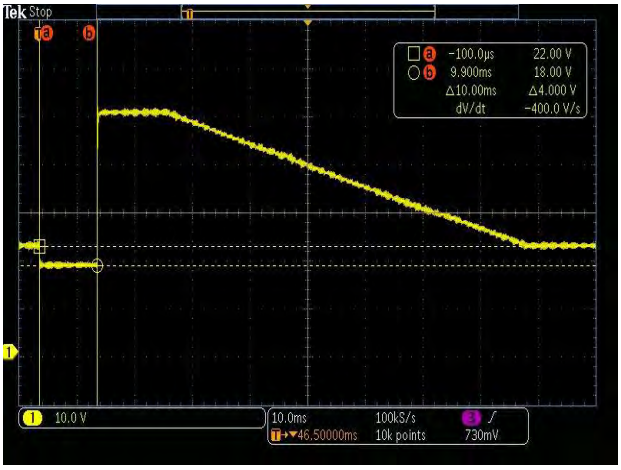
QQ - V2 & T2



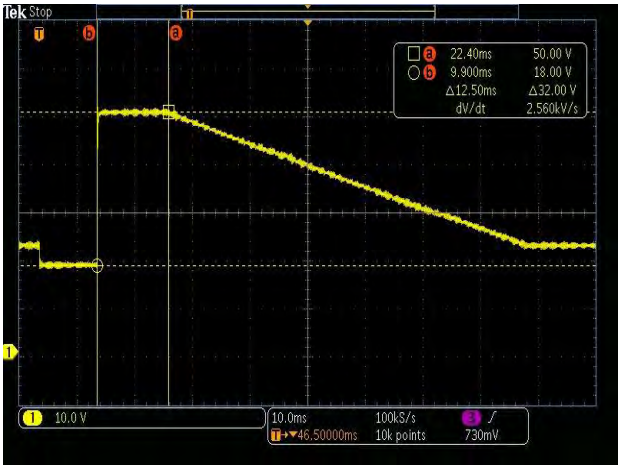
QQ - V3 & T4



RR - T5



RR - V2 & T2

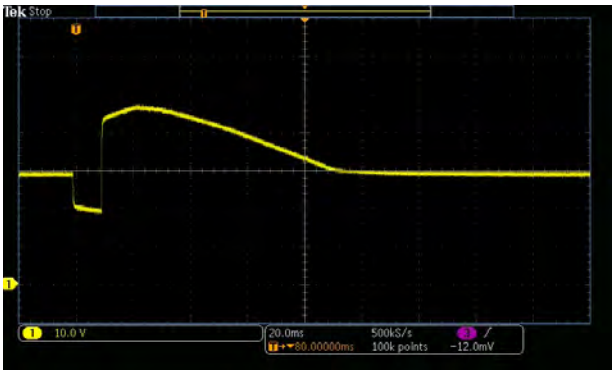


RR - V3 & T4

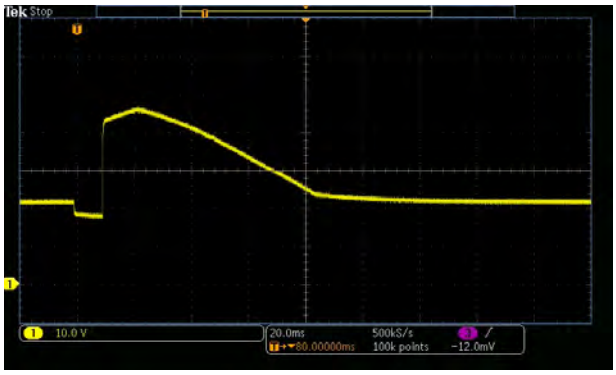
Test Results (Combined Transients QQ & RR):

Combined Transient #	V1	T1 (mS)	V2	T2 (mS)	T3 (mS)	V3	T4 (mS)	T5 (mS)	EUT Observation	Result
QQ	29	<1	18	10	<1	50	12.5	70	None	**PASS**
RR	22	<1	18	10	<1	50	12.5	62.5	None	**PASS**

Test Waveforms (Combined Transients QQ & RR):



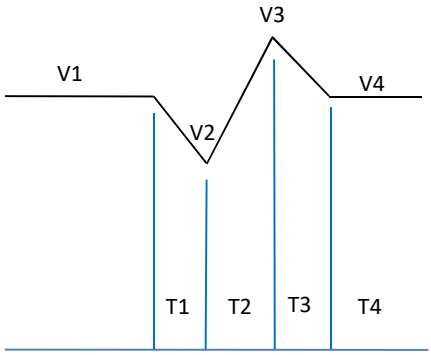
QQ - Test



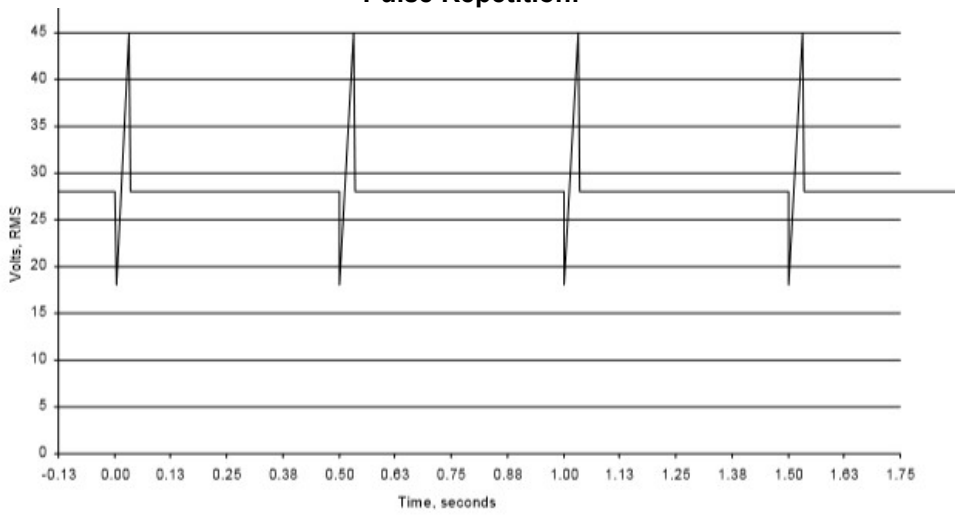
RR - Test

Test Specification & Results (Repetitive Normal Transients):

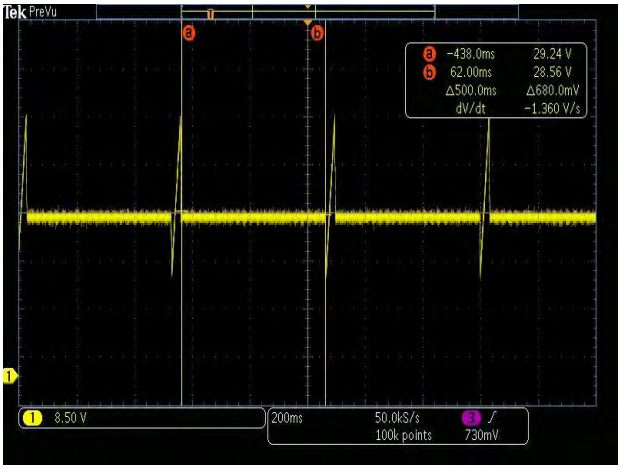
V1	T1 (mS)	V2	T2 (mS)	V3	T3 (mS)	V4	Rep. Separation (S)	Duration (min.)	EUT Observation	Result
28.5	2.5	18	30	45	2.5	28.5	0.5	30	None	**PASS**



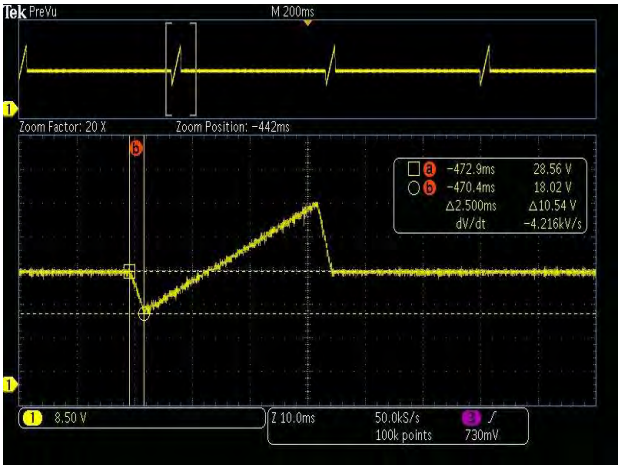
Pulse Repetition:



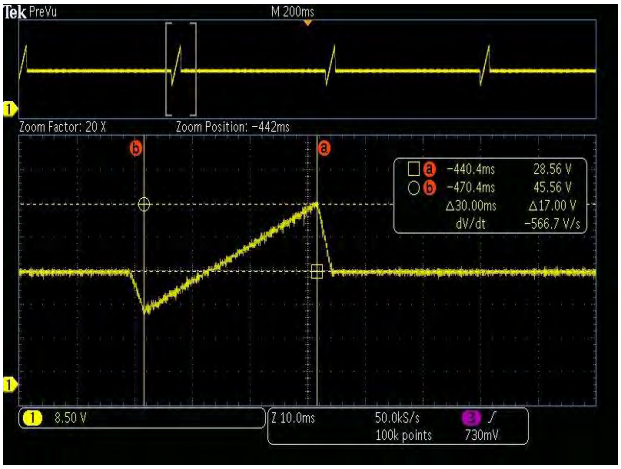
Calibration Waveforms (Repetitive Normal Transients):



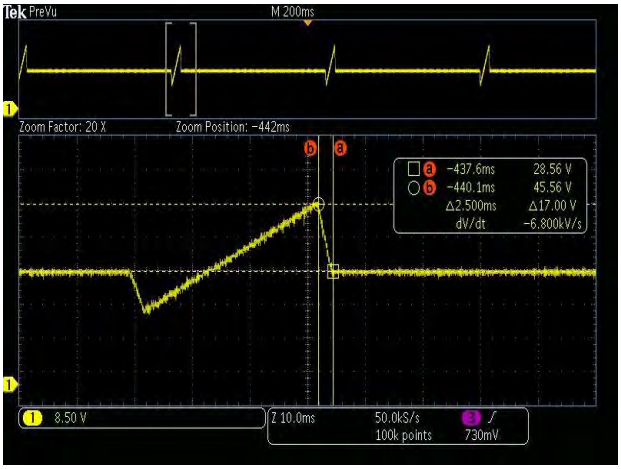
Repetitive Normal Transient - Rep Separation



Repetitive Normal Transient - V1, T1, V2

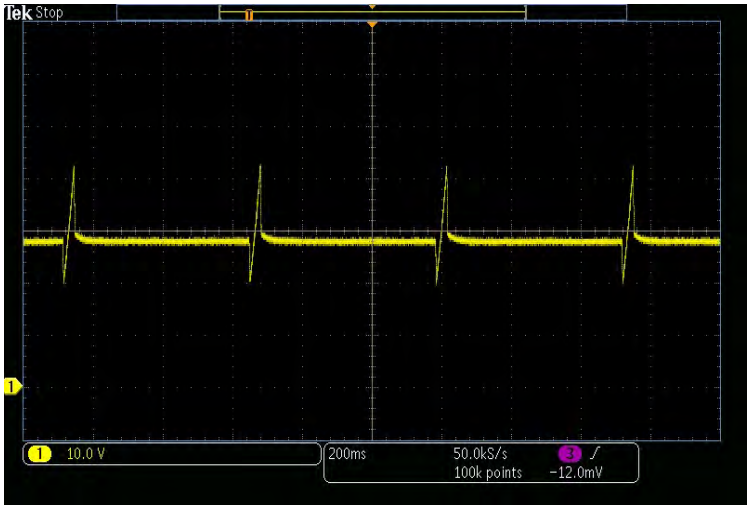


Repetitive Normal Transient - V2, T2, V3



Repetitive Normal Transient - V3, T3, V4

Test Waveforms (Repetitive Normal Transients):



Repetitive Normal Transient Test

LDC201 (Power Interrupt) Data Sheet

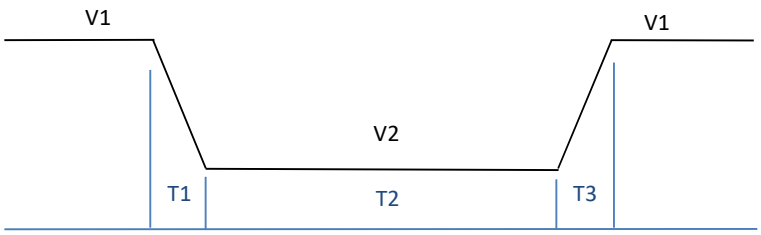
Job Number:	PR131850	**Date:**	4/12/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC201
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

LDC201 Pass / Fail Criteria:
The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for transfer aircraft electrical conditions when subjected to power interrupts as specified by MIL-STD-F. The utilization equipment must not suffer damage or cause an unsafe condition. The utilization equipment must maintain the specified performance during power interrupts. Unless otherwise specified in the utilization equipment performance specification document, the utilization equipment must automatically return to the performance specified for normal aircraft electrical conditions when the power returns to within normal limits. **The Amphenol Aerospace 19CD0002 SwitchBox must continue to operate normally during all power interruptions with a duration of 50ms or less.**

Note: The SwitchBox was tested with a Vishay VS-T110HF10 diode in series with the +28V power input line.

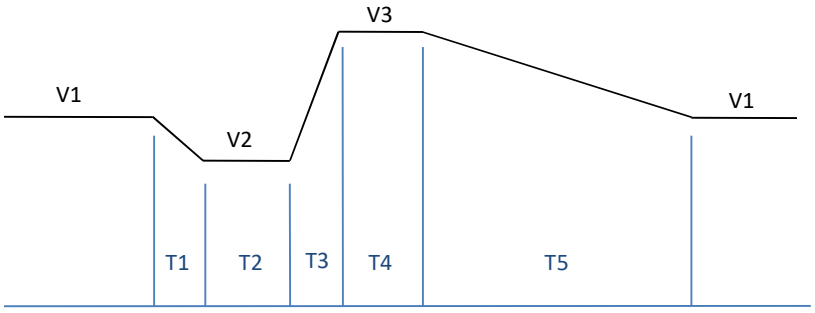
LDC201 Test Specification (Test Conditions A – J):

Test Condition	V1	T1 (mS)	V2	T2 (mS)	T3 (mS)	Repetitions
A	28	<0.25	0	50	<0.25	5
B	22	<0.25	0	50	<0.25	5
C	29	<0.25	0	50	<0.25	5
D	28	<0.25	0	30	<0.25	5
E	22	<0.25	0	30	<0.25	5
F	29	<0.25	0	30	<0.25	5
G	28	<0.25	0	10	<0.25	5
H	22	<0.25	0	10	<0.25	5
I	29	<0.25	0	10	<0.25	5
J	28	<0.25	0V, 3x, @ 0.5mS	50	<0.25	5

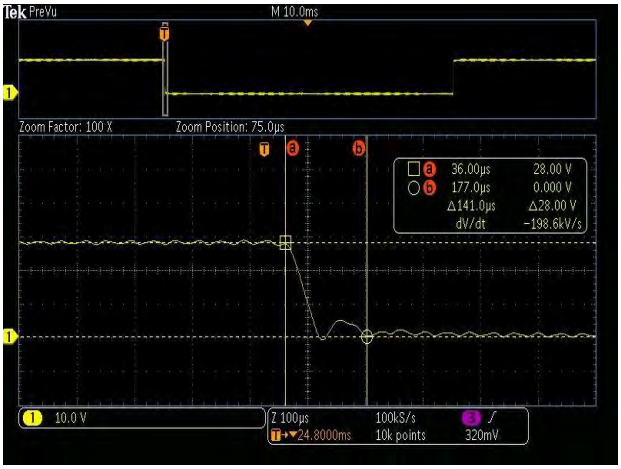


LDC201 Test Specification (Test Conditions K - L):

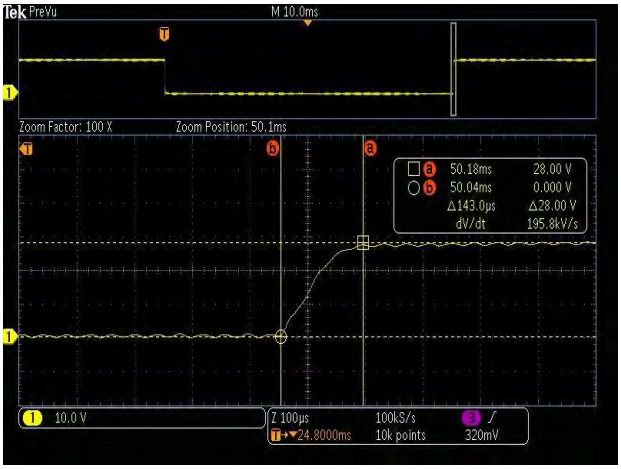
Test Condition	V1	T1 (mS)	V2	T2 (mS)	T3 (mS)	V3	T4 (mS)	T5 (mS)
K	28	<0.25	0	50	<0.25	50	12.5	70
L	28	<0.25	0	50	<0.25	18	15	85



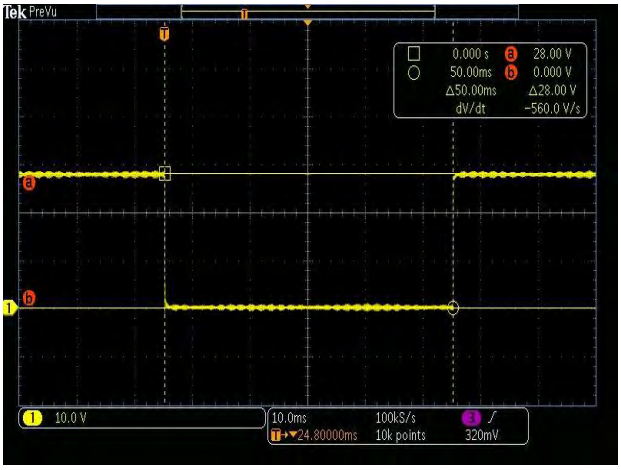
Calibration Waveforms:



