Test Data
For PMP9484
9/02/2014

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1. Design Specifications

Vin Minimum	**7.5VDC**
Vin Maximum	**20VDC**
Vin Nominal	**12VDC**
Vout	**24VDC**
Iout	**5A**
Switching Frequency(SMPS)	**145KHz**
Audio Amplifier Total Power	**100W**
Audio Amp Output	**50W +50W Stereo(on 4 ohm BTL) or 100W Woofer (on 2 ohm PBTL)**
Audio Amp Input	**Stereo Inputs. Processing for Woofer Amp Built-in**

2. Circuit Description

PMP9484 is a 100W Automotive Amplifier Design which can be used in 50W +50W Stereo or 100W Woofer Applications. The design is broadly divided into three main stages:

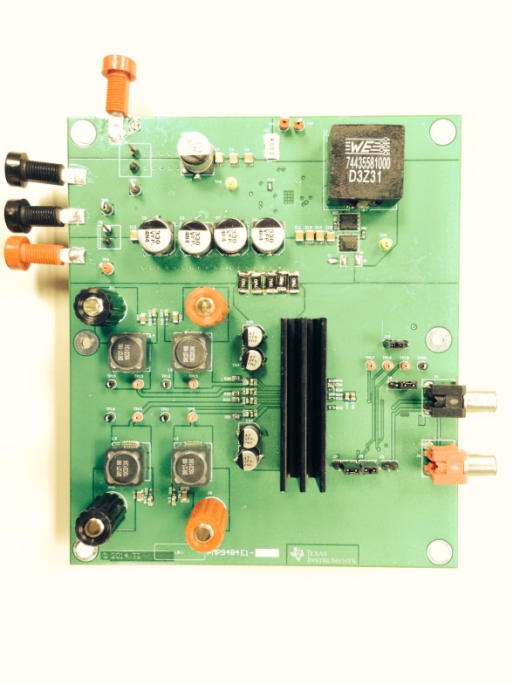
1. Single-Phase Synchronous Boost Converter using the LM5122 controller IC. The design accepts an input voltage of 7.5Vin to 20Vin (12Vin Nominal) and provides an output of 24 Vout capable of supplying 5A of continuous current to the load.

2. 50W+ 50W Stereo Audio Amplifier with TPA3116D2 Class D device.

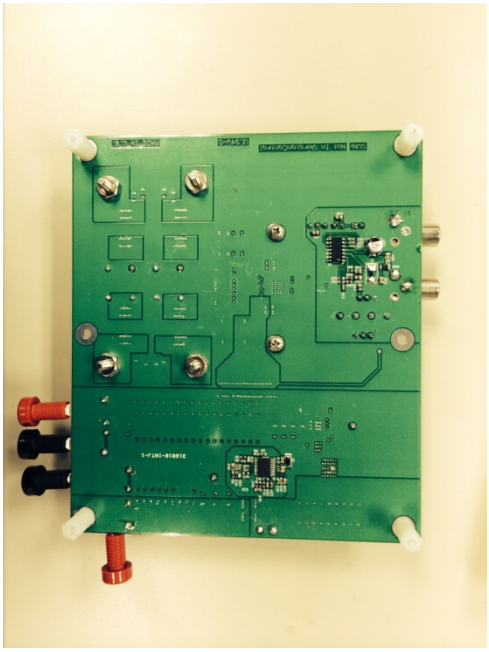
3. Stereo Inputs to Woofer Bass Input Conversion.

3. PMP9484 Board Photos

Board Dimensions: 5700mil *4900mil



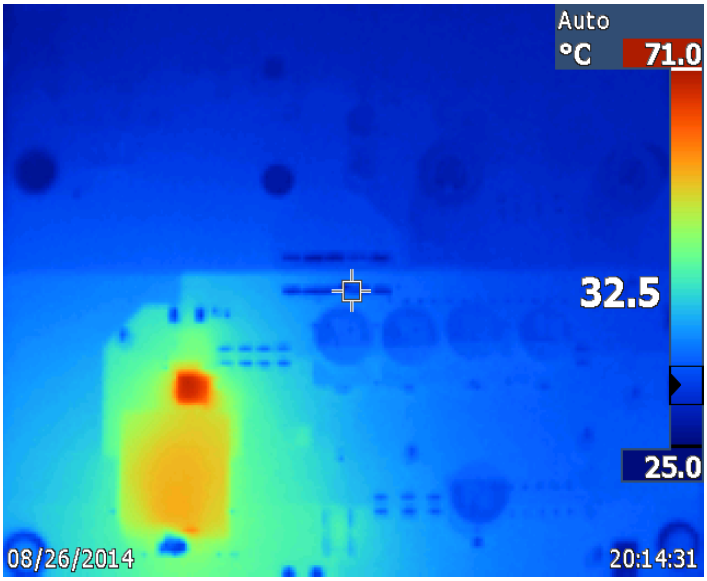
Board Photo (Top)



Board Photo (Bottom)

4. DC/DC Boost Test Results

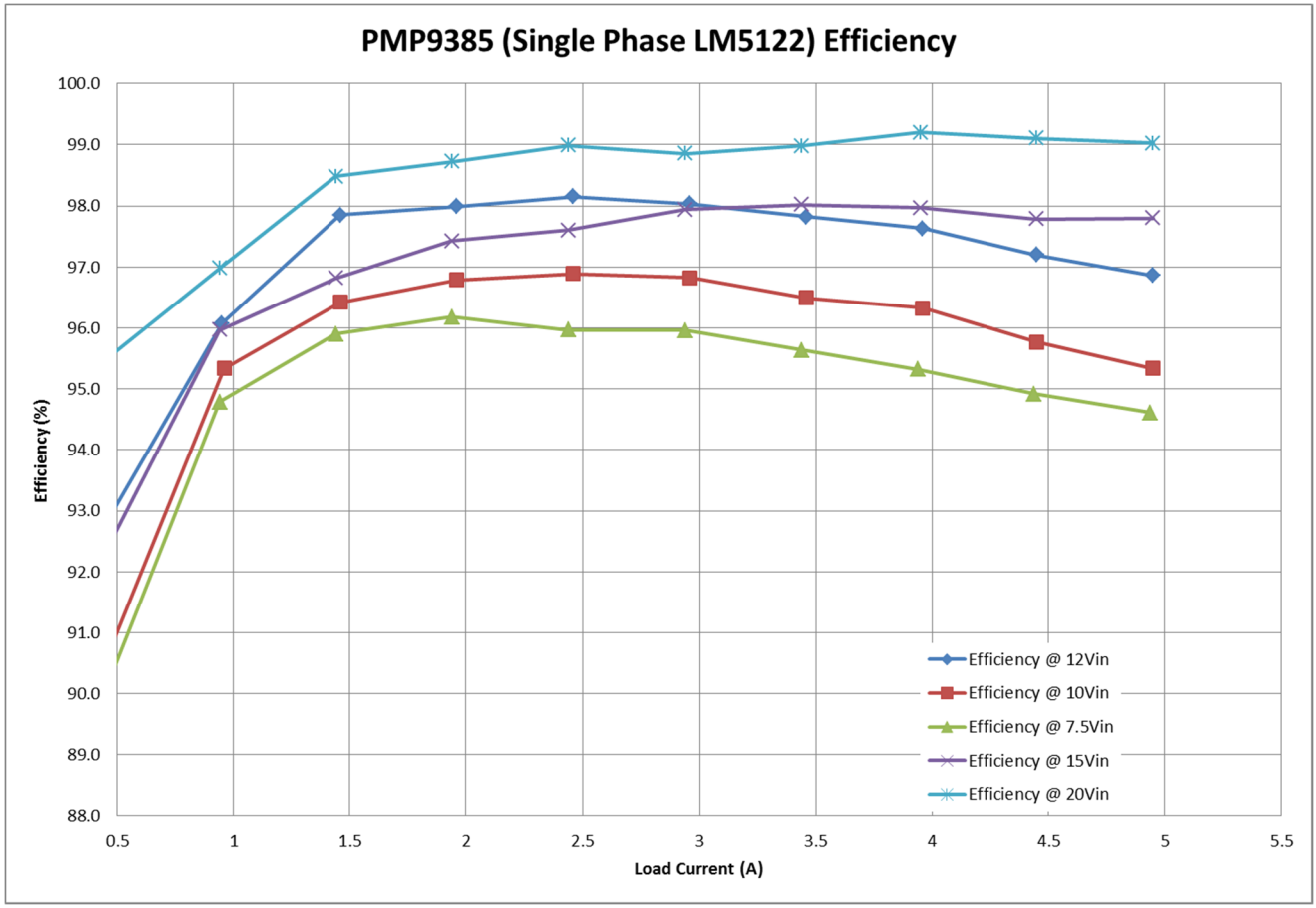
4.1 Thermal Data



IR thermal image taken at steady state with 12 Vin and 24V@ 5 A load (no airflow)