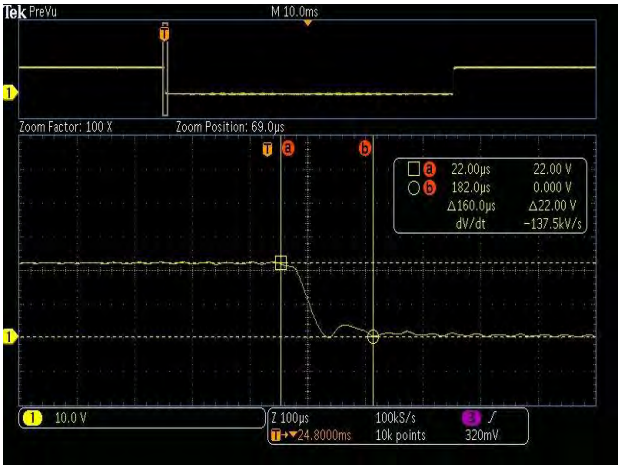
A - T1



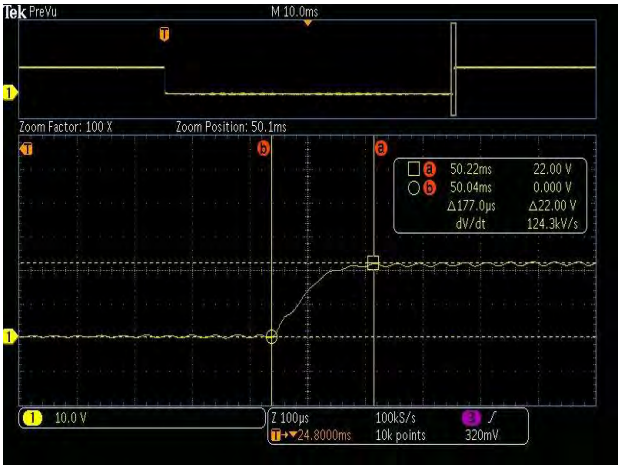
A - T3



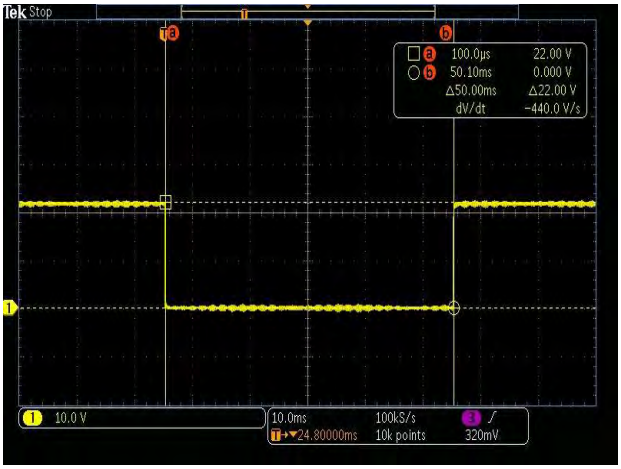
A - V2 & T2



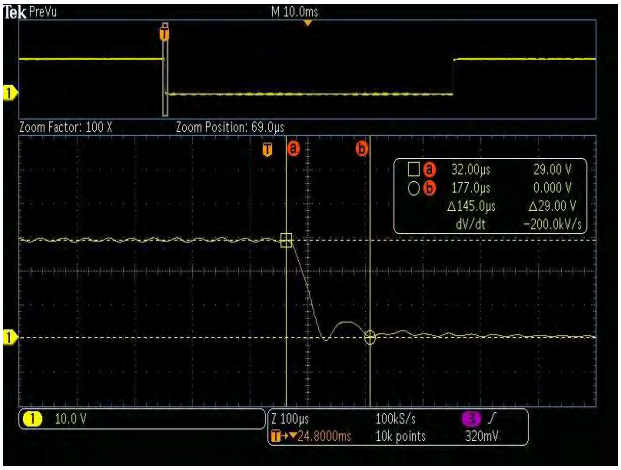
B - T1



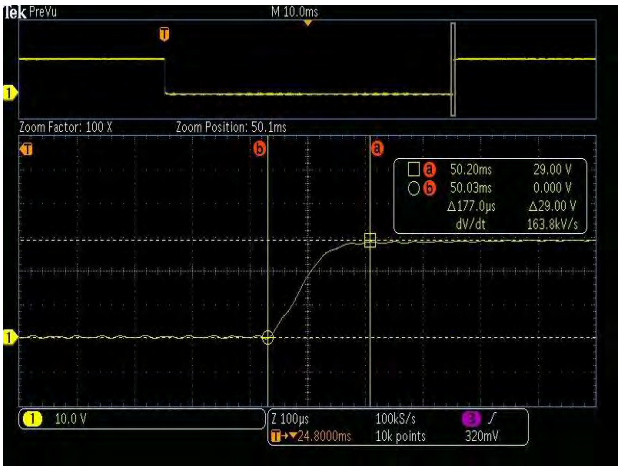
B - T3



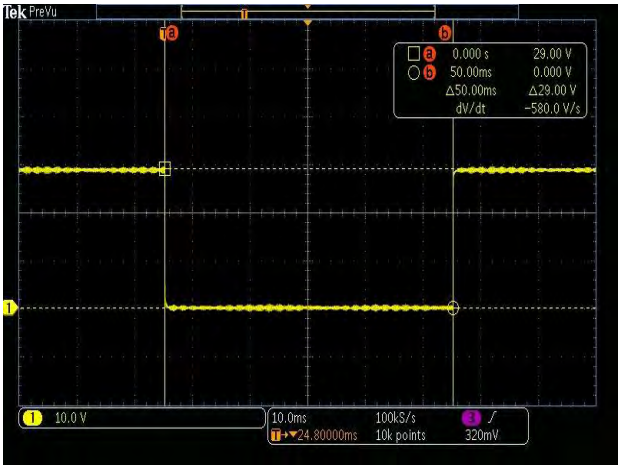
B - V2 & T2



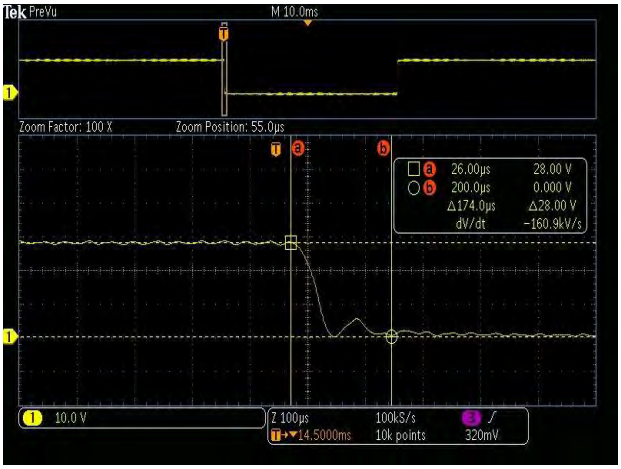
C - T1



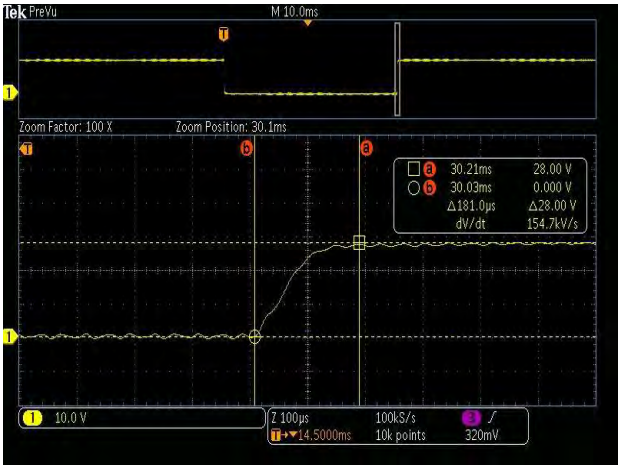
C - T3



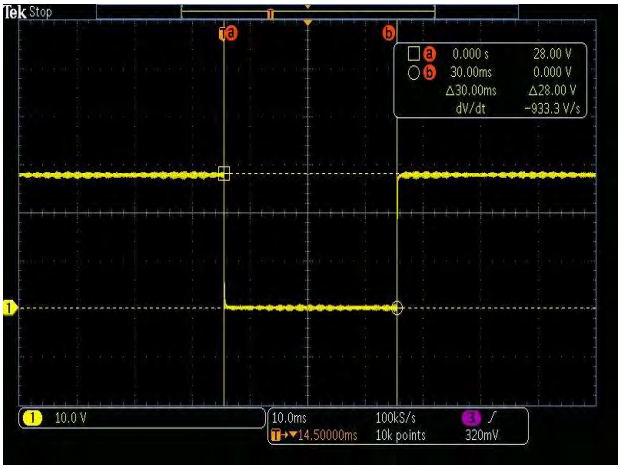
C - V1, V2 & T2



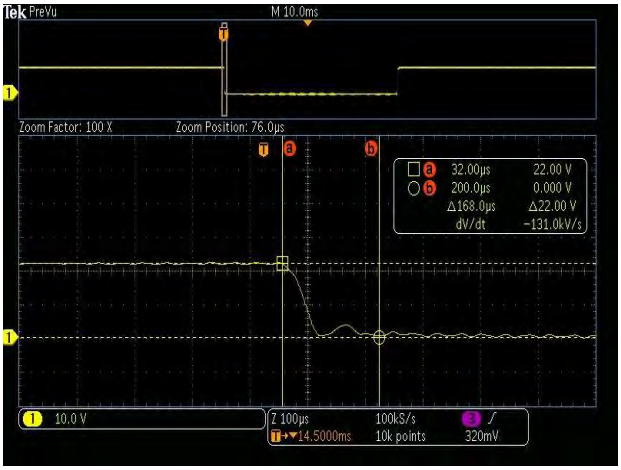
D - T1



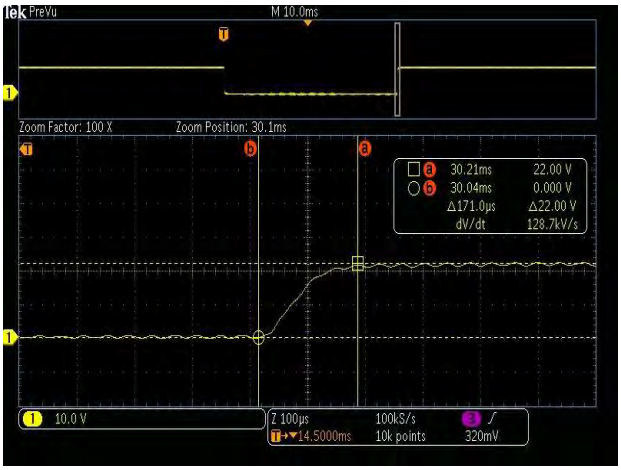
D - T3



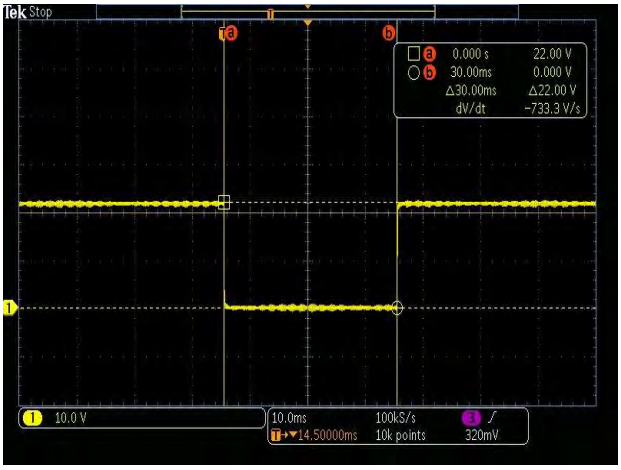
D - V1, V2 & T2



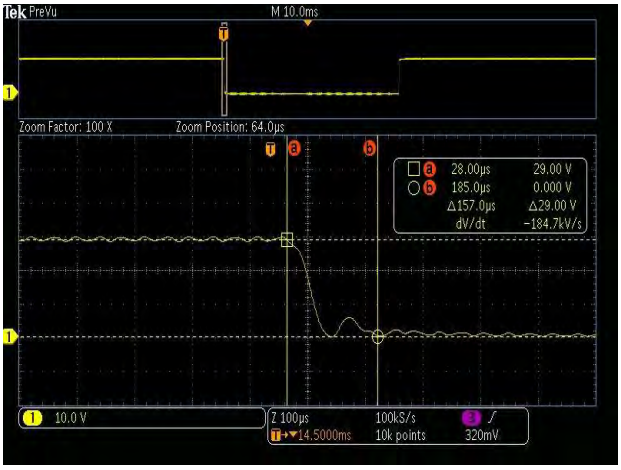
E - T1



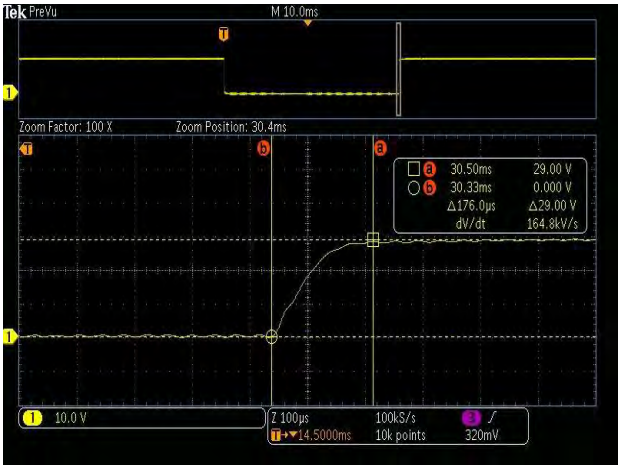
E - T3



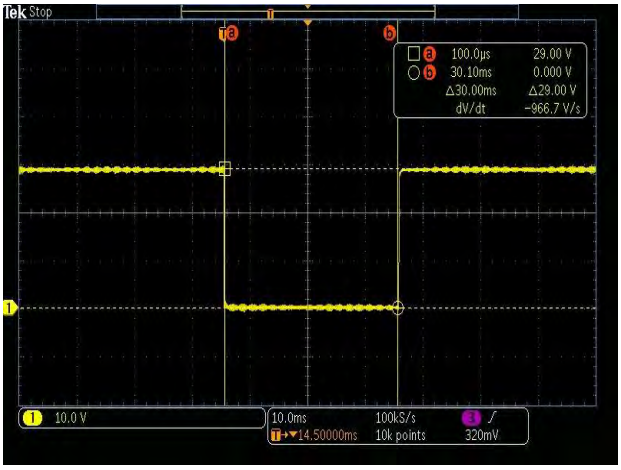
E - V1, V2 & T2



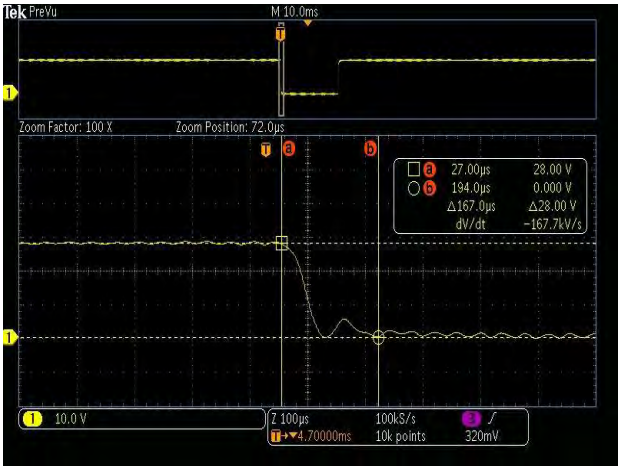
F - T1



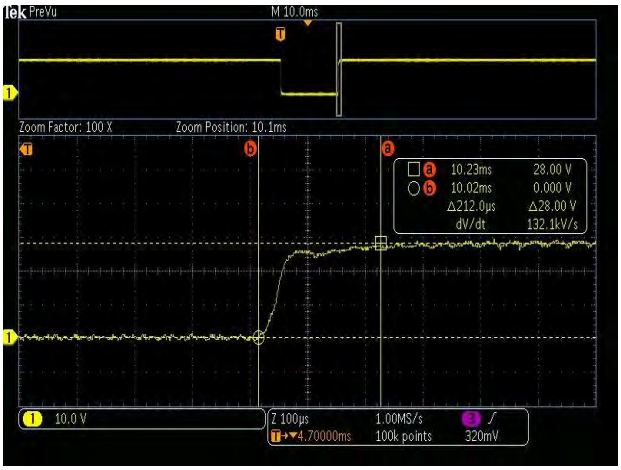
F - T3



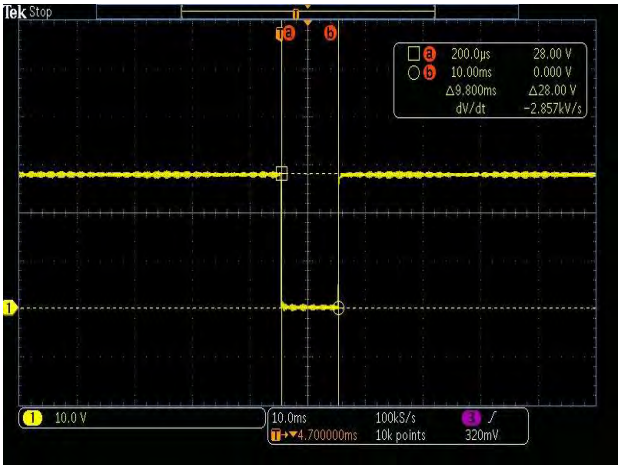
F - V1, V2 & T2



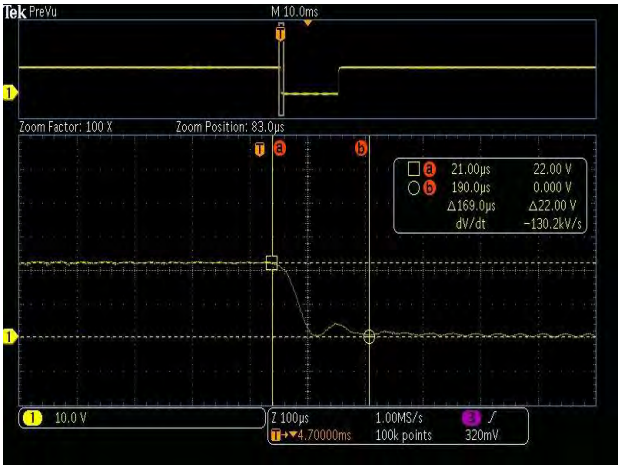
G - T1



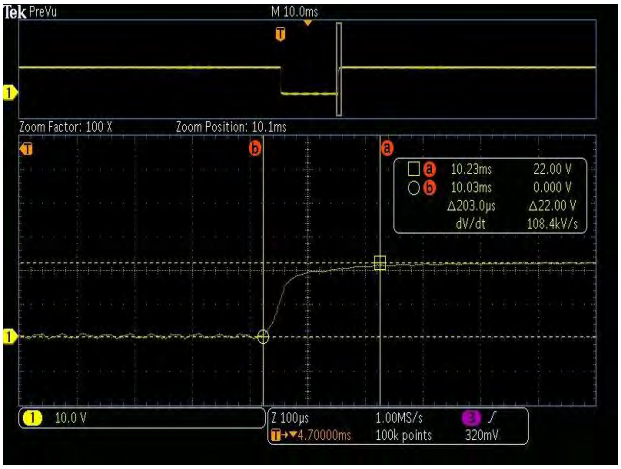
G - T3



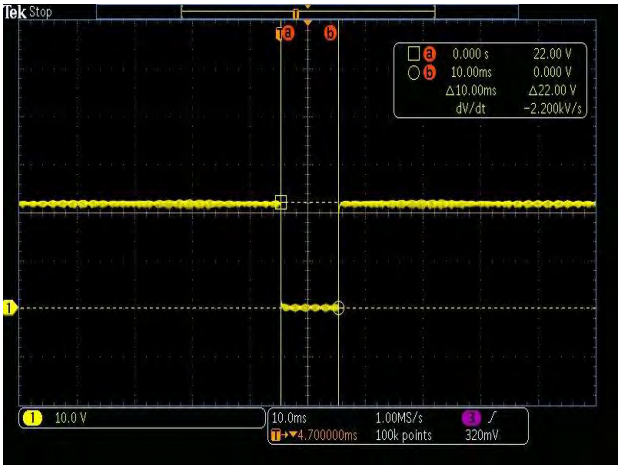
G - V1, V2 & T2



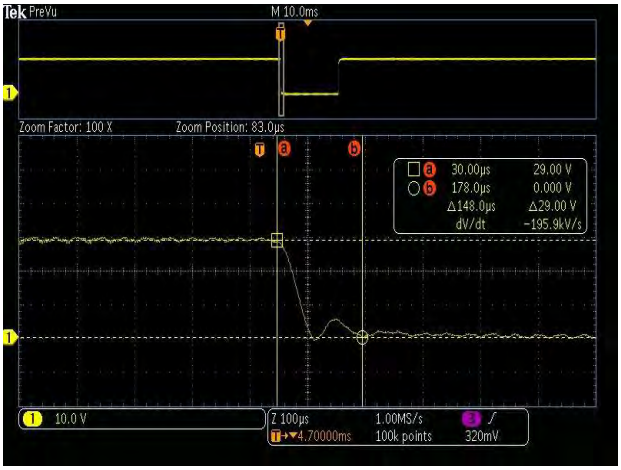
H - T1



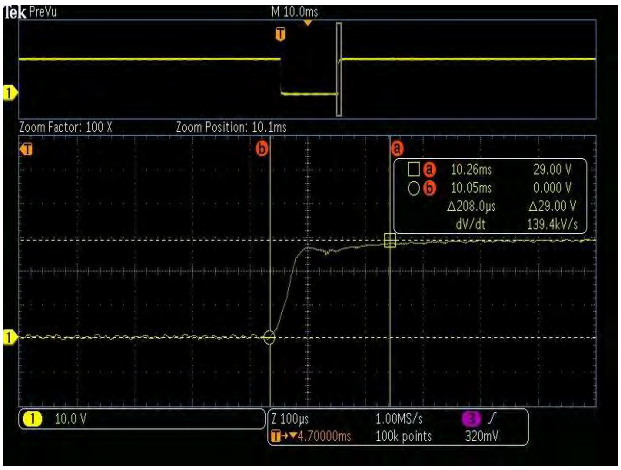
H - T3



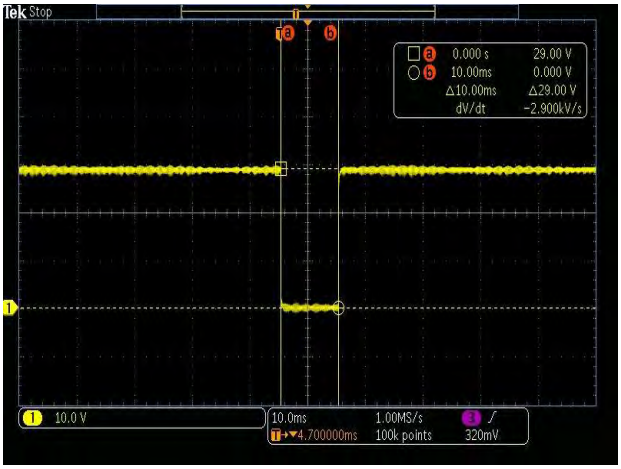
H - V1, V2 & T2



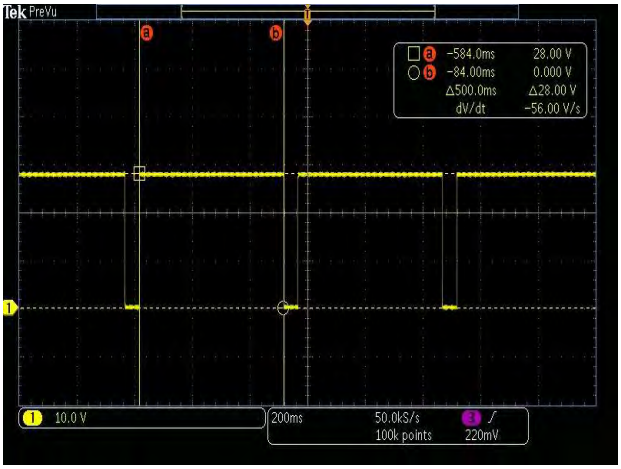
I - T1



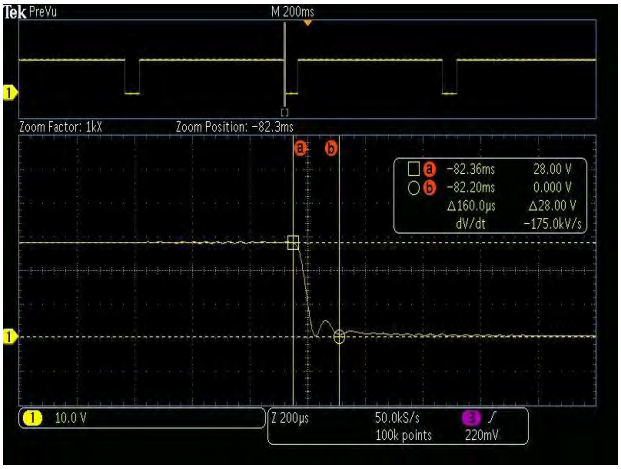
I - T3



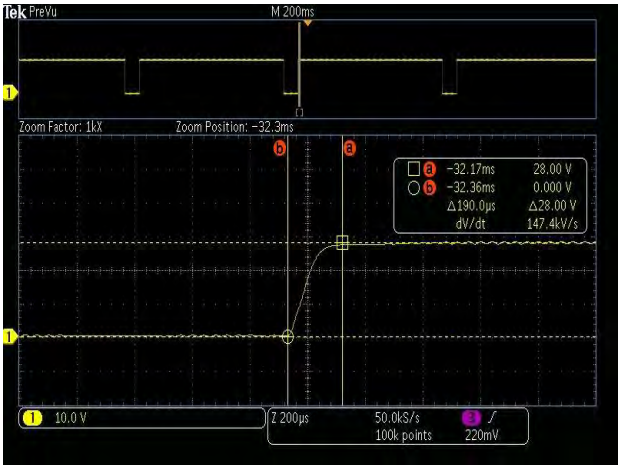
I - V1, V2 & T2



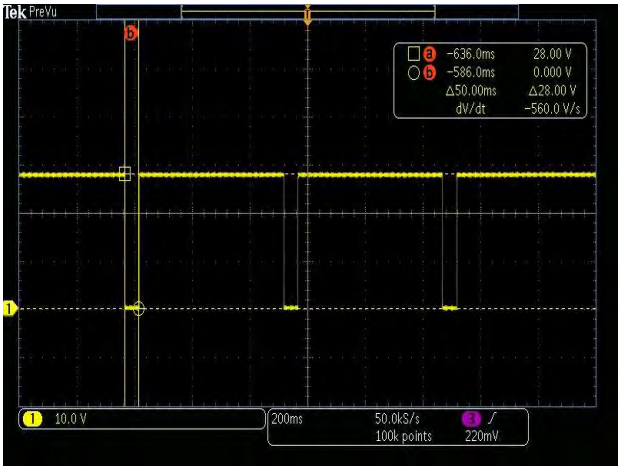
J - Repetition Separation



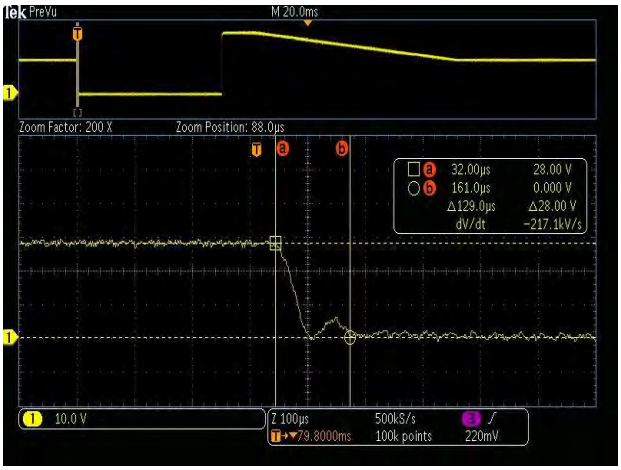
J - T1



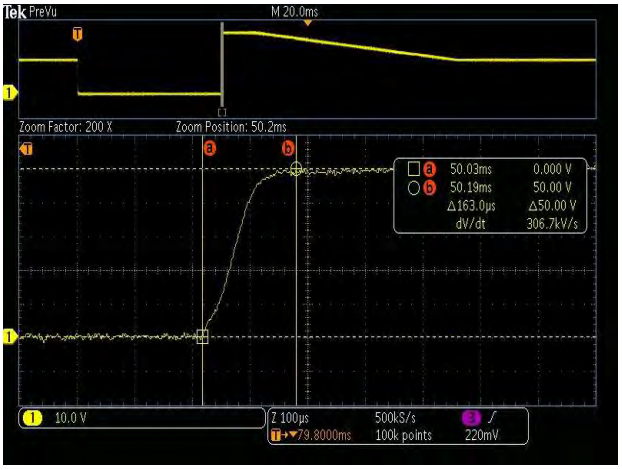