4.2 Efficiency

4.2.1 Efficiency Chart



4.2.2 Efficiency Data

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Efficiency (%)
12.13	10.072	23.906	4.95	122.1734	118.3347	96.9
12.154	9.005	23.906	4.45	109.4468	106.3817	97.2
12.178	7.9625	23.906	3.96	96.96733	94.66776	97.6
12.201	6.93	23.904	3.46	84.55293	82.70784	97.8
12.223	5.905	23.904	2.96	72.17682	70.75584	98.0
12.245	4.8925	23.903	2.46	59.90866	58.80138	98.2
12.267	3.8975	23.902	1.96	47.81063	46.84792	98.0
12.289	2.902	23.902	1.46	35.66268	34.89692	97.9
12.31	1.92	23.902	0.95	23.6352	22.7069	96.1
12.33	0.94	23.902	0.45	11.5902	10.7559	92.8

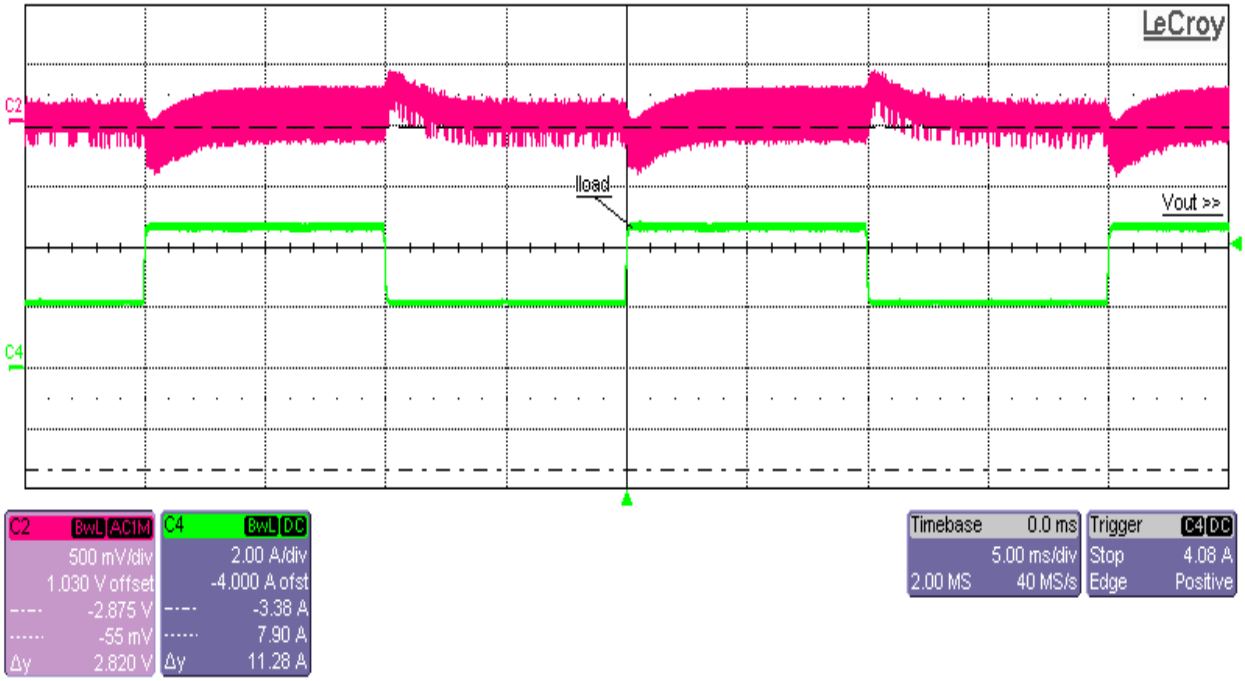
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Efficiency (%)
10.0428	12.36	23.906	4.95	124.129	118.3347	95.3
10.0726	11.027	23.904	4.45	111.0706	106.3728	95.8
10.1024	9.727	23.902	3.96	98.26604	94.65192	96.3
10.1306	8.46	23.902	3.46	85.70488	82.70092	96.5
10.1578	7.1935	23.901	2.96	73.07013	70.74696	96.8
10.1853	5.958	23.901	2.46	60.68402	58.79646	96.9
10.211	4.74	23.901	1.96	48.40014	46.84596	96.8
10.2373	3.535	23.9	1.46	36.18886	34.894	96.4
10.2628	2.345	23.9	0.96	24.06627	22.944	95.3
10.2886	1.13	23.901	0.44	11.62612	10.51644	90.5

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Efficiency (%)
7.493	16.661	23.91	4.94	124.8409	118.1154	94.6
7.534	14.845	23.909	4.44	111.8422	106.156	94.9
7.575	13.0455	23.907	3.94	98.81966	94.19358	95.3
7.615	11.2921	23.906	3.44	85.98934	82.23664	95.6
7.6531	9.57	23.905	2.94	73.24017	70.2807	96.0
7.6901	7.903	23.903	2.44	60.77486	58.32332	96.0
7.7252	6.241	23.902	1.94	48.21297	46.36988	96.2
7.7596	4.625	23.901	1.44	35.88815	34.41744	95.9
7.793	3.0415	23.901	0.94	23.70241	22.46694	94.8
7.826	1.445	23.901	0.425	11.30857	10.15793	89.8

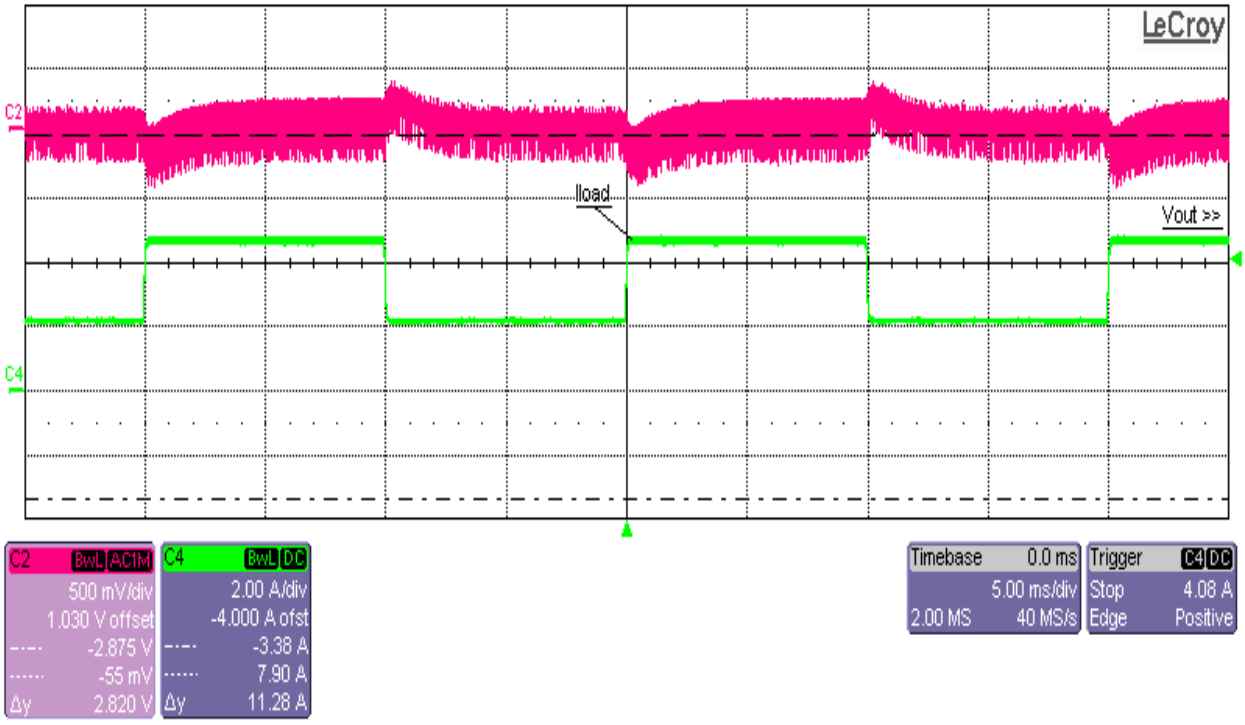
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Efficiency (%)
15.244	7.93685	23.905	4.95	120.9893	118.3298	97.8
15.26	7.129	23.905	4.45	108.7885	106.3773	97.8
15.277	6.309	23.904	3.95	96.38259	94.4208	98.0
15.295	5.4845	23.903	3.44	83.88543	82.22632	98.0
15.312	4.686	23.903	2.94	71.75203	70.27482	97.9
15.328	3.8984	23.903	2.44	59.75468	58.32332	97.6
15.344	3.102	23.903	1.94	47.59709	46.37182	97.4
15.36	2.3145	23.902	1.44	35.55072	34.41888	96.8
15.377	1.5225	23.902	0.94	23.41148	22.46788	96.0
15.392	0.7407	23.902	0.44	11.40085	10.51688	92.2

4.3 Waveforms

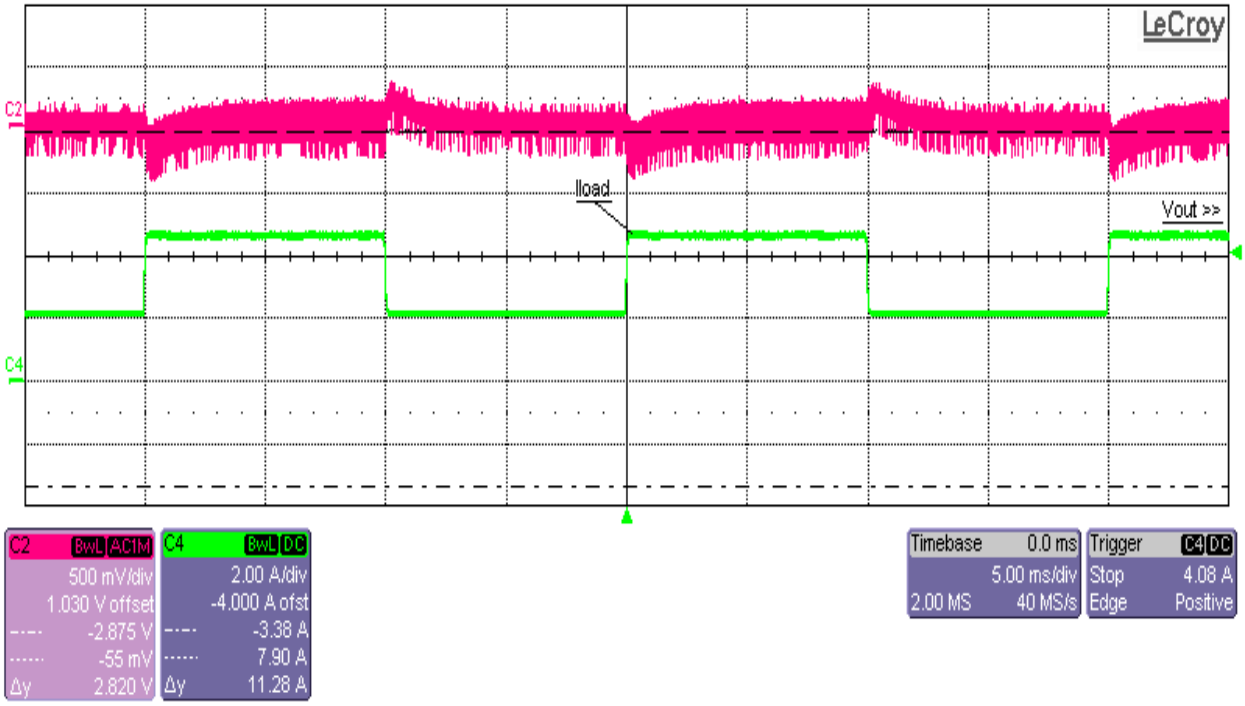
4.3.1 Load Transient Response



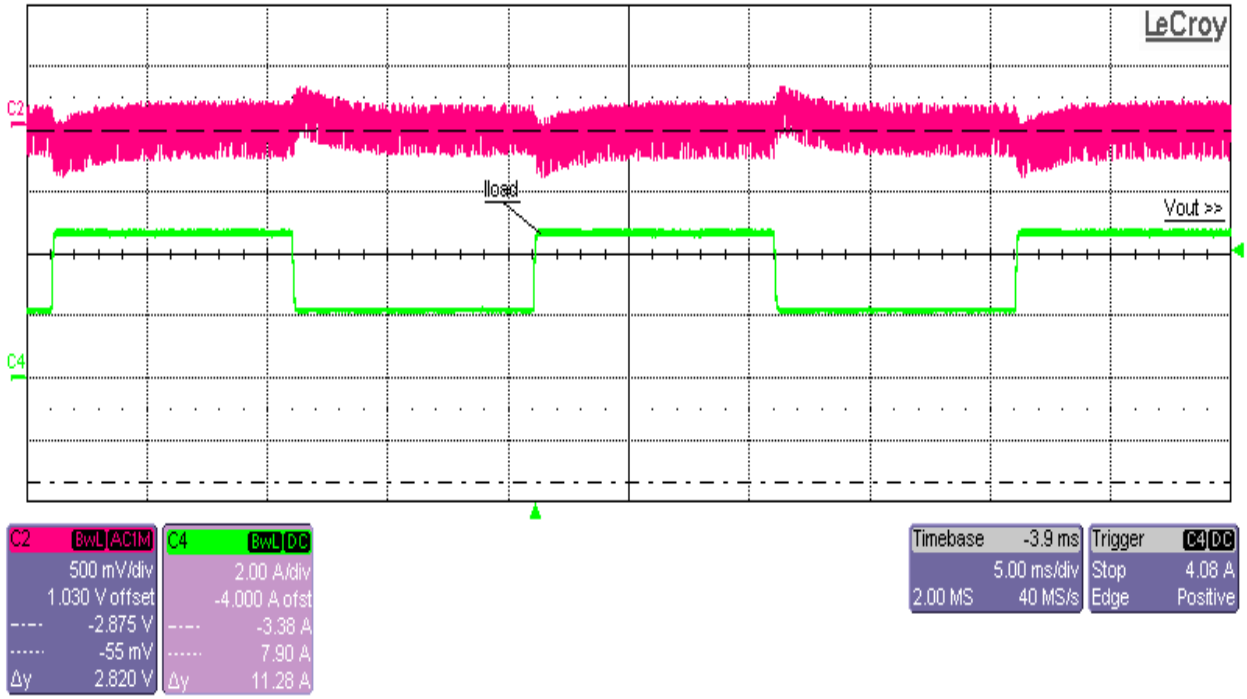
Load Transient Response at 7.5Vin and 50%-to-100% (2.5A-to-5A) Load Step