J - T3



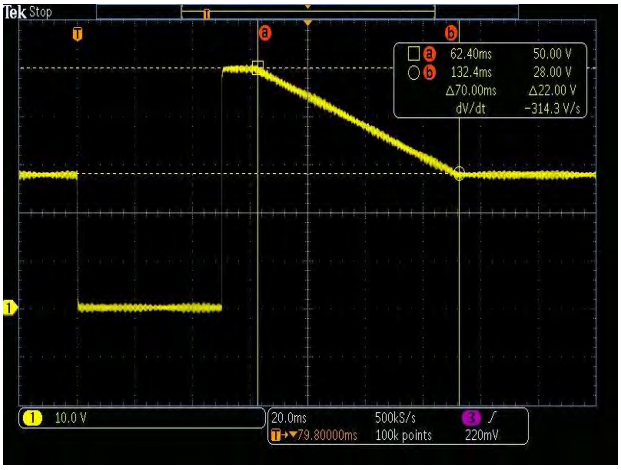
J - V1, V2, T3



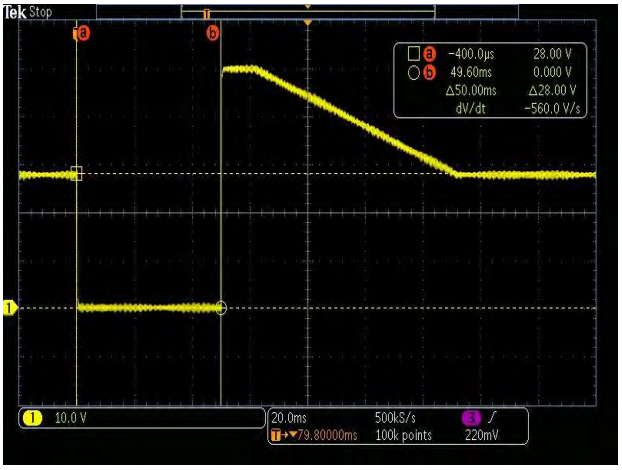
K - T1



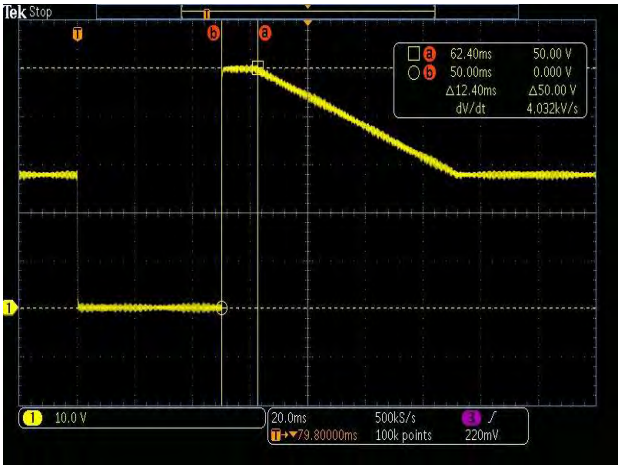
K - T3



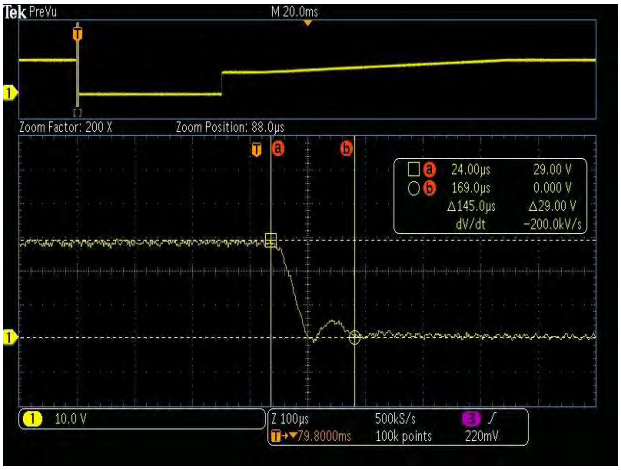
K - T5



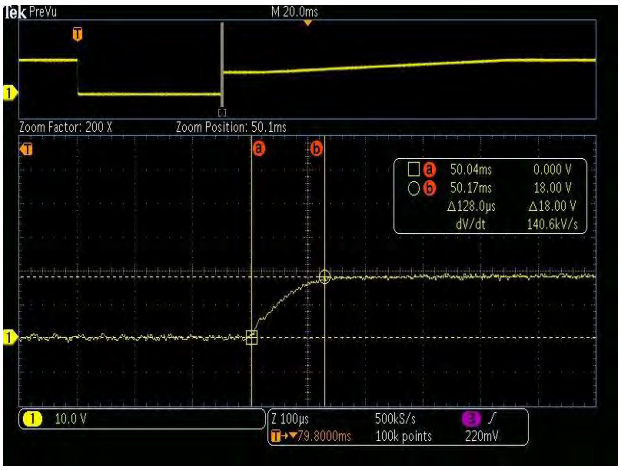
K - V1, V2, T2



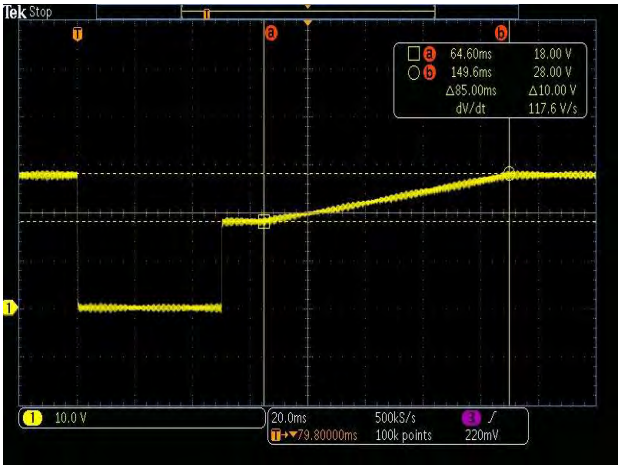
K - V3, T4



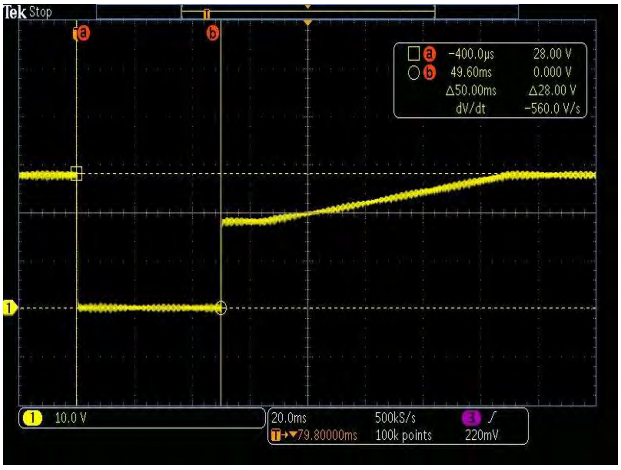
L - T1



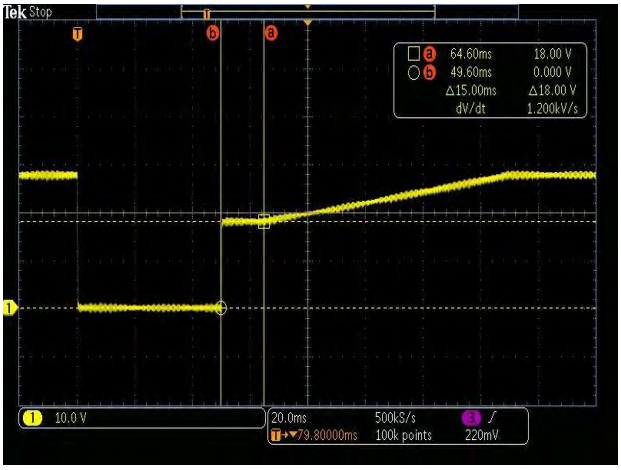
L - T3



L - T5



L - V1, V2, T2



L - V3, T4

LDC201 Test Results (Test Conditions A - J):

Test Condition	V1	T1 (mS)	V2	T2 (mS)	T3 (mS)	Reps.	EUT Observation	Result
A	28	<0.25	0	50	<0.25	5	Note 1	PASS
B	22	<0.25	0	50	<0.25	5	Note 1, 2	FAIL
C	29	<0.25	0	50	<0.25	5	Note 1	PASS
D	28	<0.25	0	30	<0.25	5	Note 1	PASS
E	22	<0.25	0	30	<0.25	5	Note 1	PASS
F	29	<0.25	0	30	<0.25	5	Note 1	PASS
G	28	<0.25	0	10	<0.25	5	Note 1	PASS
H	22	<0.25	0	10	<0.25	5	Note 1	PASS
I	29	<0.25	0	10	<0.25	5	Note 1	PASS
J	28	<0.25	0V, 3x, @ 0.5mS	50	<0.25	5	Note 1	PASS

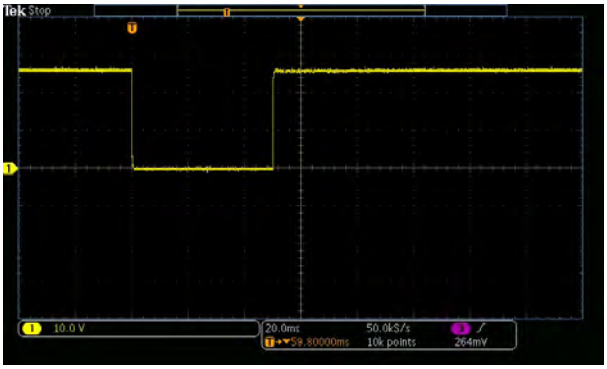
Note 1: Tested with a Vishay VS-T110HF10 diode in series with the +28V power input line.
Note 2: EUT powered off momentarily and then rebooted to login prompt.

LDC201 Test Results (Test Conditions J – L)

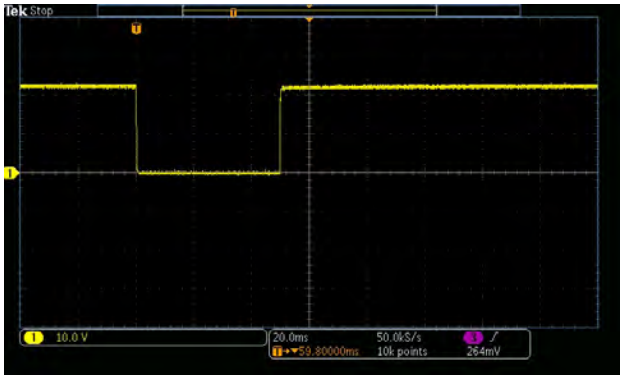
Test Condition	V1	T1 (mS)	V2	T2 (mS)	T3 (mS)	V3	T4 (mS)	T5 (mS)	EUT Observation	Result
K	28	<0.25	0	50	<0.25	50	12.5	70	Note 1	PASS
L	28	<0.25	0	50	<0.25	18	15	85	Note 1	PASS

Note 1: EUT powered off momentarily and then rebooted to login prompt.

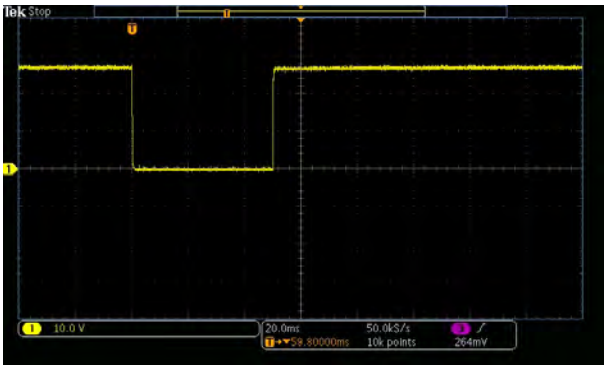
Test Waveforms:



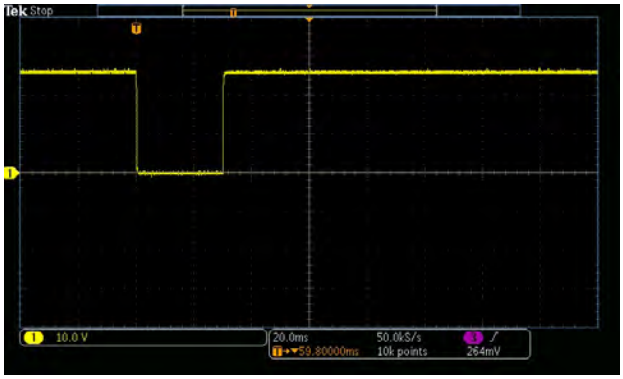
01 - LDC201, Condition A



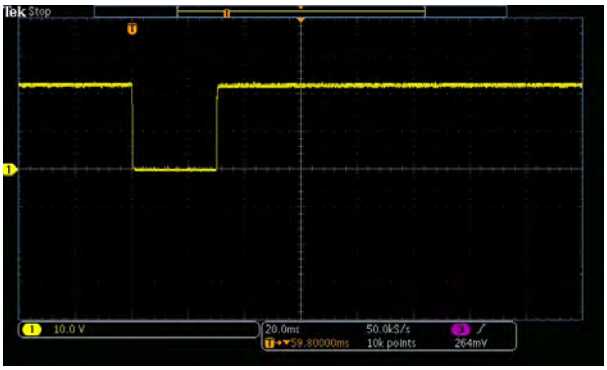
02 - LDC201, Condition B



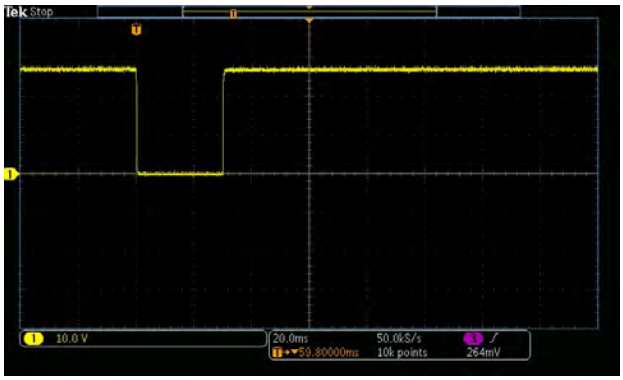
03 - LDC201, Condition C



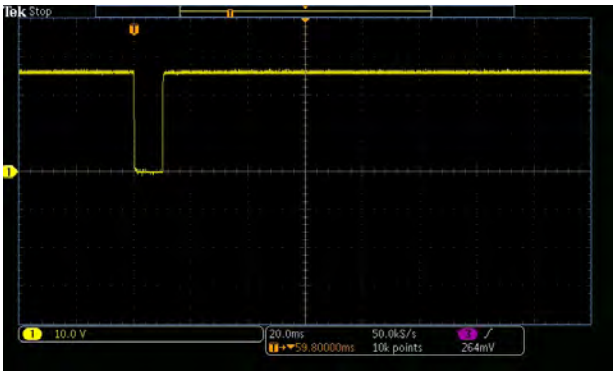
04 - LDC201, Condition D



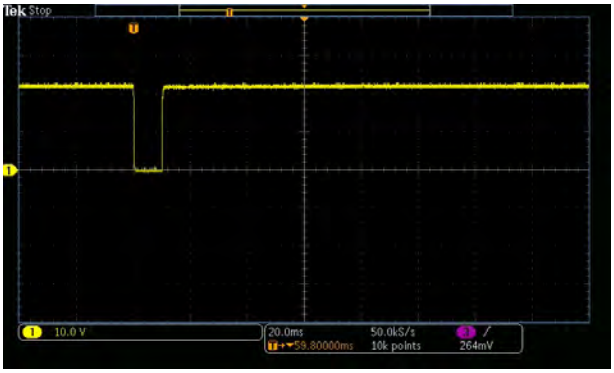
04 - LDC201, Condition E



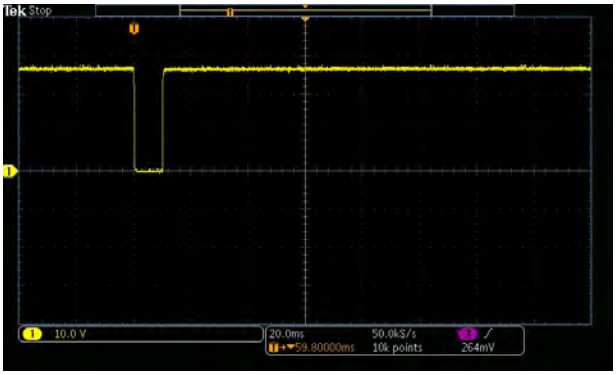
05 - LDC201, Condition F



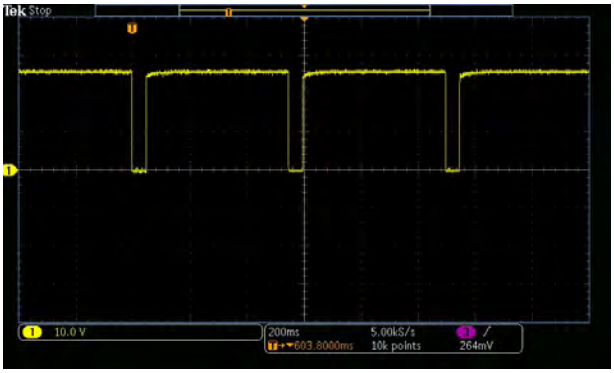
06 - LDC201, Condition G



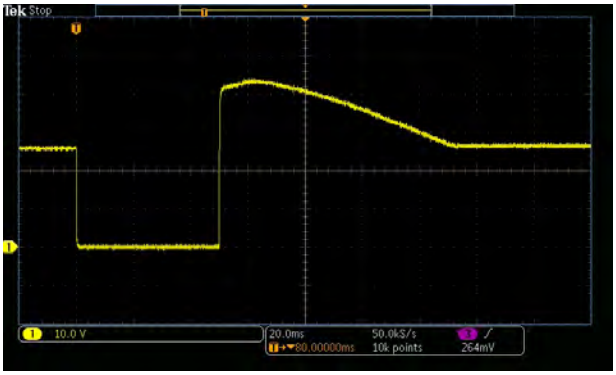
07 - LDC201, Condition H



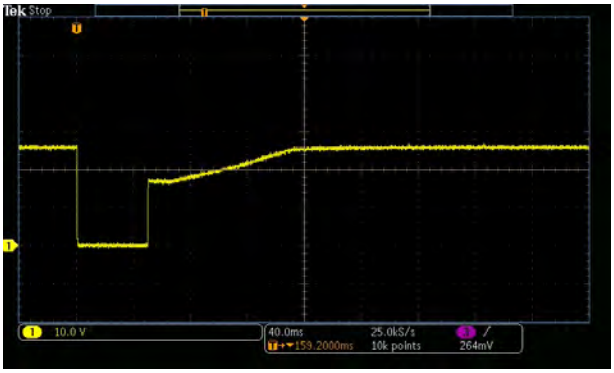
08 - LDC201, Condition I



09 - LDC201, Condition J



10 - LDC201, Condition K



11 - LDC201, Condition L

LDC301 (Abnormal Steady State Limits for Voltage) Data Sheet

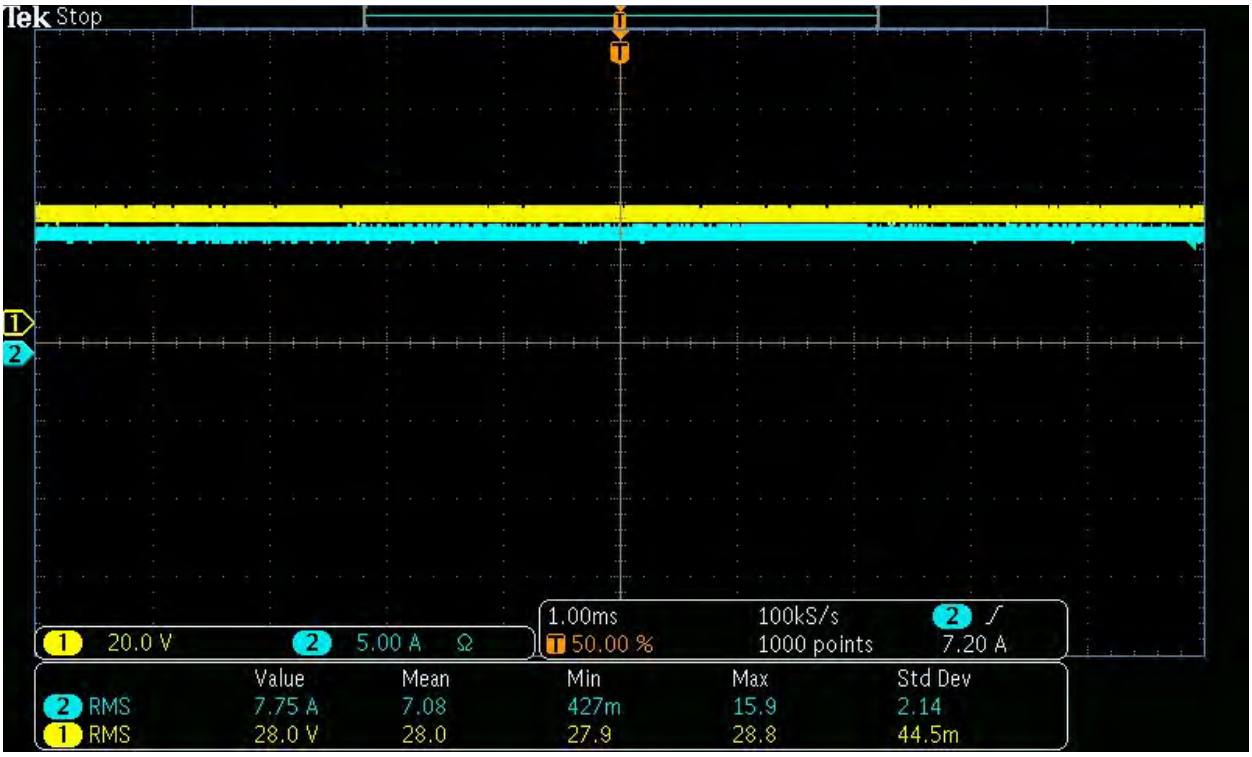
Job Number:	PR131850	**Date:**	3/29/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC301
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

LDC301 Test Specification:

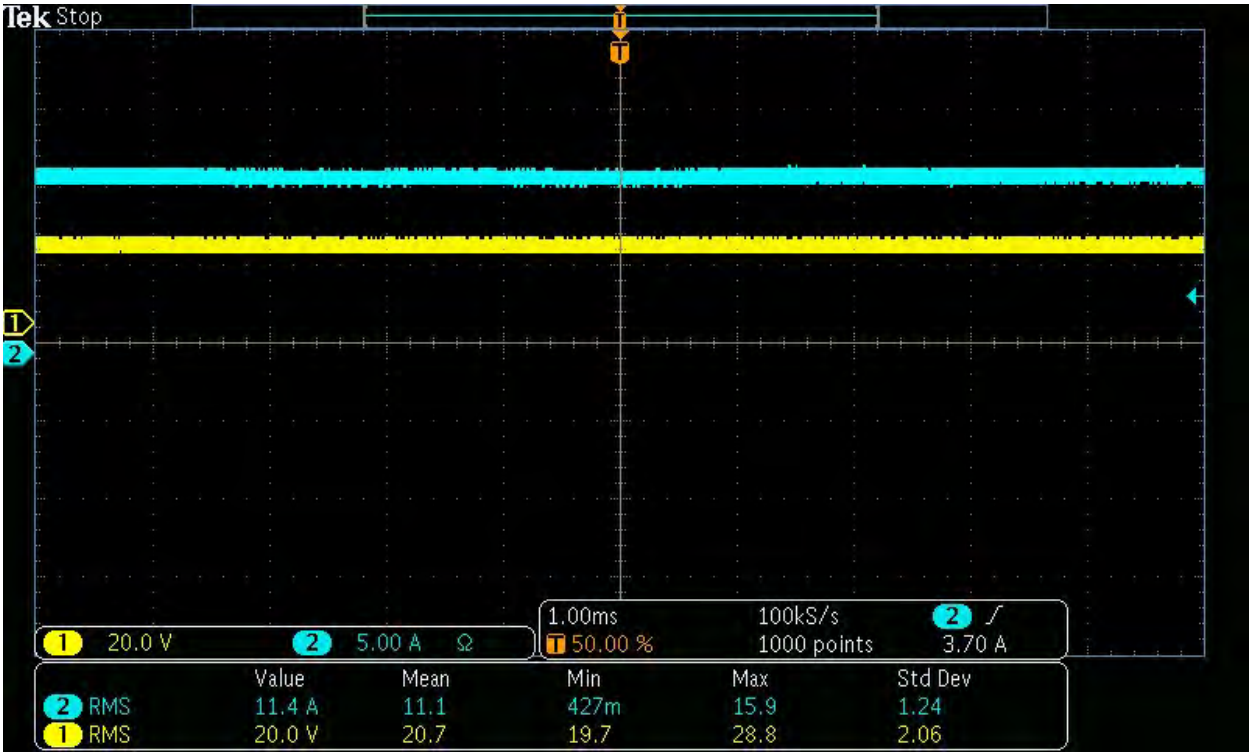
Test Condition	Abnormal Limit	Voltage (VDC) or Event
A	Nominal	28.0
B	ALSS	20.0
B1	ALSS	20.0V Restart Operation
C	AHSS	31.5
C1	AHSS	31.5V Restart Operation

LDC301 Test Results:

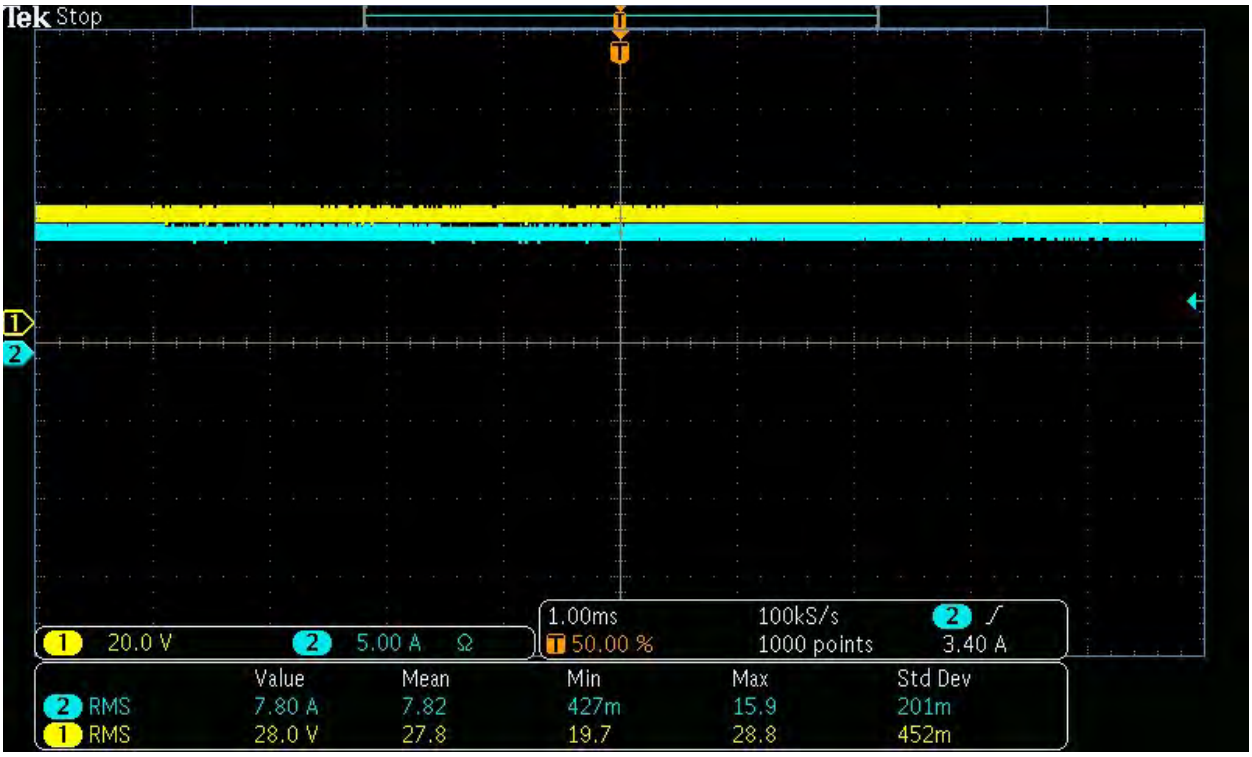
Test Condition	Abnormal Limit	Measured Voltage (VDC) or Event	Measured Current (A)	Duration (Minutes)	Result (Pass / Fail)
A	Nominal	28.0	7.75	30	**PASS**
B	ALSS	20.0	11.4	30	**PASS**
B1	ALSS	20.0V Restart Operation	-	-	**PASS**
A	Nominal	28.0	7.8	-	**PASS**
C	AHSS	31.5	6.9	30	**PASS**
C1	AHSS	31.5V Restart Operation	-	-	**PASS**
A	Nominal	28.0	7.83	30	**PASS**



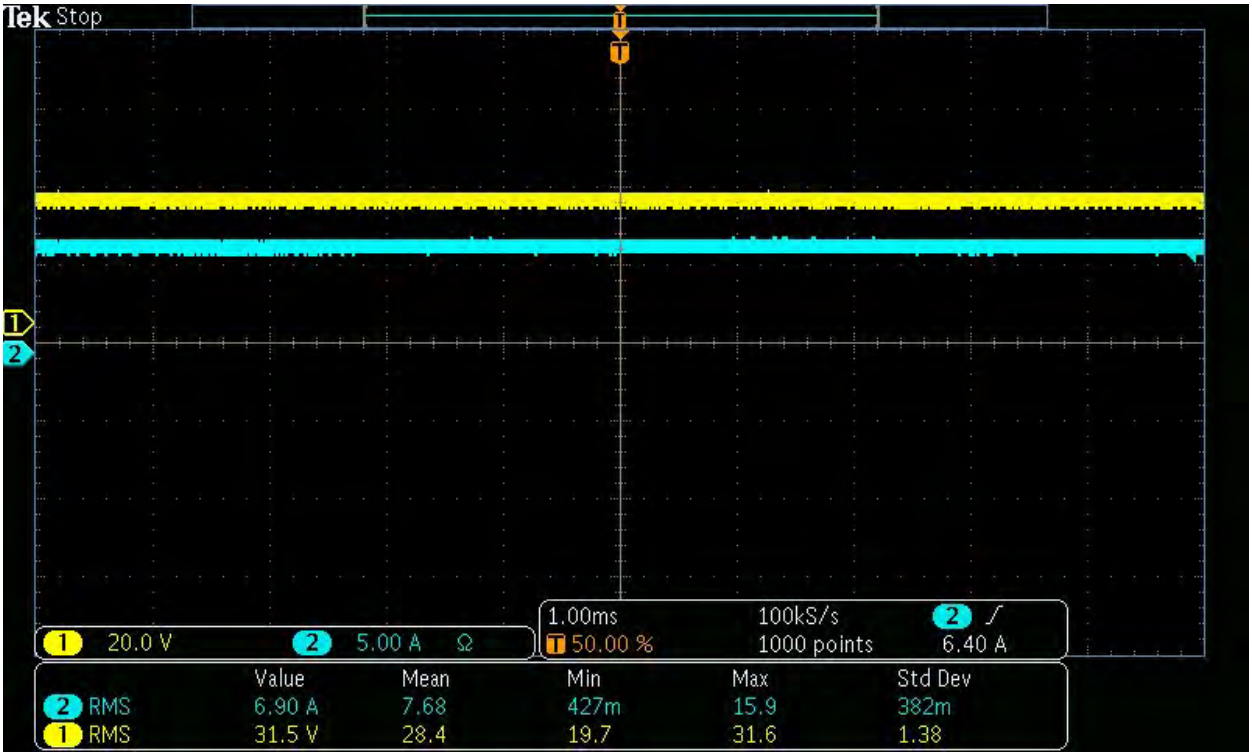
LDC102 28V Nominal



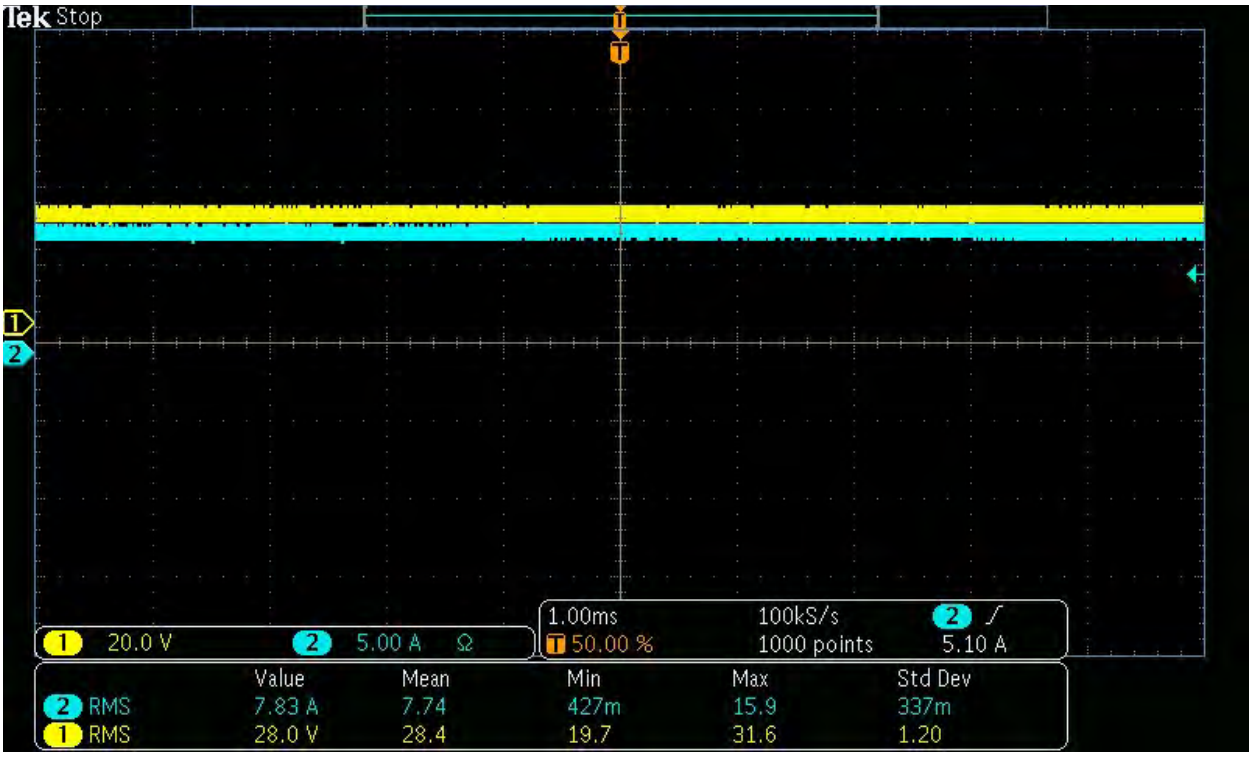
LDC102 20V



LDC102 28V Nominal



LDC102 31.5V



LDC102 28V Nominal

LDC102 31.5V

LDC302 (Abnormal Voltage Transients) Data Sheet

Job Number:	PR131850	**Date:**	4/12/21, 4/13/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC302
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

LDC302 Pass / Fail Criteria:
The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for abnormal aircraft electrical conditions when subjected to voltage transients within the abnormal limits of MIL-STD-704F. Unless otherwise specified in the utilization equipment performance specification document, the utilization equipment must automatically return to the performance specified for normal aircraft electrical conditions when the power returns to within normal limits. The utilization equipment must not suffer damage or cause an unsafe condition.

Test Specification & Results (Overvoltage Transients AAA - FFF):

Overvoltage Transient #	Steady State Voltage	Time From Steady State Voltage to Voltage Transient Level (mS)	Voltage Transient Level (V_{DC})	Duration at Voltage Transient Level (mS)	Time from Voltage Transient Level to Steady State Voltage or Next Voltage Level	Reps.	Result	Note
AAA	29	<1	50	50	<1 mS	5	**PASS**	1
BBB	29	<1	50	50	15 mS	5	**PASS**	1
		then	45	decreasing	30 mS			
		then	40	decreasing	60 mS			
		then	35	decreasing	4.85 S			
		then	30	decreasing	1 mS			
		then	29	decreasing	-			
CCC	29	<1	50 (3 Times)	50, Every 0.5 Sec.	<1	5	**PASS**	1
DDD	22	<1	50	50	<1 mS	5	**PASS**	1
EEE	22	<1	50	50	15 mS	5	**PASS**	1
		then	45	decreasing	30 mS			
		then	40	decreasing	60 mS			
		then	35	decreasing	4.85 S			
		then	30	decreasing	8 mS			
		then	22	-	-			
FFF	22	<1	50 (3 Times)	50, Every 0.5 Sec.	<1	5	**PASS**	1

Note 1: EUT was not affected by event.

Test Specification & Results (Undervoltage Transients GGG - LLL):

Undervoltage Transient #	Steady State Voltage	Time From Steady State Voltage to Voltage Transient Level (mS)	Voltage Transient Level (V_{DC})	Duration at Voltage Transient Level (mS)	Time from Voltage Transient Level to Steady State Voltage or Next Voltage Level	Reps.	Result	Note
GGG	29	<1	7	50	<1 mS	5	**PASS**	1
HHH	29	<1	7	50	15 mS	5	**PASS**	2
		then	12	increasing	30 mS			
		then	17	increasing	60 mS			
		then	22	increasing	4.85			
		then	28	increasing	1 mS			
		then	29	increasing	-			
III	29	<1	7 (3 Times)	50, Every 0.5 Sec.	<1 mS	5	**PASS**	1
JJJ	22	<1	7	50	<1 mS	5	**PASS**	2
KKK	22	<1	7	50	15 mS	5	**PASS**	2
		then	12	increasing	30 mS			
		then	17	increasing	60 mS			
		then	22	increasing	-			
LLL	22	<1	7 (3 Times)	50, Every 0.5 Sec.	<1	5	**PASS**	2

Note 1: EUT was not affected by event.

Note 2: EUT powered off during the event and then automatically resumed normal operation when normal power was restored.

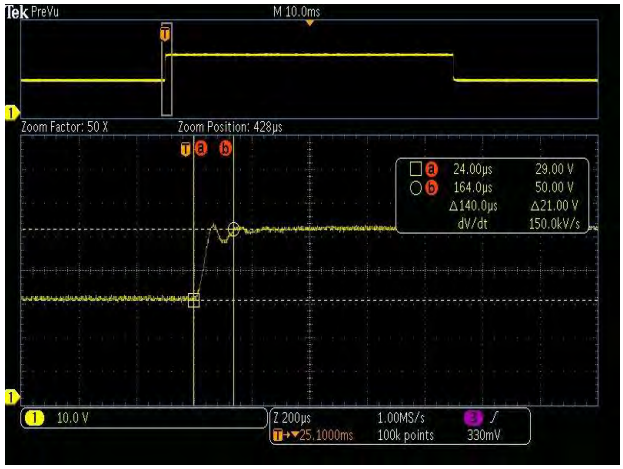
Test Specification & Results (Combined Transients MMM & NNN):

Combined Transient #	Steady State Voltage	Time From Steady State Voltage to Voltage Transient Level (mS)	Voltage Transient Level (V_{DC})	Duration at Voltage Transient Level (mS)	Time from Voltage Transient Level to Steady State Voltage or Next Voltage Level	Reps.	Result	Note
MMM	29	<1 <1	7 50	10 50	<1 mS 15 mS	5	**PASS**	1
		then	45	decreasing	30 mS			
		then	40	decreasing	60 mS			
		then	35	decreasing	4.85 S			
		then	30	decreasing	1 mS			
		then	29	-	-			
NNN	22	<1 <1	7 50	10 50	<1 mS 15 mS	5	**PASS**	1
		then	45	decreasing	30 mS			
		then	40	decreasing	60 mS			
		then	35	decreasing	4.85 S			
		then	30	decreasing	8 S			
		then	22	-	-			

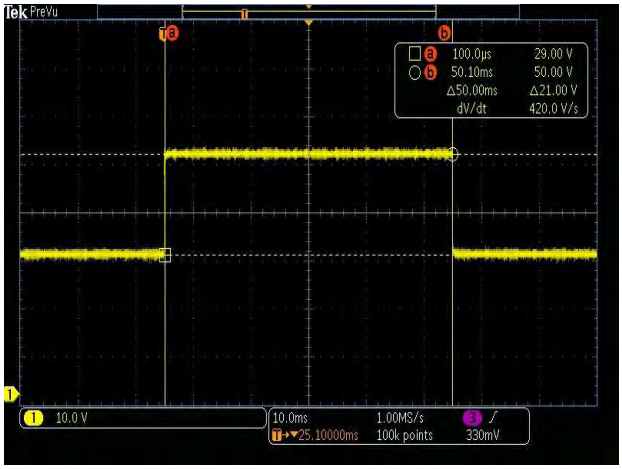
Note 1: EUT was not affected by event.