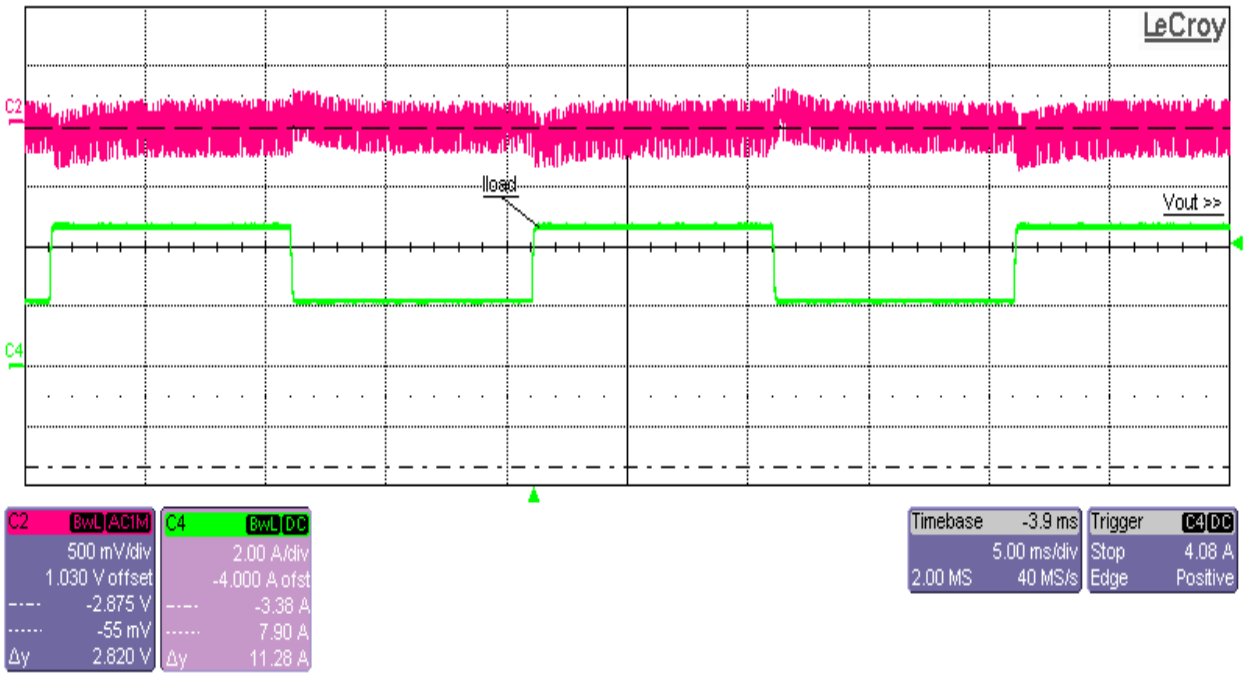
Load Transient Response at 10Vin and 50%-to-100% (2.5A-to-5A) Load Step



Load Transient Response at 12Vin and 50%-to-100% (2.5A-to-5A) Load Step

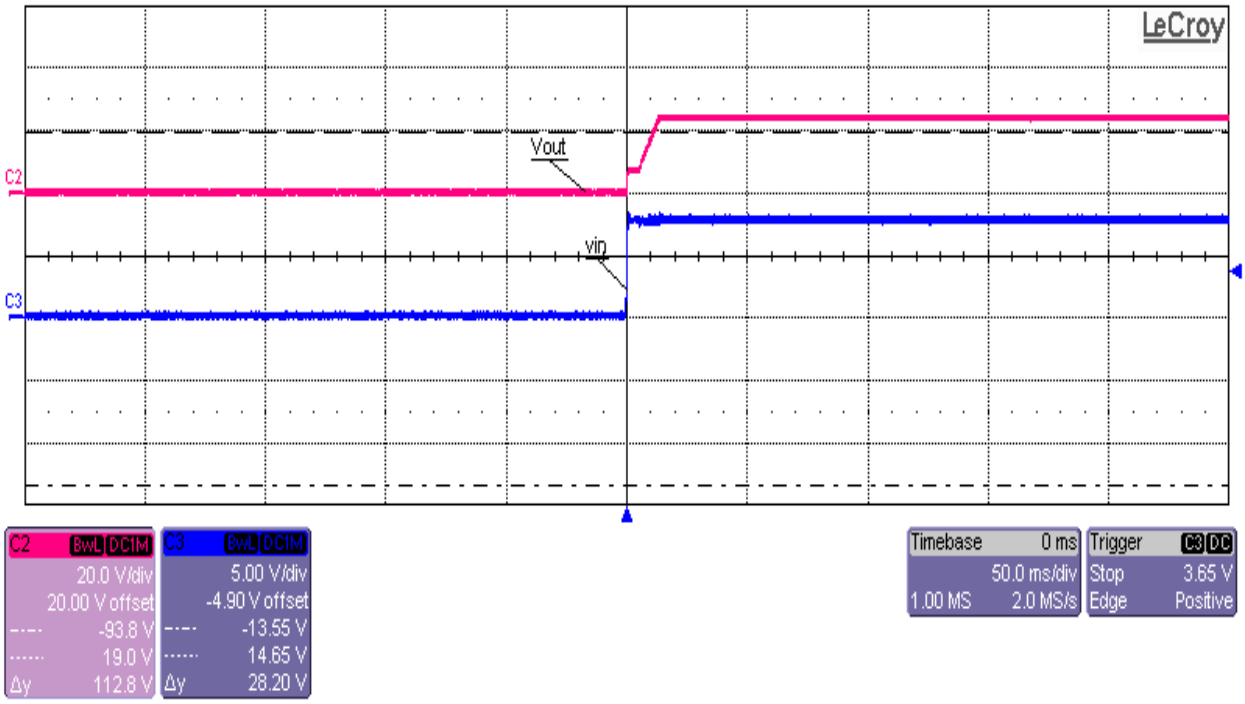


Load Transient Response at 15Vin and 50%-to-100% (2.5A-to-5A) Load Step

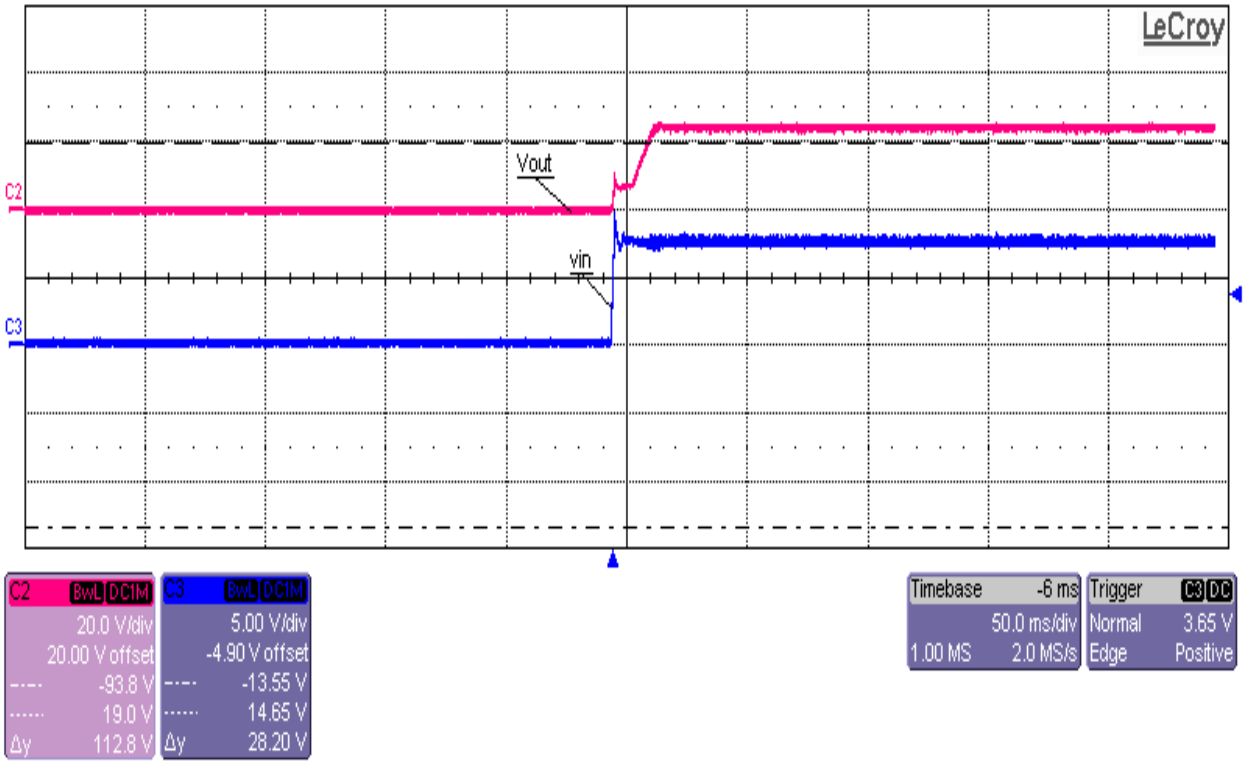