Note 2: EUT powered off during the event and then automatically resumed normal operation when normal power was restored.

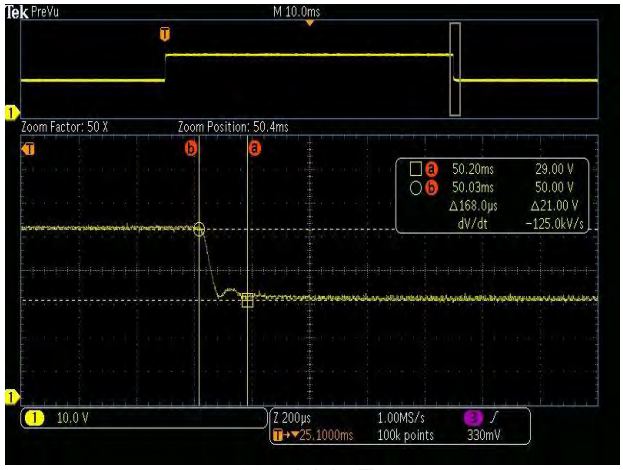
Calibration Waveforms:



01 - AAA, T1

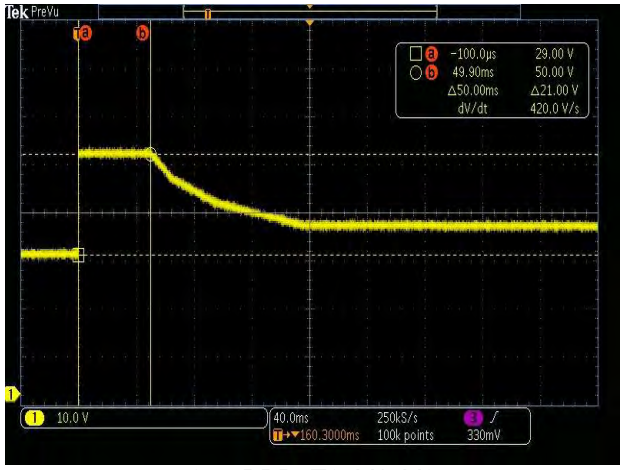


02 - AAA, T2, V1, V2

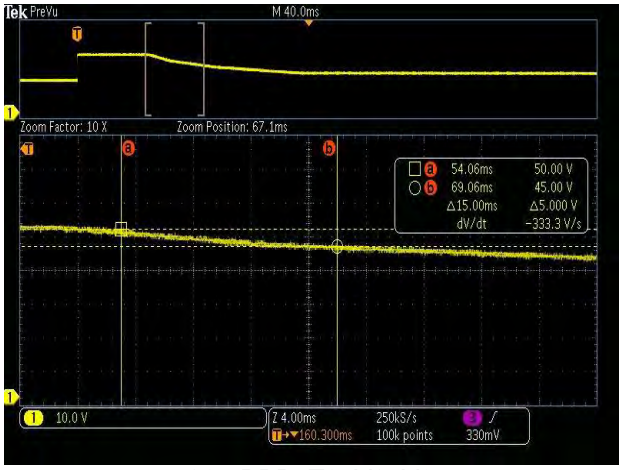


03 - AAA, T3

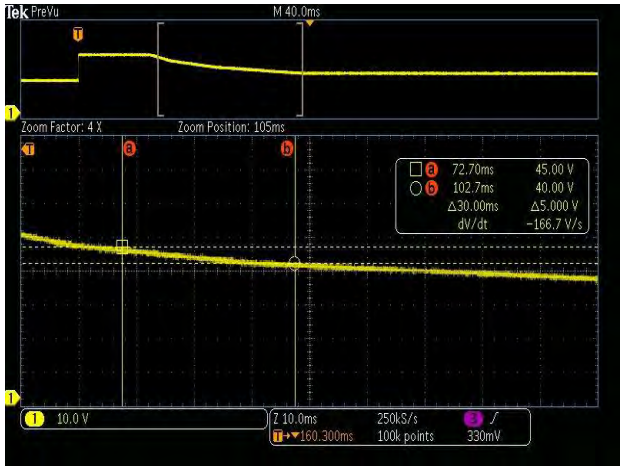
04 - BBB, T1



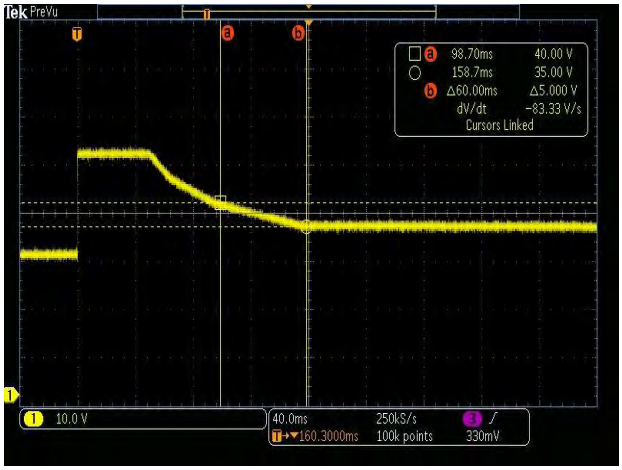
05 - BBB, T2, V1, V2



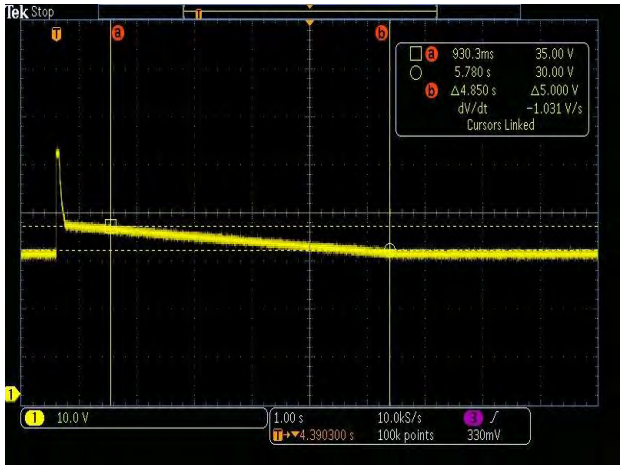
06 - BBB, T3, V2, V3



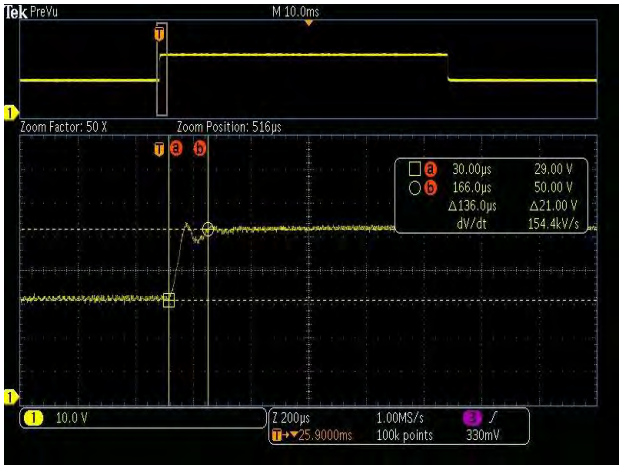
07 - BBB, T4, V3, V4



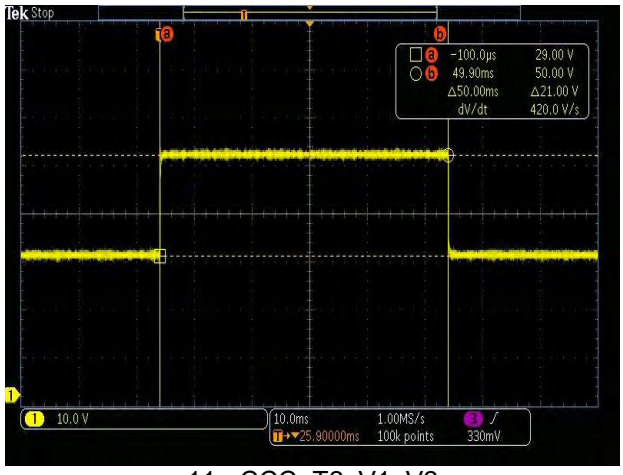
08 - BBB, T5, V4, V5



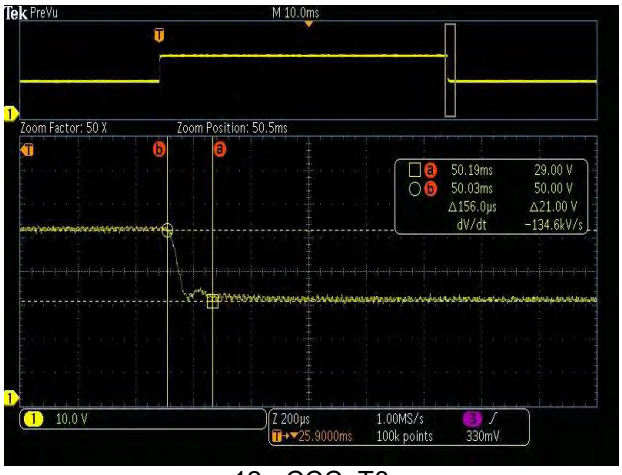
09 - BBB, T6, V5, V6



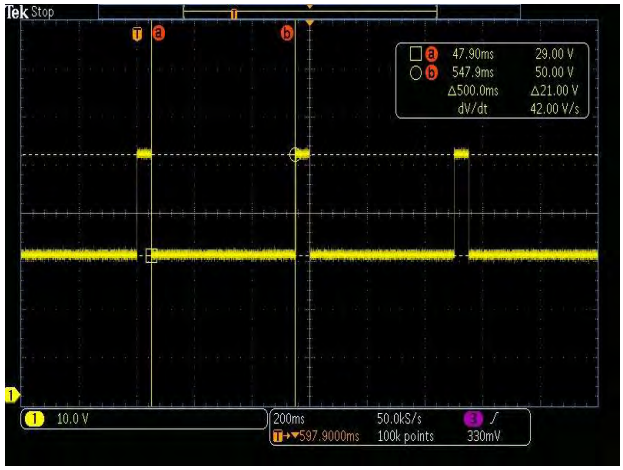
10 - CCC, T1



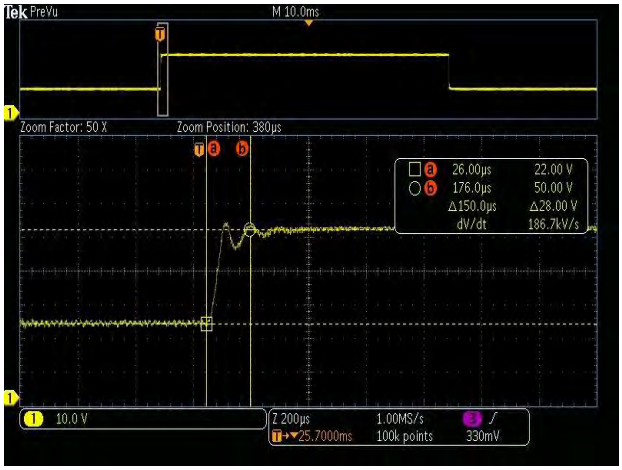
11 - CCC, T2, V1, V2



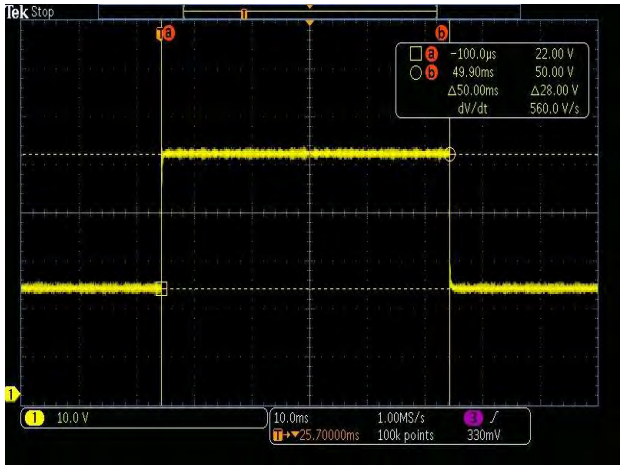
12 - CCC, T3



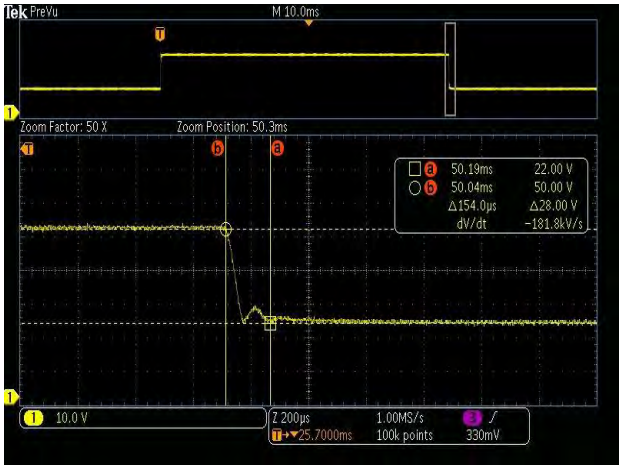
13 - CCC, Rep



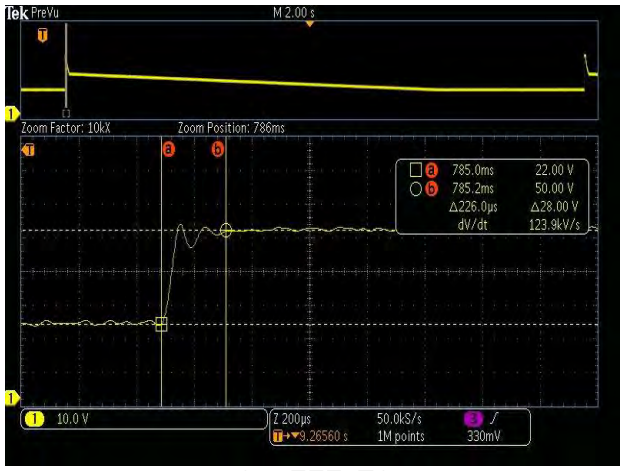
14 - DDD, T1



15 - DDD, T2, V1, V2



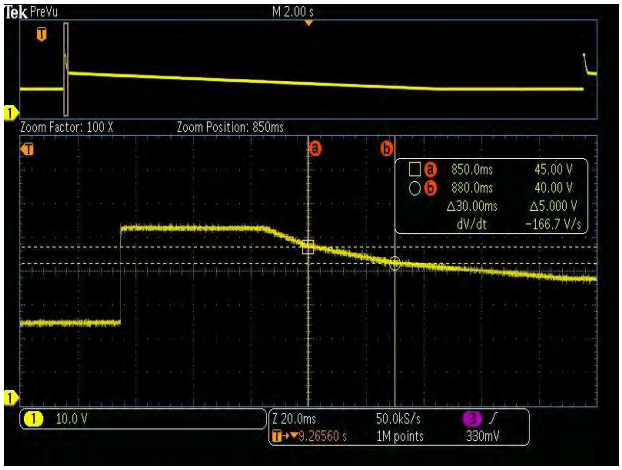
16 - DDD, T3



17 - EEE, T1

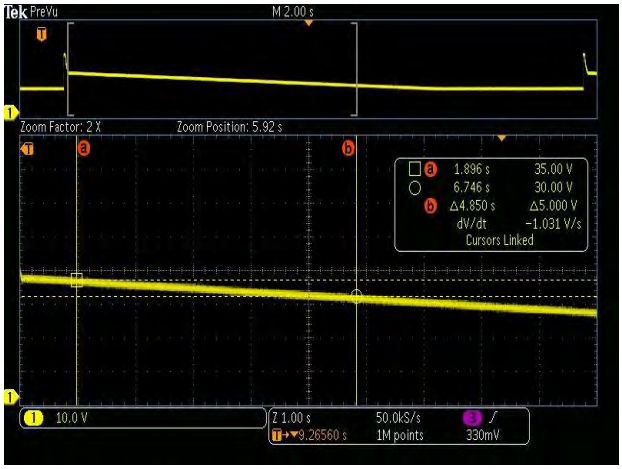
18 - EEE, T2, V1, V2

19 - EEE, T3, V2, V3

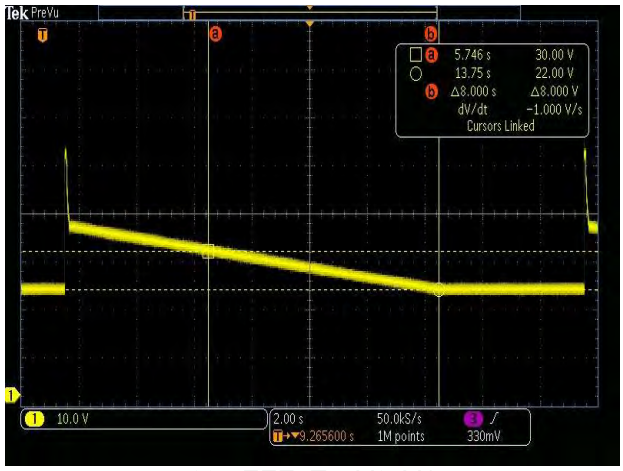


20 - EEE, T4, V3, V4

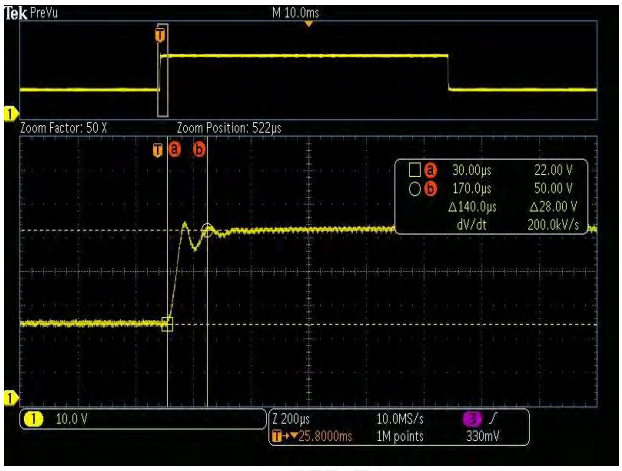
21 - EEE, T5, V4, V5



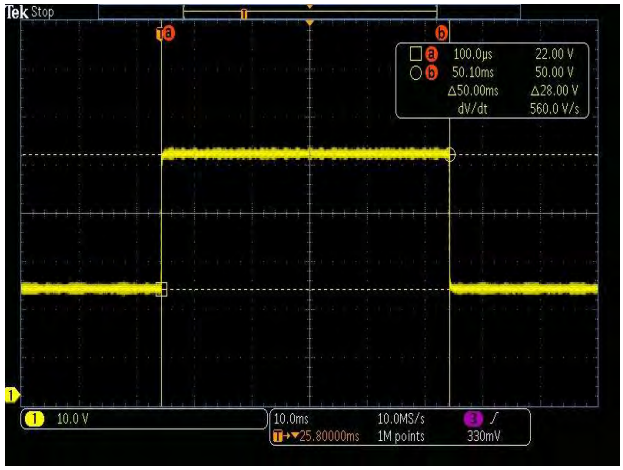
22 - EEE, T6, V5, V6



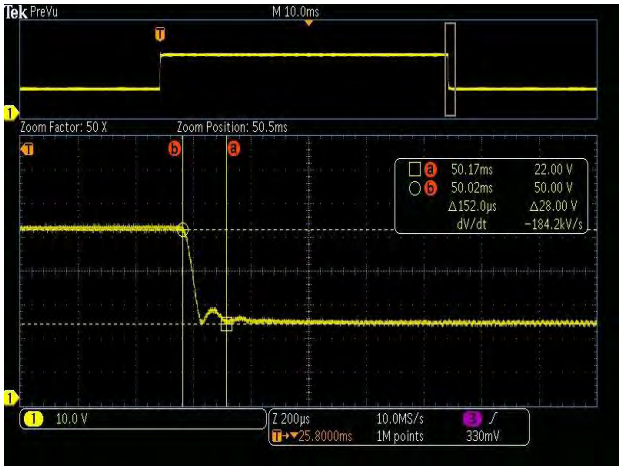