Load Transient Response at 20 Vin and 50%-to-100% (2.5A-to-5A) Load Step

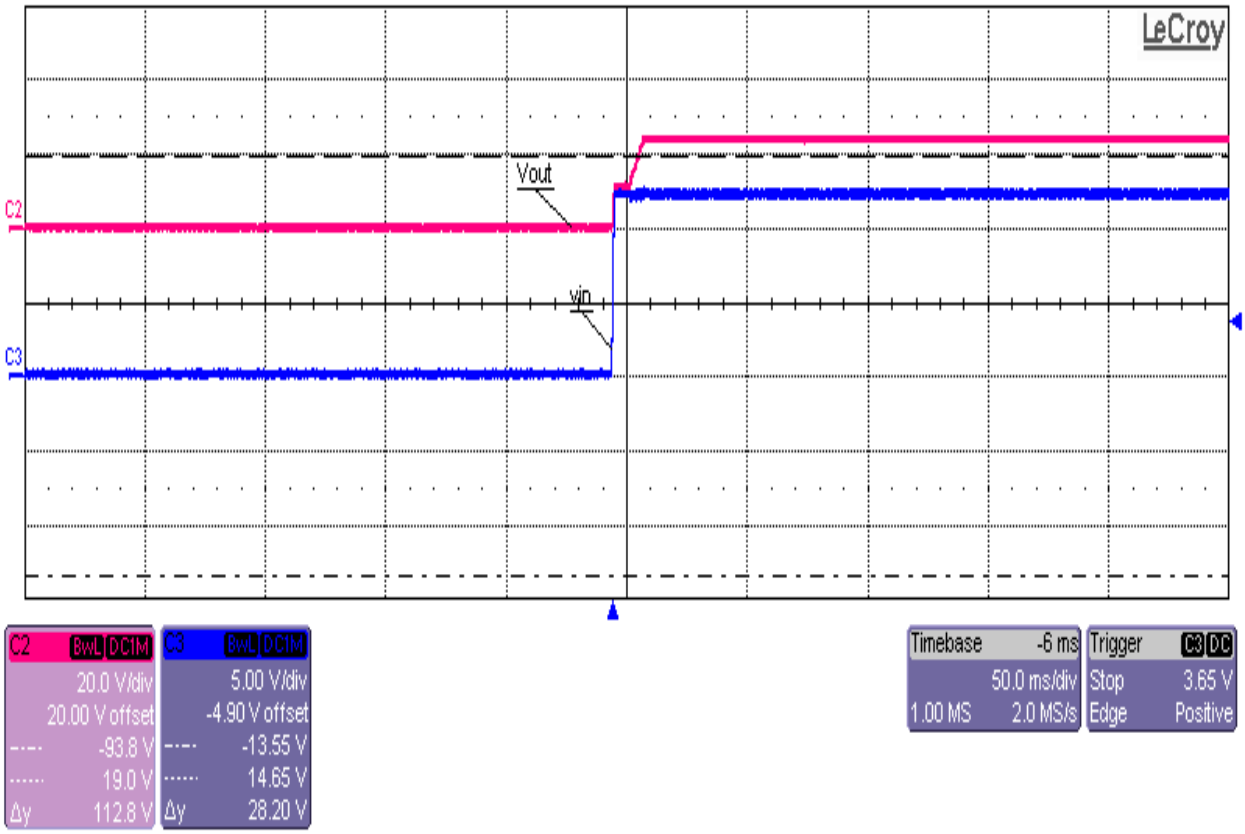
4.3.2 Startup



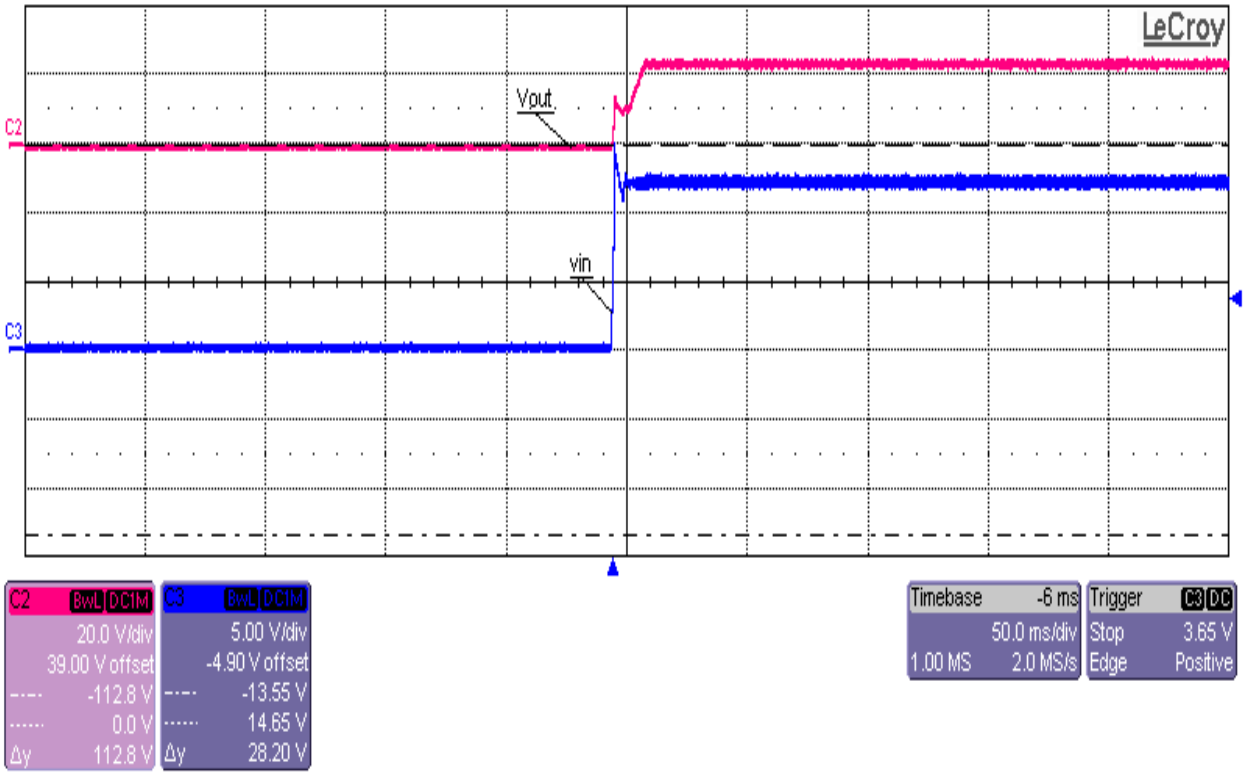
Startup into No Load at 7.5Vin



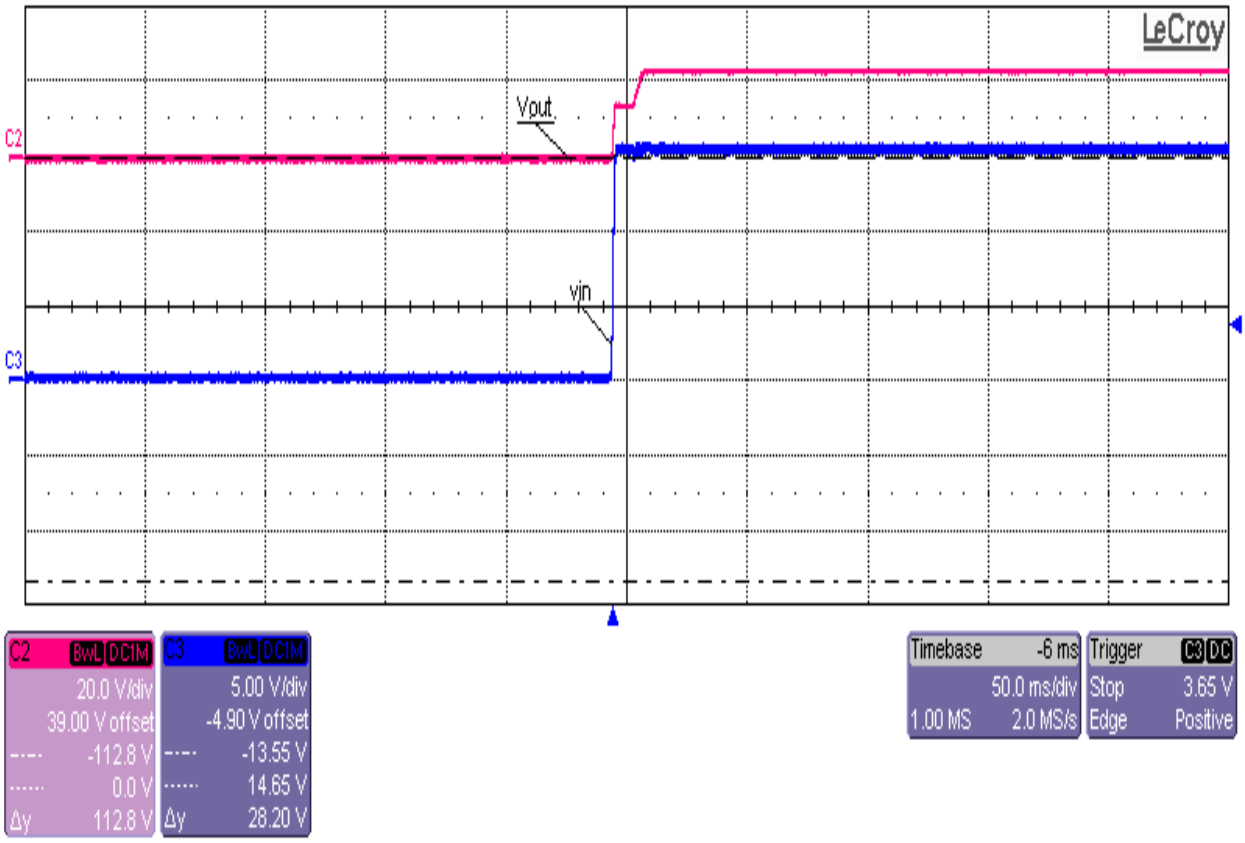
Startup into 5A Load at 7.5Vin