23 - EEE, T7, V6, V1



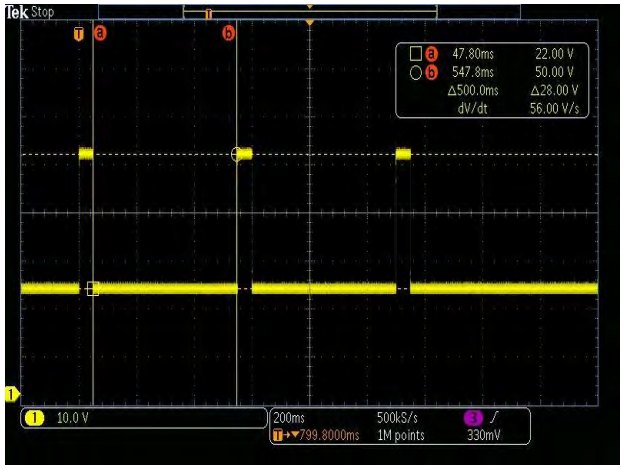
24 - FFF, T1



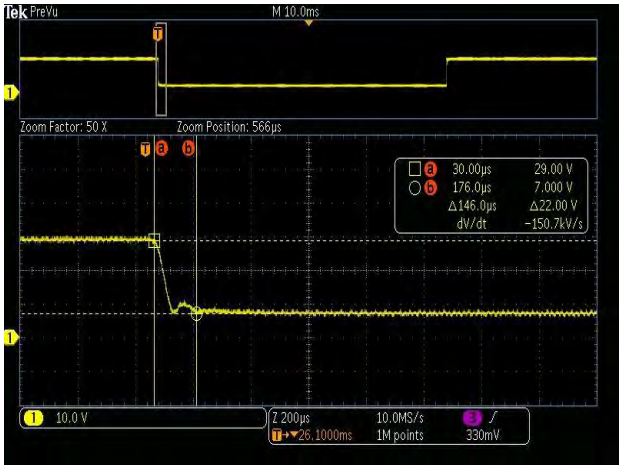
25 - FFF, T2, V1, V2



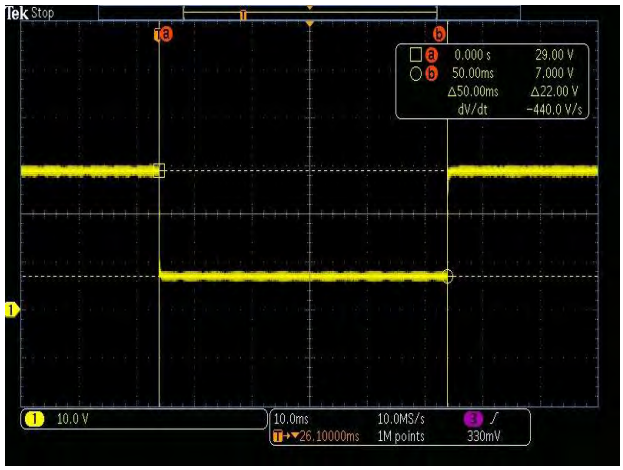
26 - FFF, T3



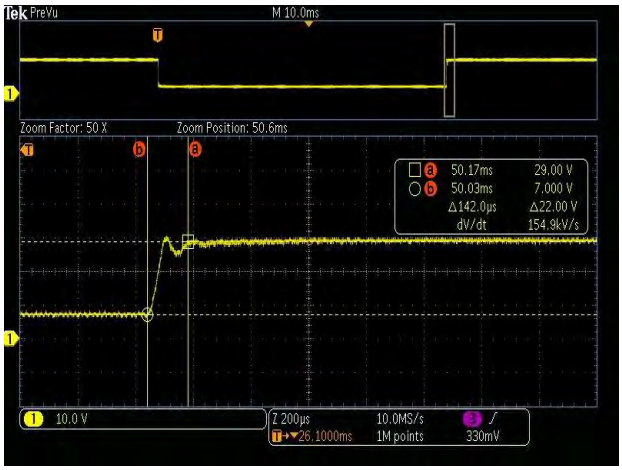
27 - FFF, Rep



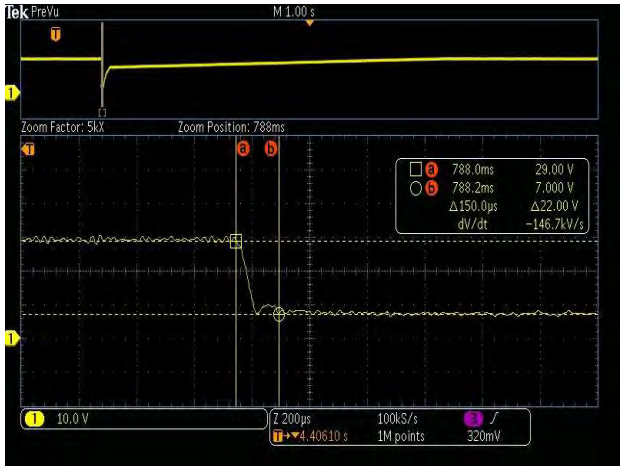
28 - GGG, T1



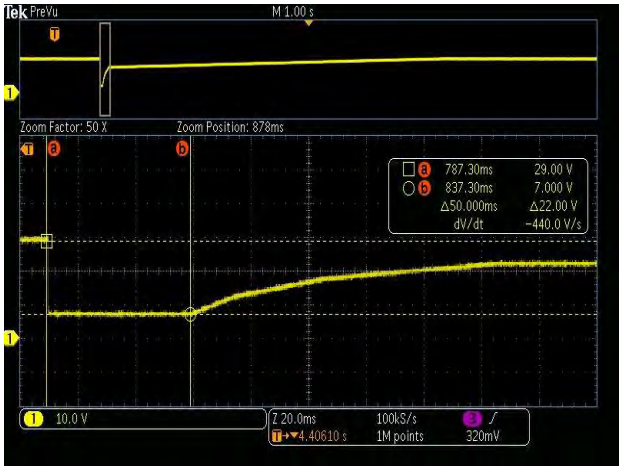
29 - GGG, T2, V1, V2



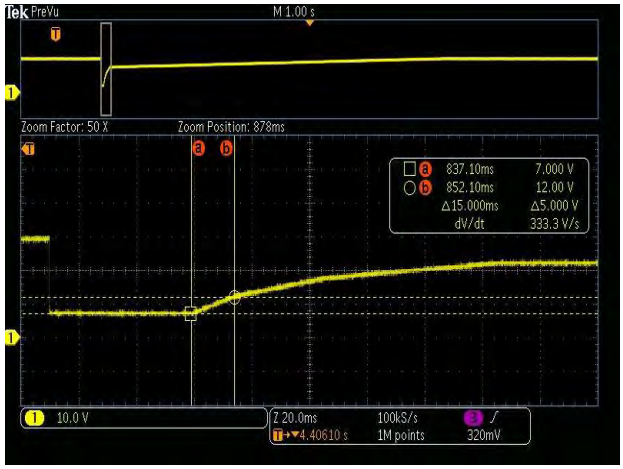
30 - GGG, T3



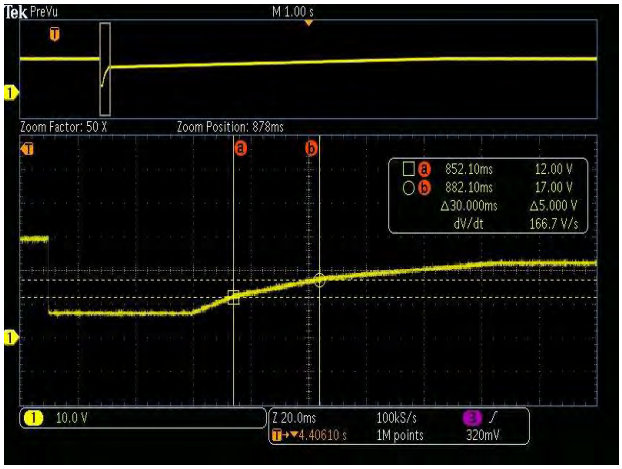
31 - HHH, T1



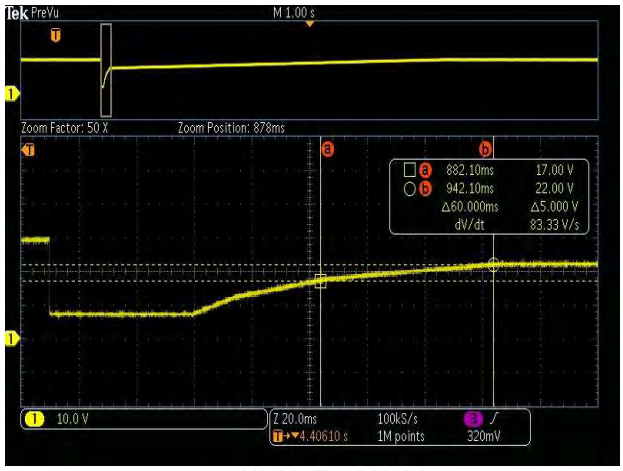
32 - HHH, T2, V1, V2



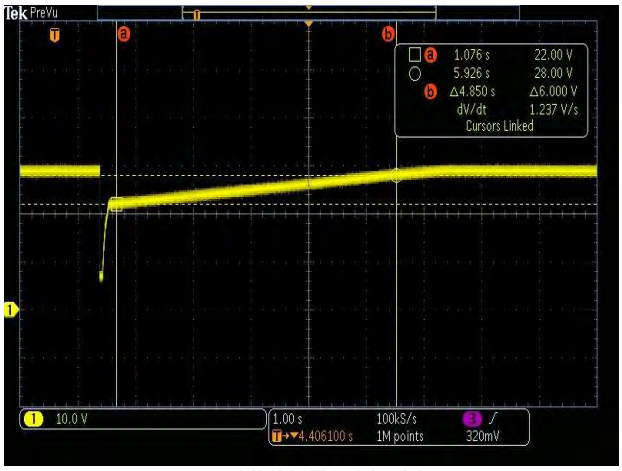
33 - HHH, T3, V2, V3



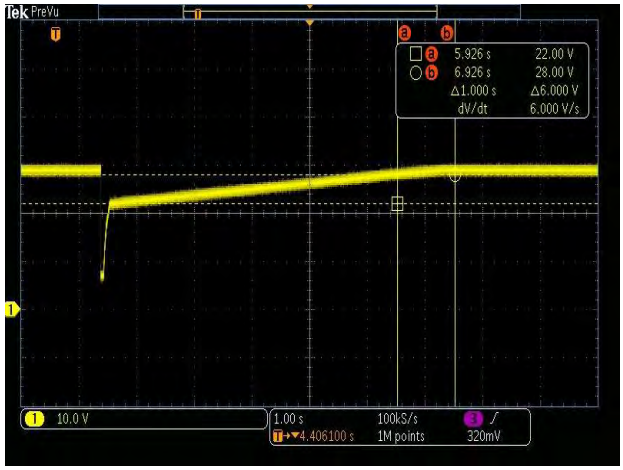
34 - HHH, T4, V3, V4



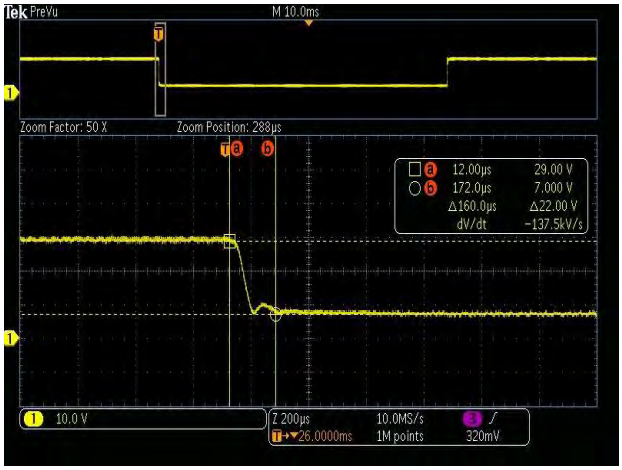
35 - HHH, T5, V4, V5



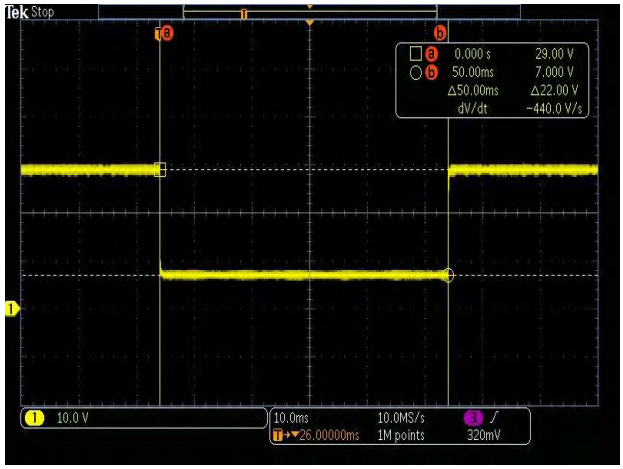
36 - HHH, T6, V5, V6



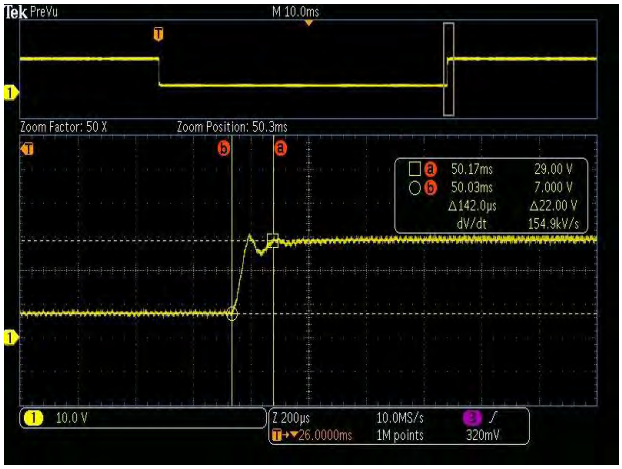
37 - HHH, T7, V6, V1,png



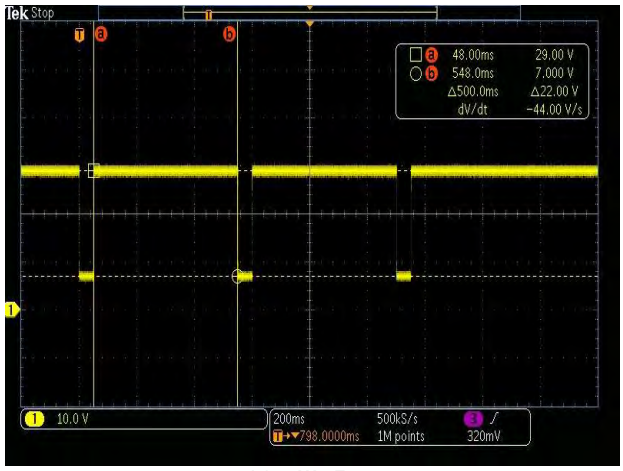
38 - III, T1



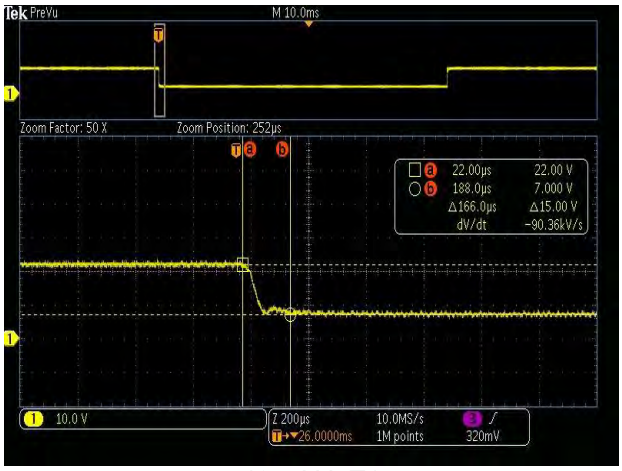
39 - III, T2, V1, V2



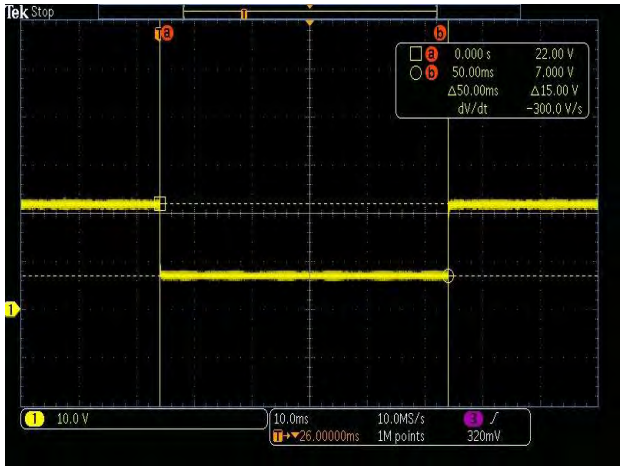
40 - III, T3



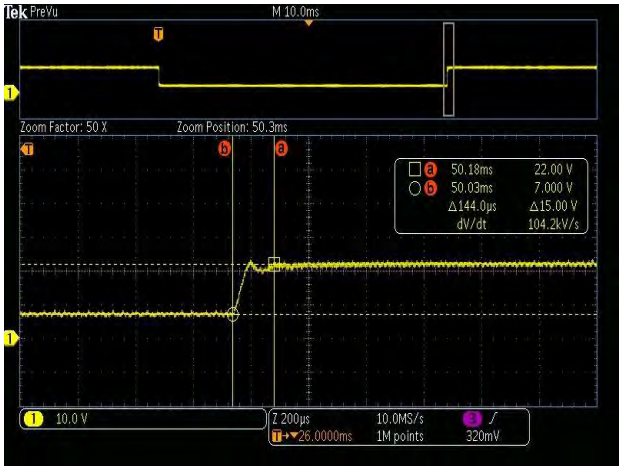
41 - III, Rep



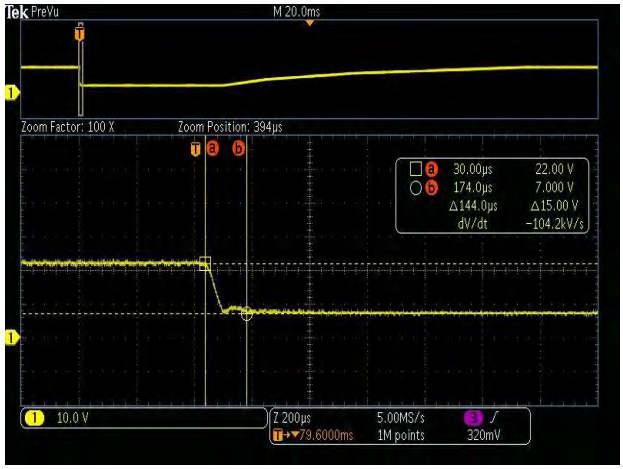
42 - JJJ, T1



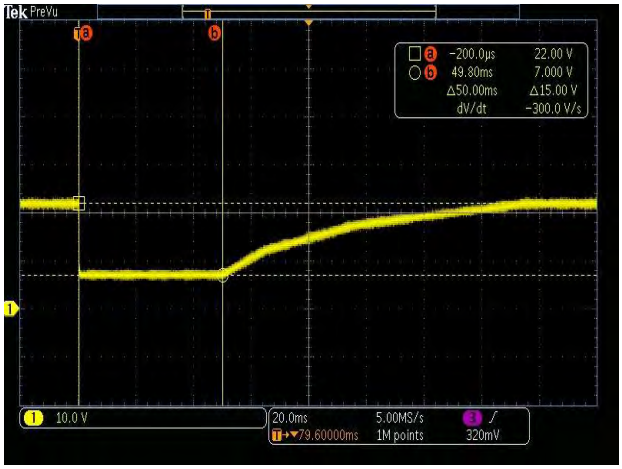
43 - JJJ, T2, V1, V2



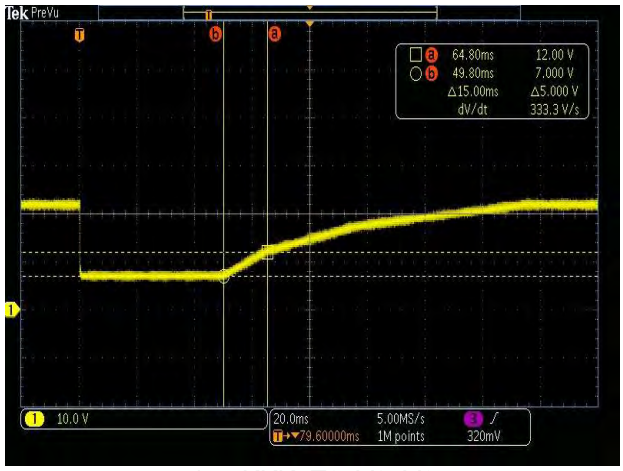
44 - JJJ, T3



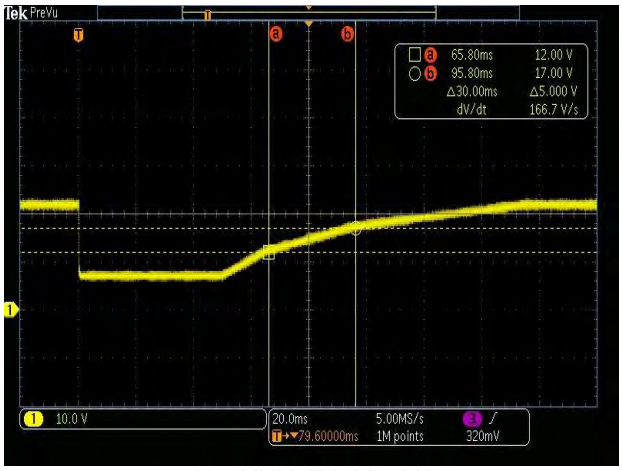
45 - KKK, T1



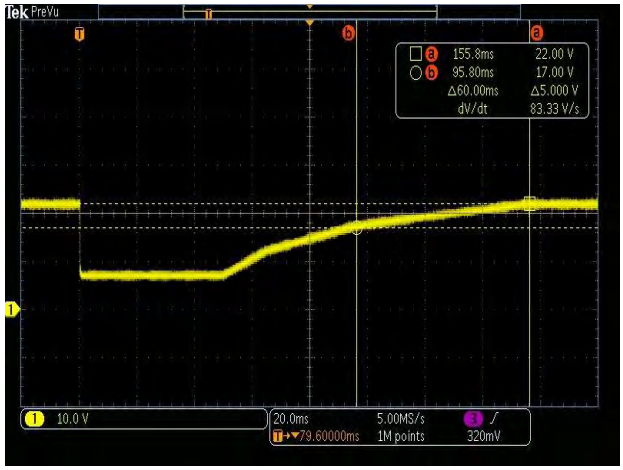
46 - KKK, T2, V1, V2