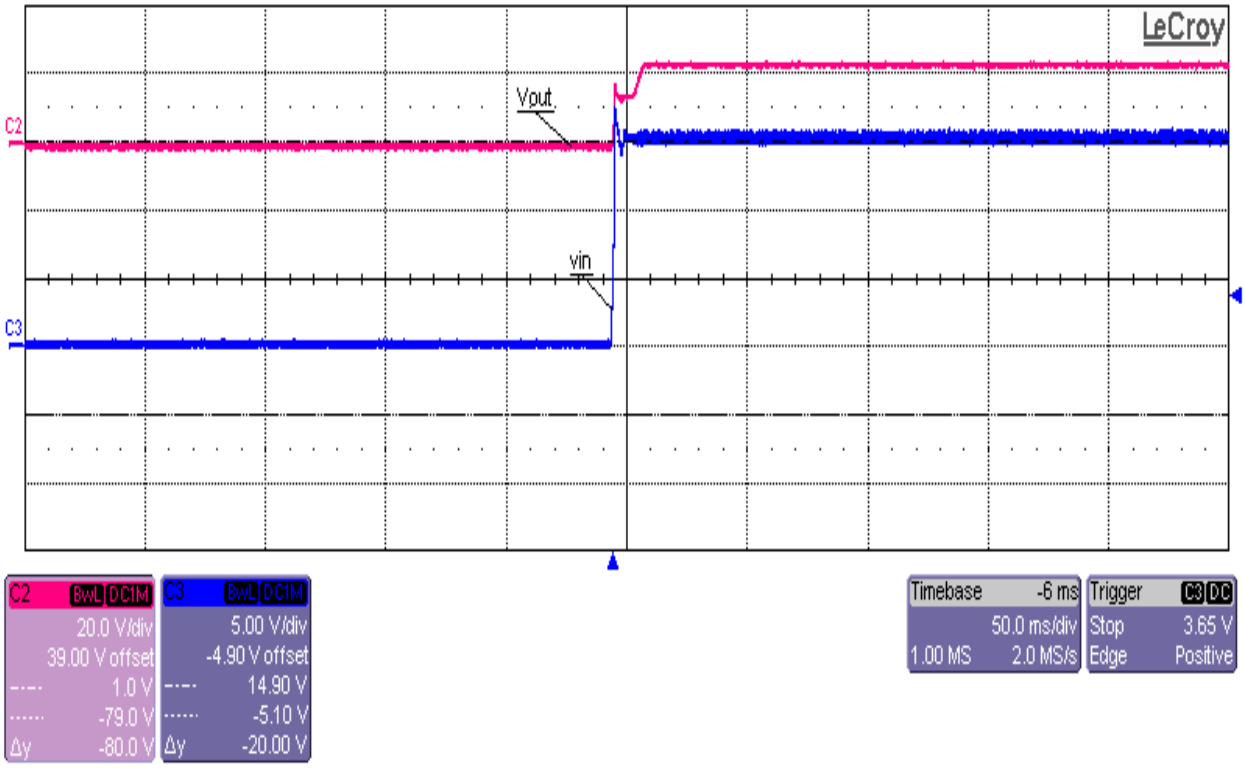
Startup into No Load at 12Vin



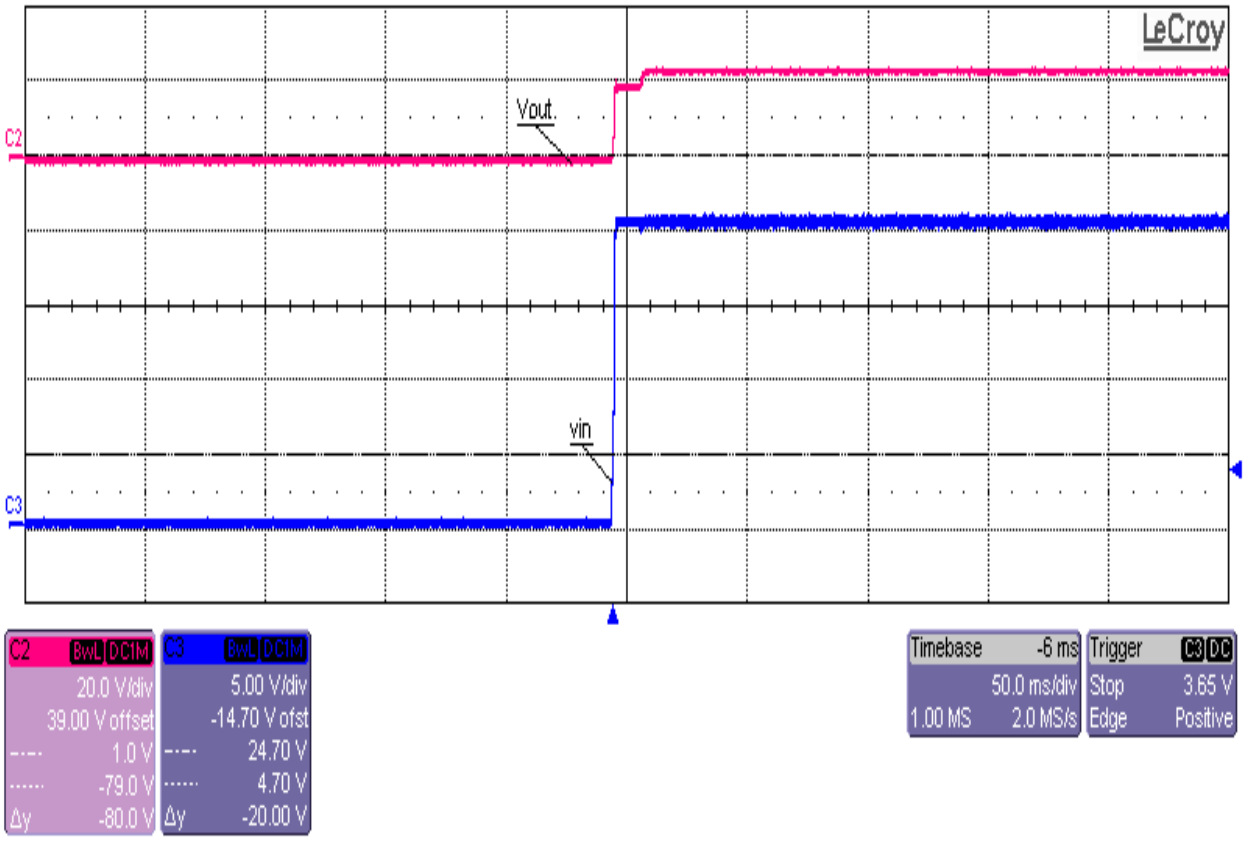
Startup into 5 A Load at 12 Vin



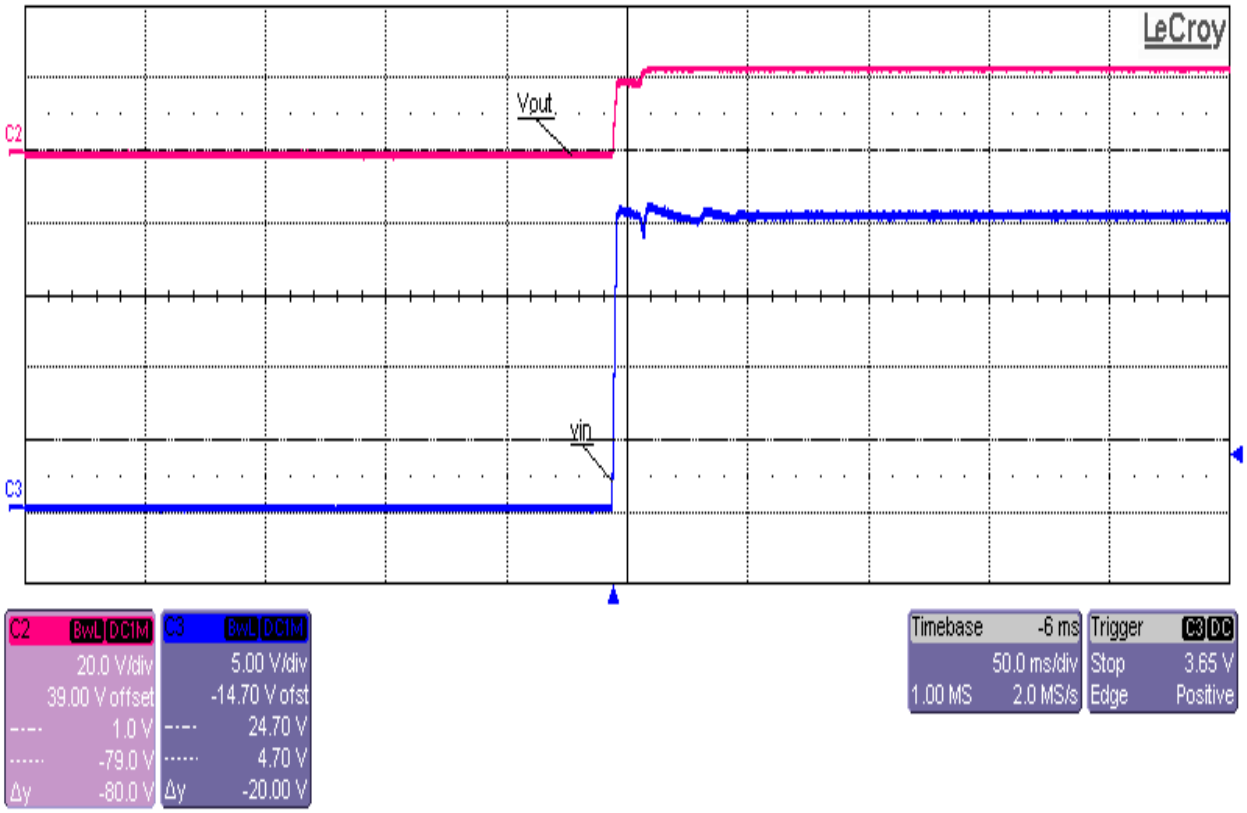
Startup into No Load at 15Vin



Startup into 5A Load at 15Vin