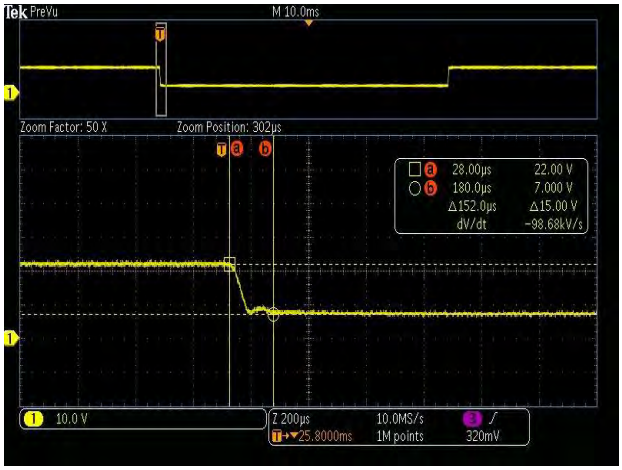
47 - KKK, T3, V2, V3



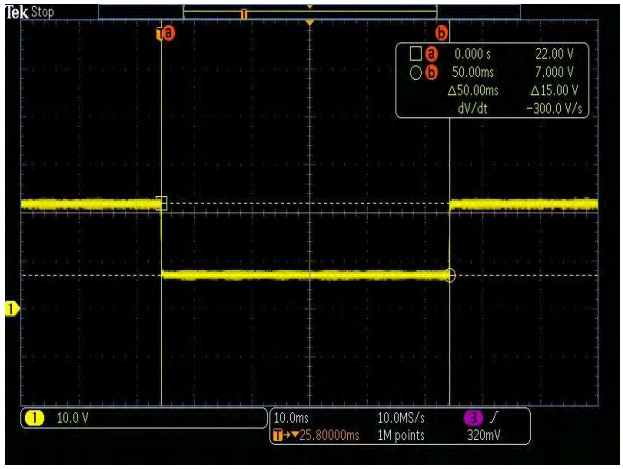
48 - KKK, T4, V3, V4



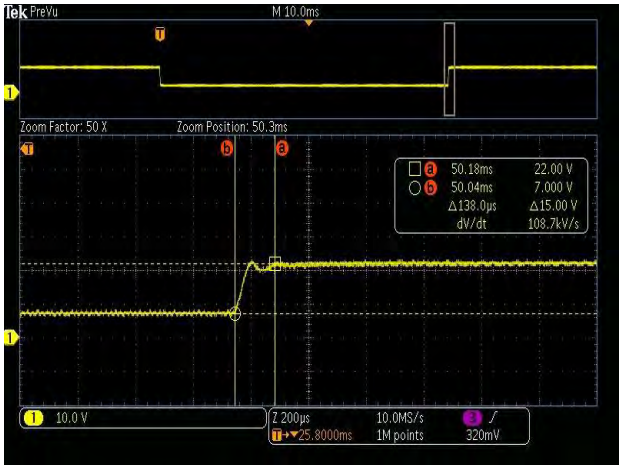
49 - KKK, T5, V4, V5



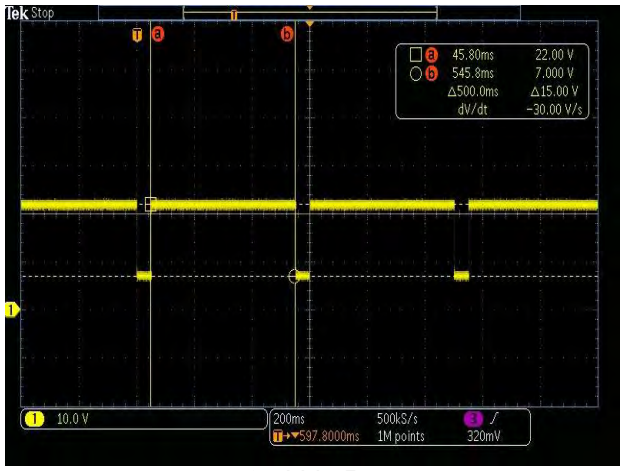
50 - LLL, T1



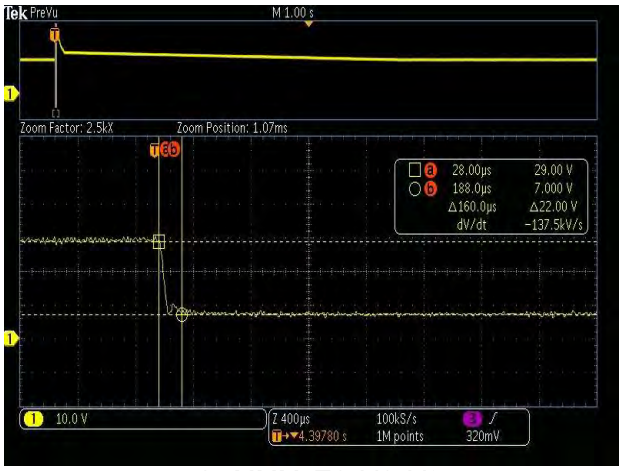
51 - LLL, T2, V1, V2



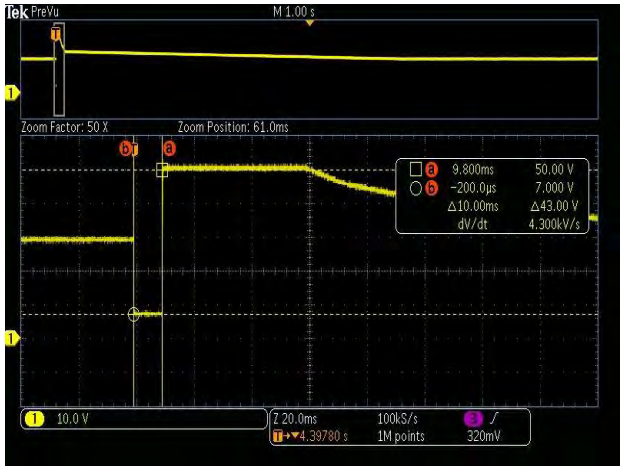
52 - LLL, T3



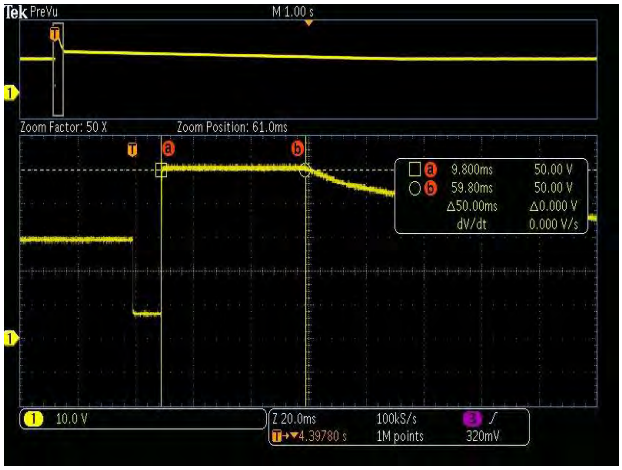
53 - LLL, Rep



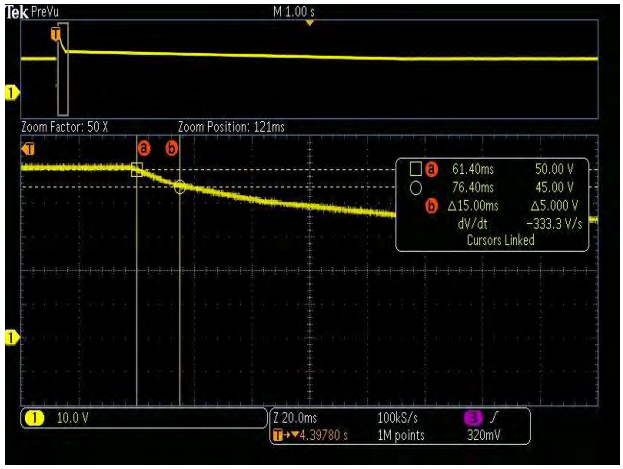
54 - MMM, T1, V1, V2



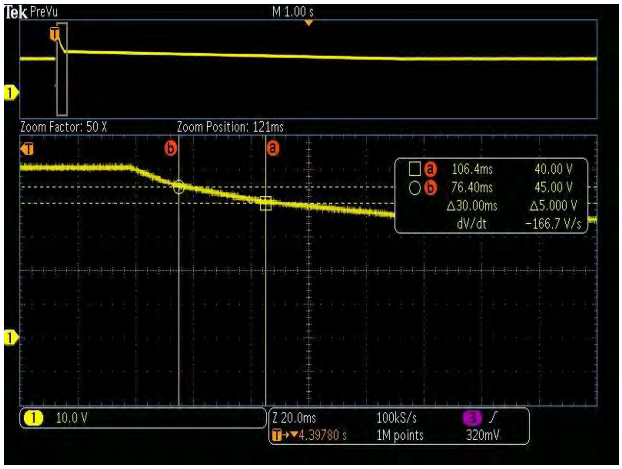
55 - MMM, T2, V2, V3



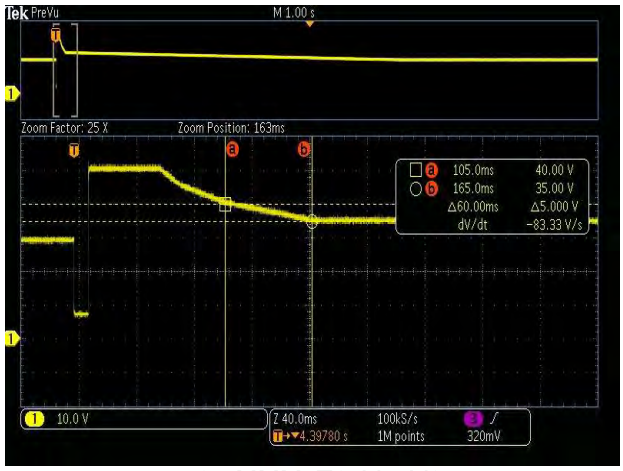
56 - MMM, T3, V3



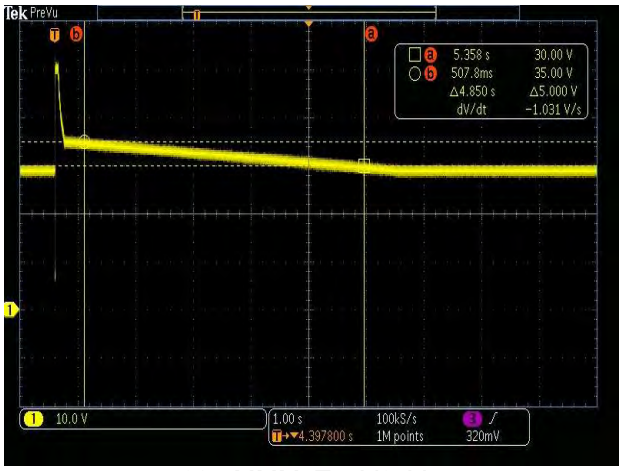
57 - MMM, T4, V3, V4



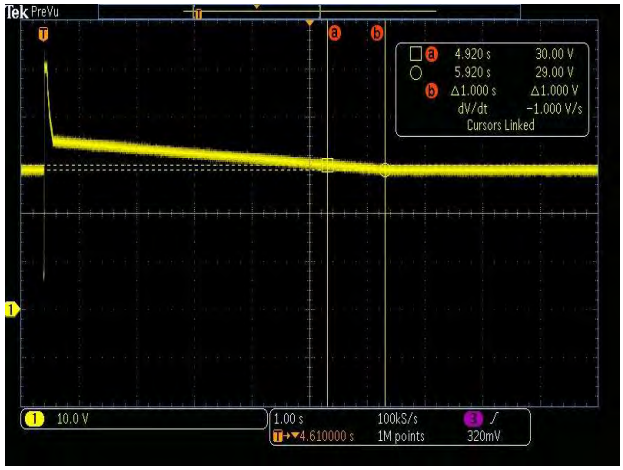
58 - MMM, T5, V4, V5



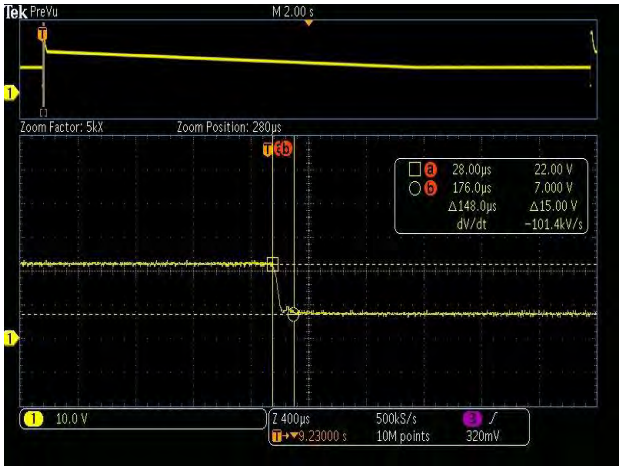
59 - MMM, T6, V5, V6



60 - MMM, T7, V6, V7



61 - MMM, T8, V7, V8

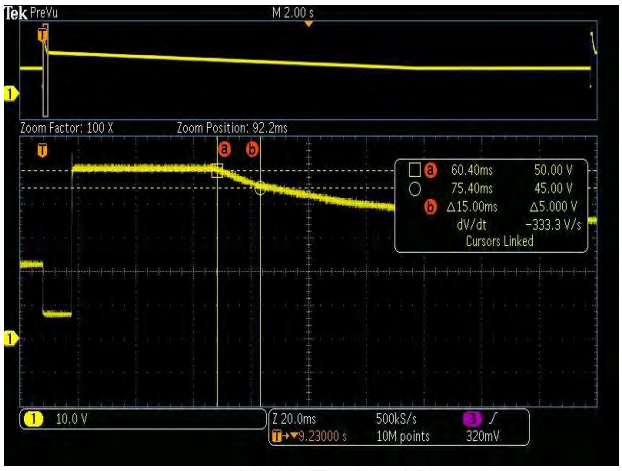


62 - NNN, T1, V1, V2

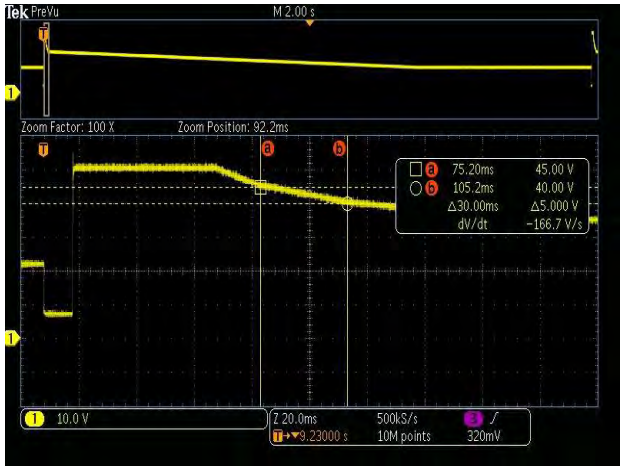
63 - NNN, T2, V2

64 - NNN, T3, V2, V3

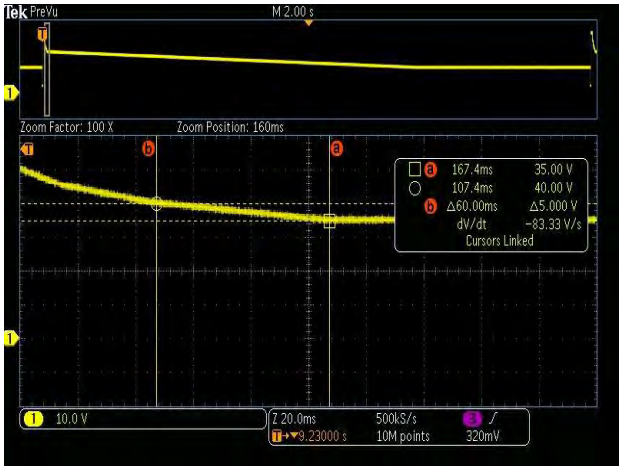
65 - NNN, T4, V3



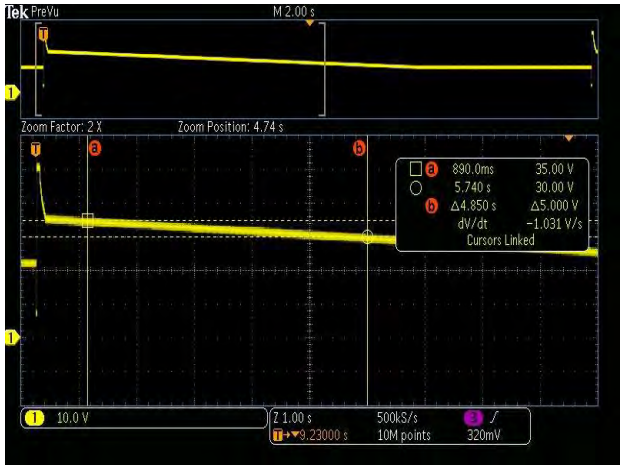
66 - NNN, T5, V3, V4



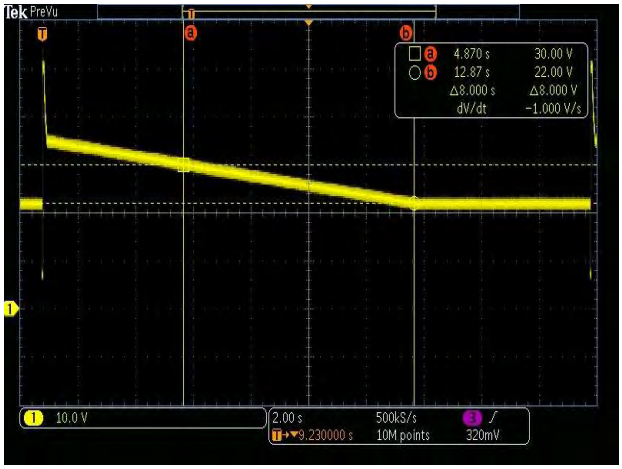
67 - NNN, T6, V4, V5



68 - NNN, T7, V5, V6

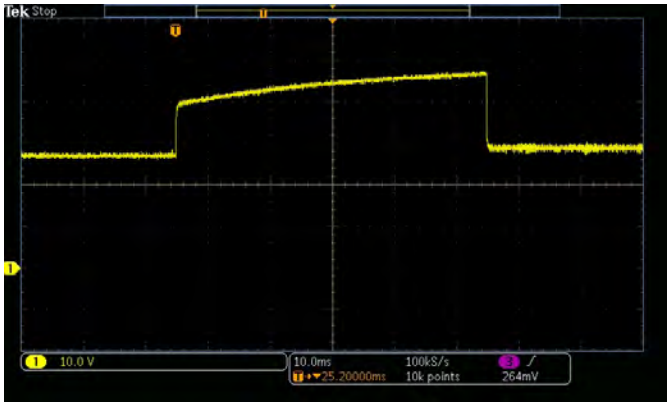


69 - NNN, T8, V6, V7

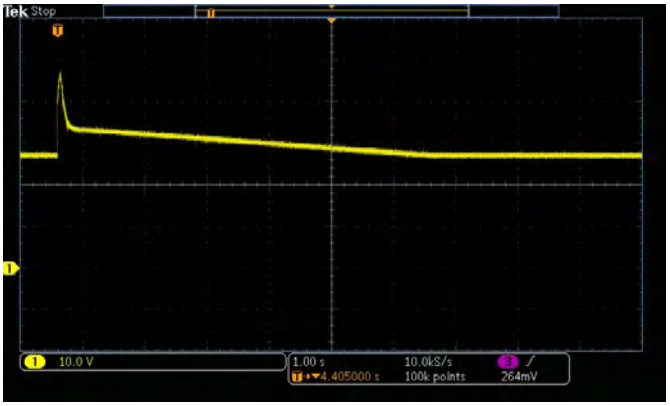


70 - NNN, T9, V7, V8

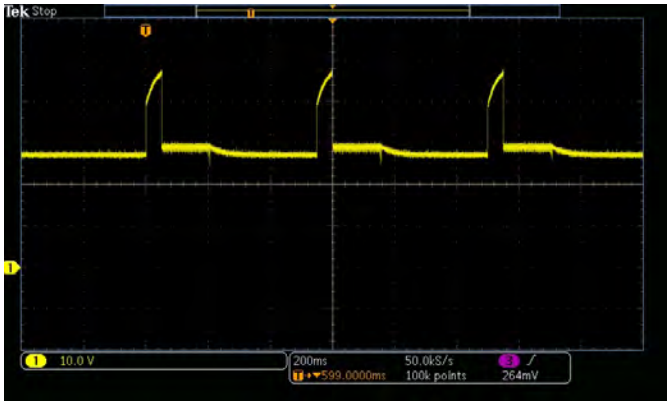
Test Waveforms:



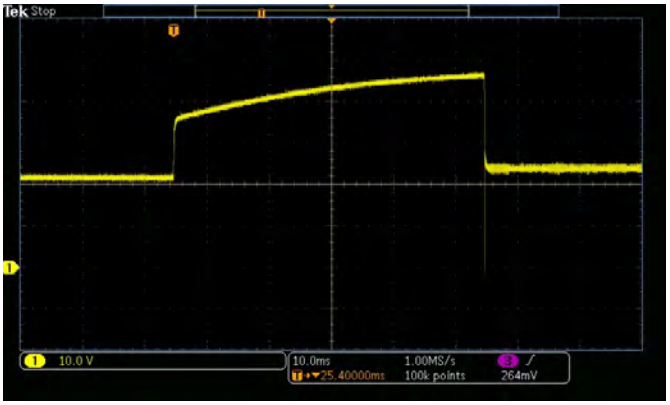
01 - LDC302, Condition AAA



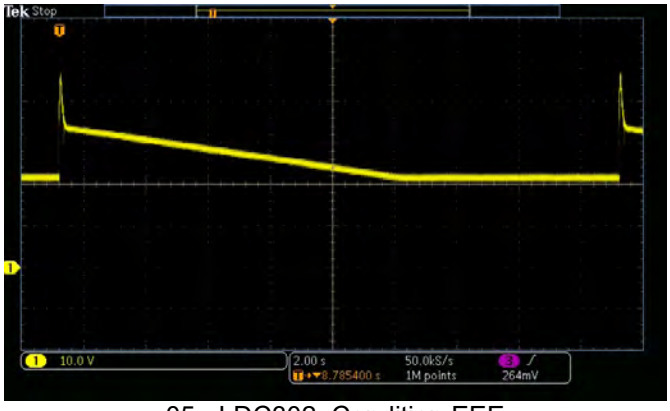
02 - LDC302, Condition BBB



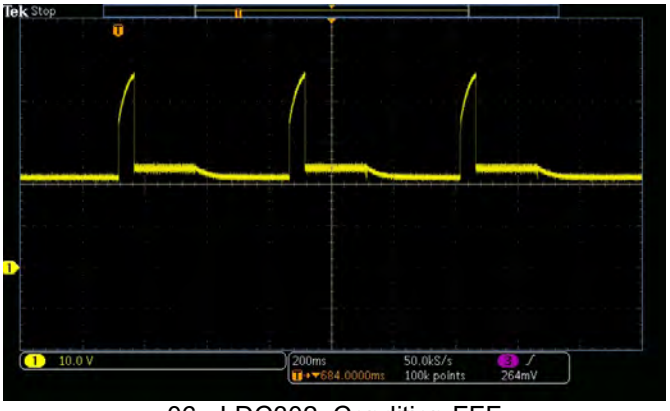
03 - LDC302, Condition CCC



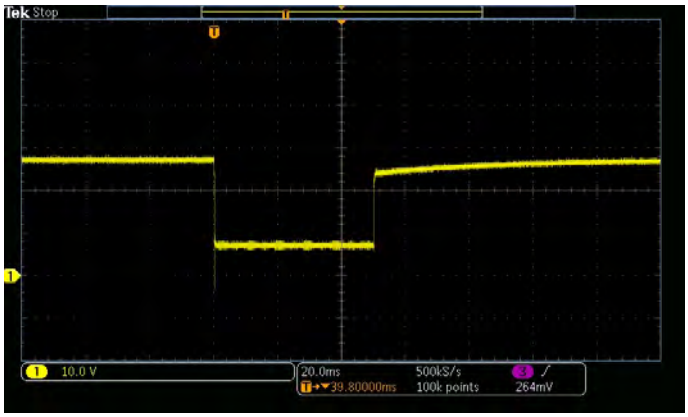
04 - LDC302, Condition DDD



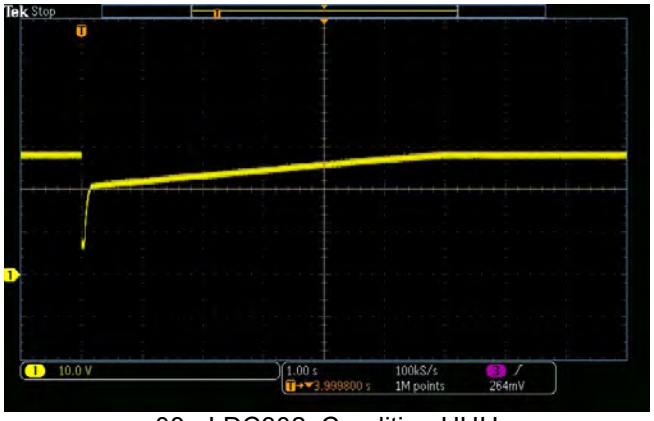
05 - LDC302, Condition EEE



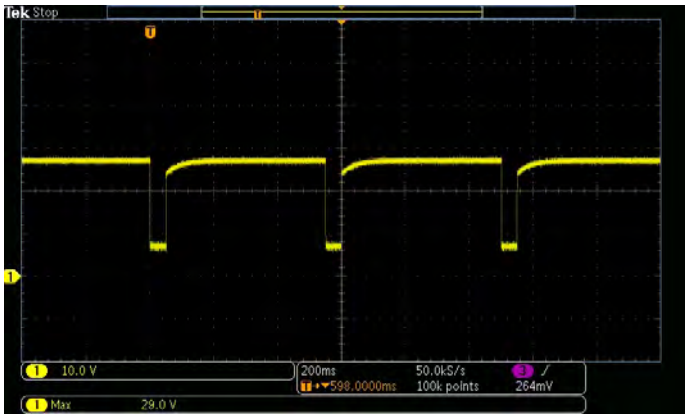
06 - LDC302, Condition FFF



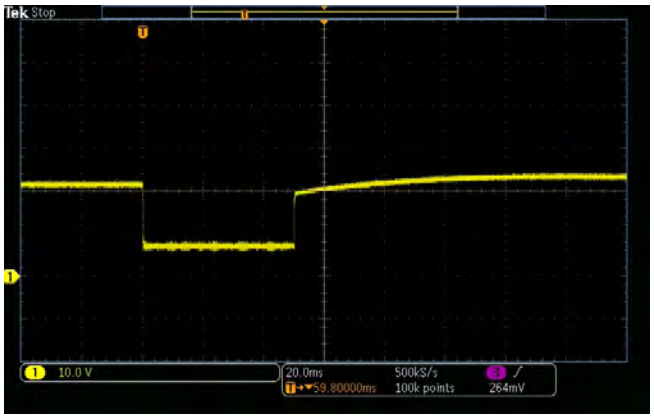
07 - LDC302, Condition GGG



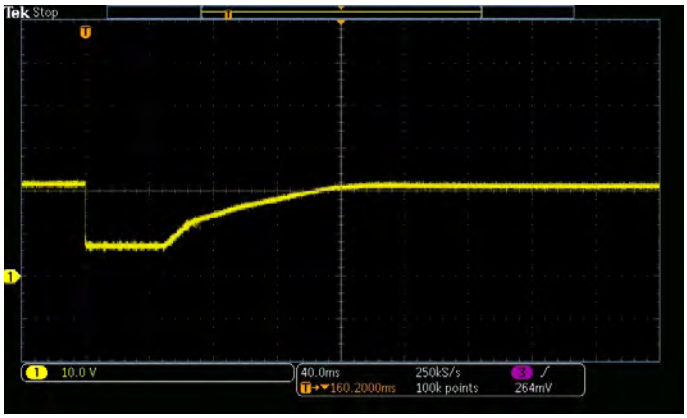
08 - LDC302, Condition HHH



09 - LDC302, Condition III

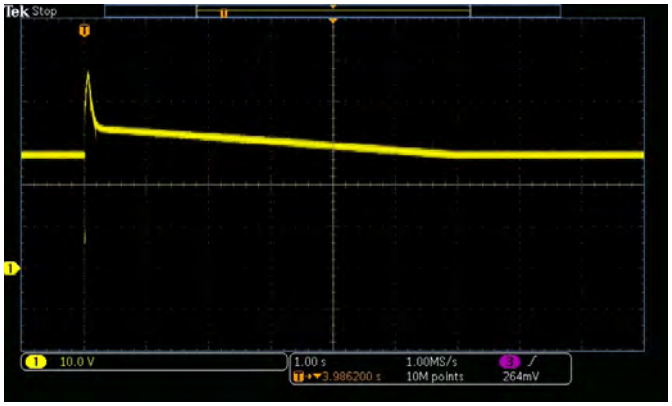


10 - LDC302, Condition JJJ

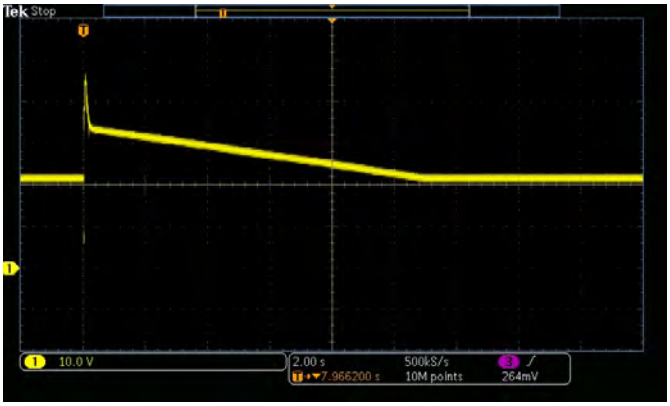


11 - LDC302, Condition KKK

12 - LDC302, Condition LLL



13 - LDC302, Condition MMM



14 - LDC302, Condition NNN

LDC401 (Emergency Steady State Limits for Voltage) Data Sheet

Job Number:	PR131850	**Date:**	4/7/21
Manufacturer:	Amphenol Aerospace	**Standard:**	MIL-STD-704F
EUT Name:	SwitchBox	**Method:**	MIL-HDBK-704-8, LDC401
EUT PN:	19CD0002-1	**Procedure:**	19CD0002 Rev. B
EUT SN:	N/A	**Test Personnel:**	Jeff Maselli

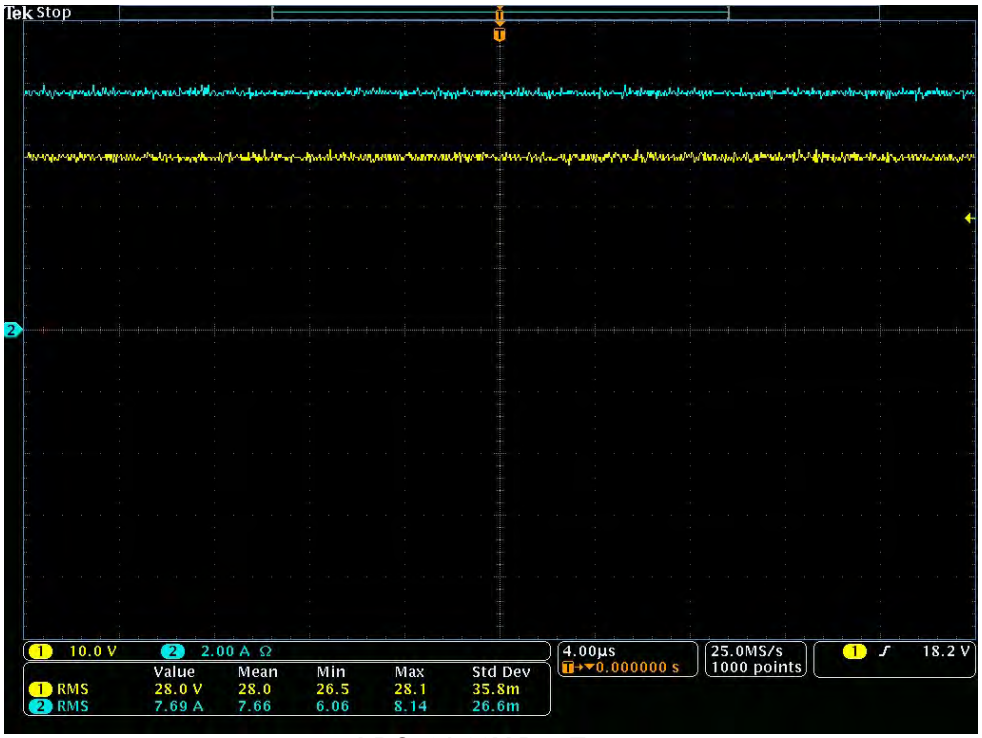
LDC401 Test Specification:

Test Condition	Emergency Limit	Voltage (VDC) or Event
A	Nominal	28.0
B	ELSS	18.0
B1	ELSS	18.0V Restart Operation
C	EHSS	29.0
C1	EHSS	29.0V Restart Operation

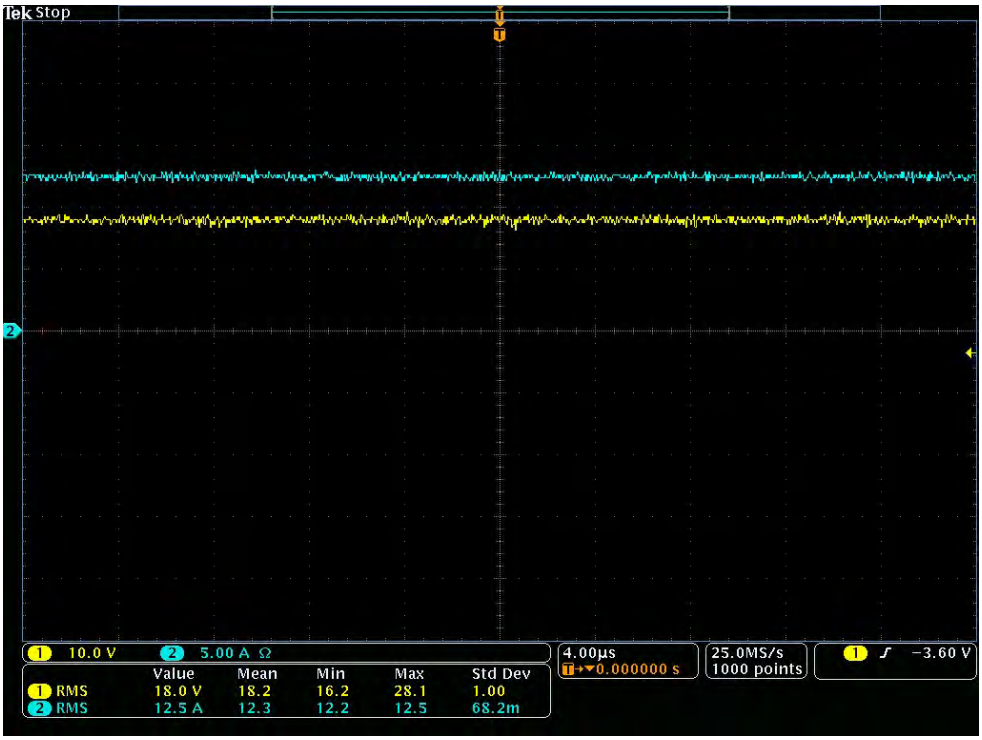
LDC401 Test Results:

Test Condition	Emergency Limit	Measured Voltage (VDC) or Event	Measured Current (A)	Duration (Minutes)	Result (Pass / Fail)
A	Nominal	28.0	7.69	30	**PASS**
B	ELSS	18.0	12.5	30	**PASS**
B1	ELSS	18.0V Restart Operation	-	-	**PASS**
C	EHSS	29.0	7.65	30	**PASS**
C1	EHSS	29.0V Restart Operation	-	-	**PASS**
A	Nominal	28.0	7.89	30	**PASS**

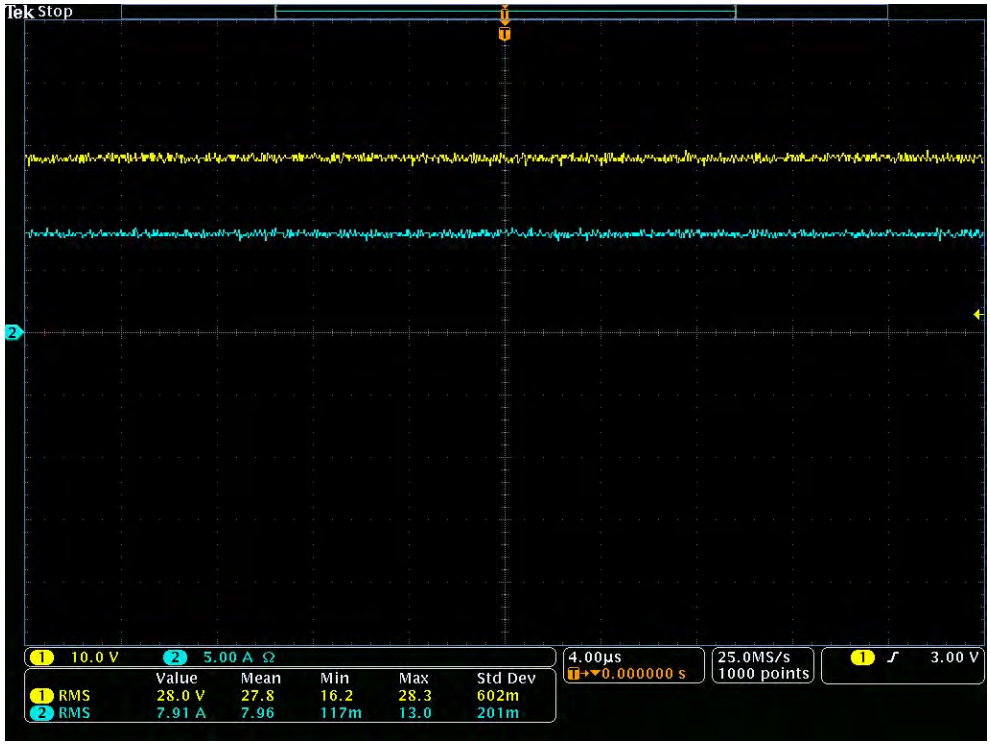
LDC104 Plots:



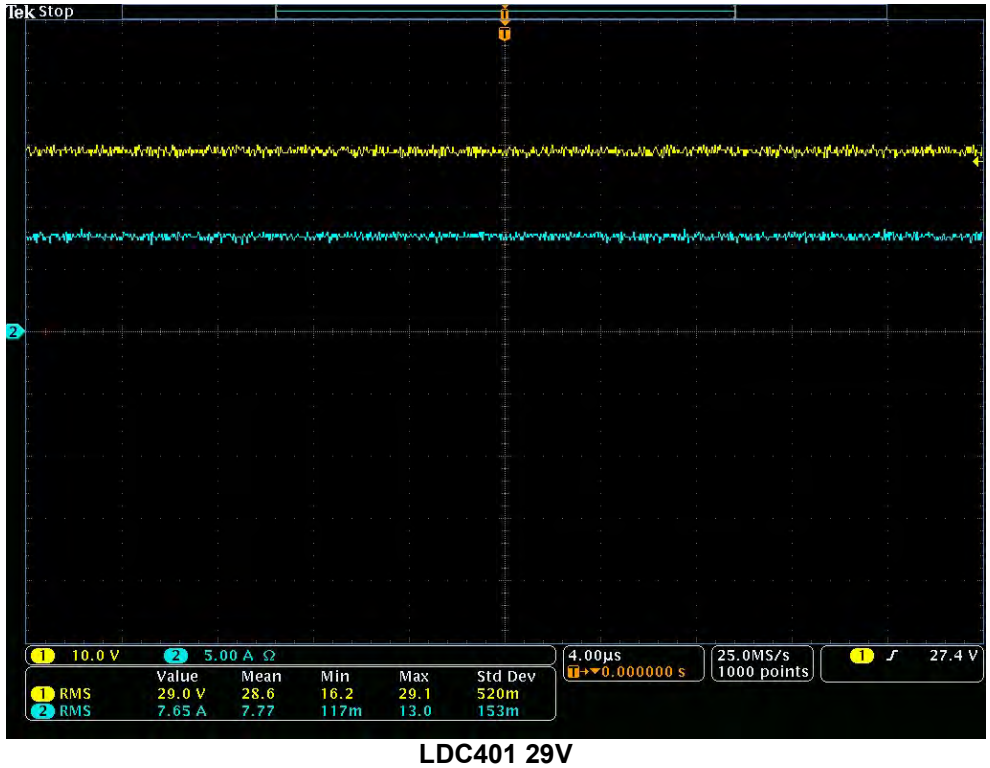
LDC401 28V Pre-Test



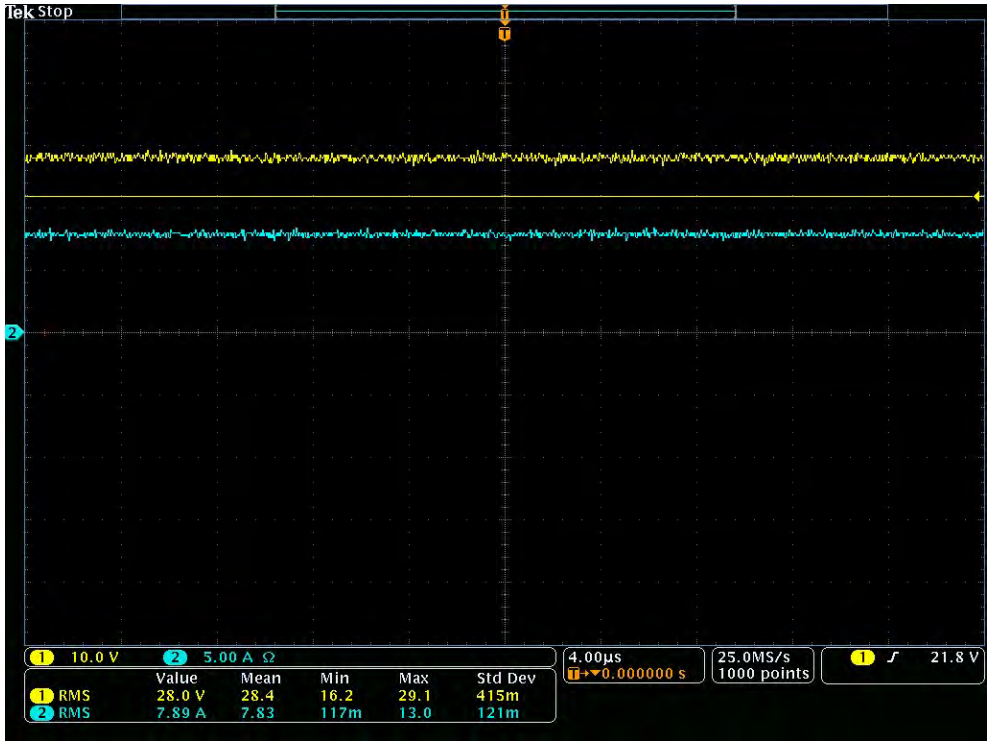
LDC401 18V



LDC401 28V Pre-Test



LDC401 29V



LDC401 28V Post-Test

The failure on page 47 is resolved by an ECN adding more capacitance which by analysis, resolved the issue and places the overall part in compliance.