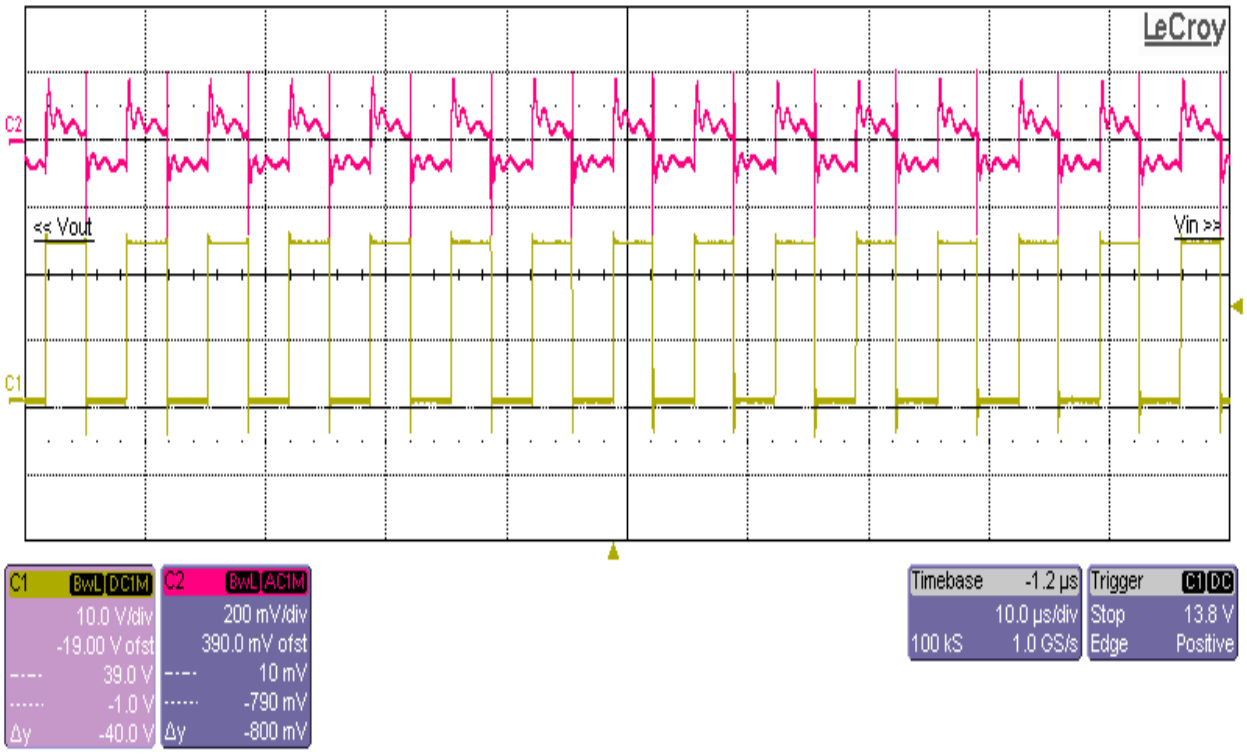


Startup into No Load at 20 Vin

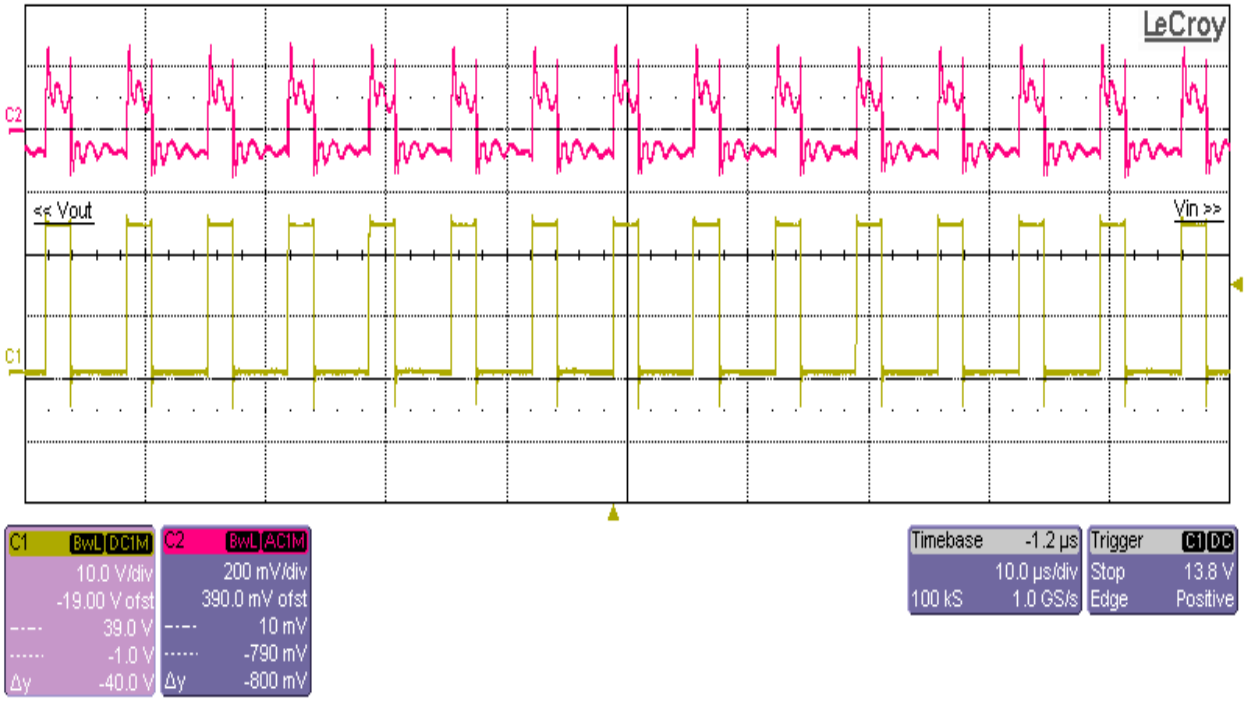


Startup into 5A Load at 20Vin

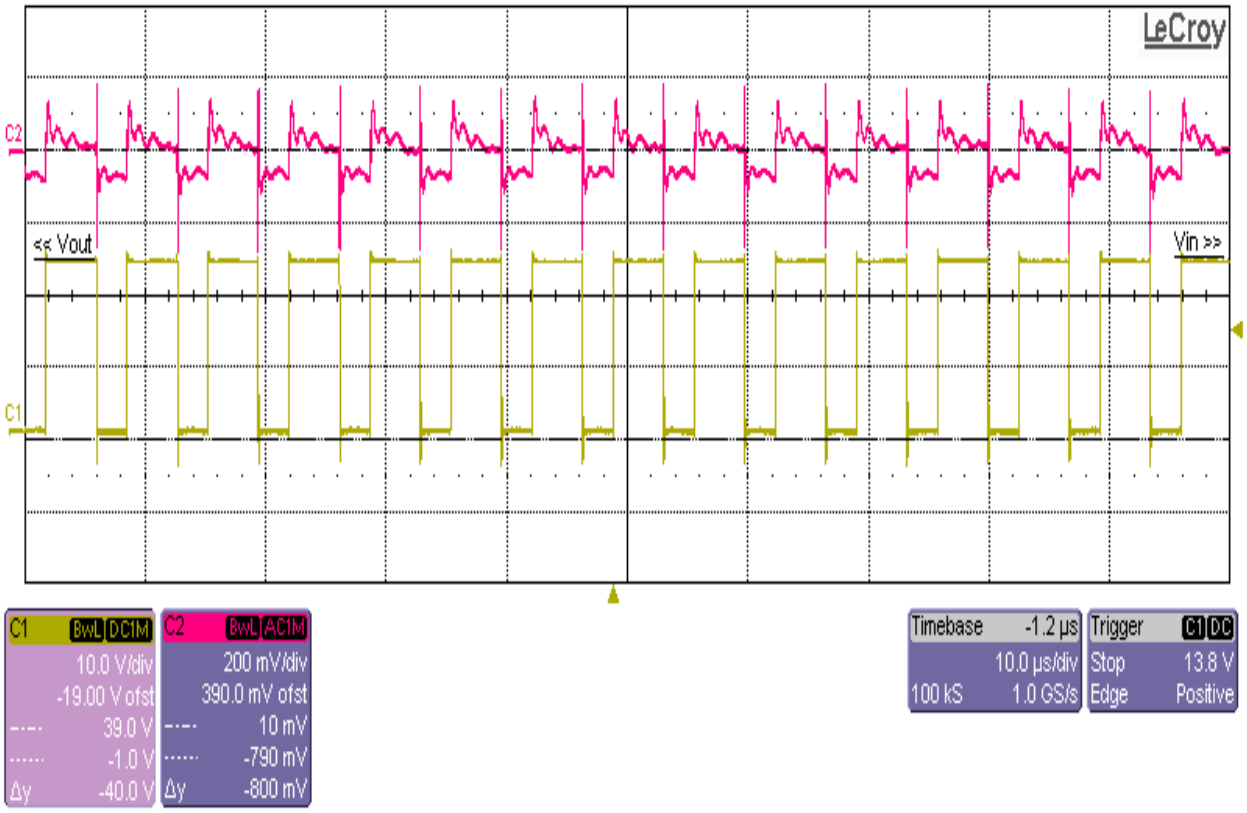
4.3.3 Output Voltage Ripple and Switch Node Voltage



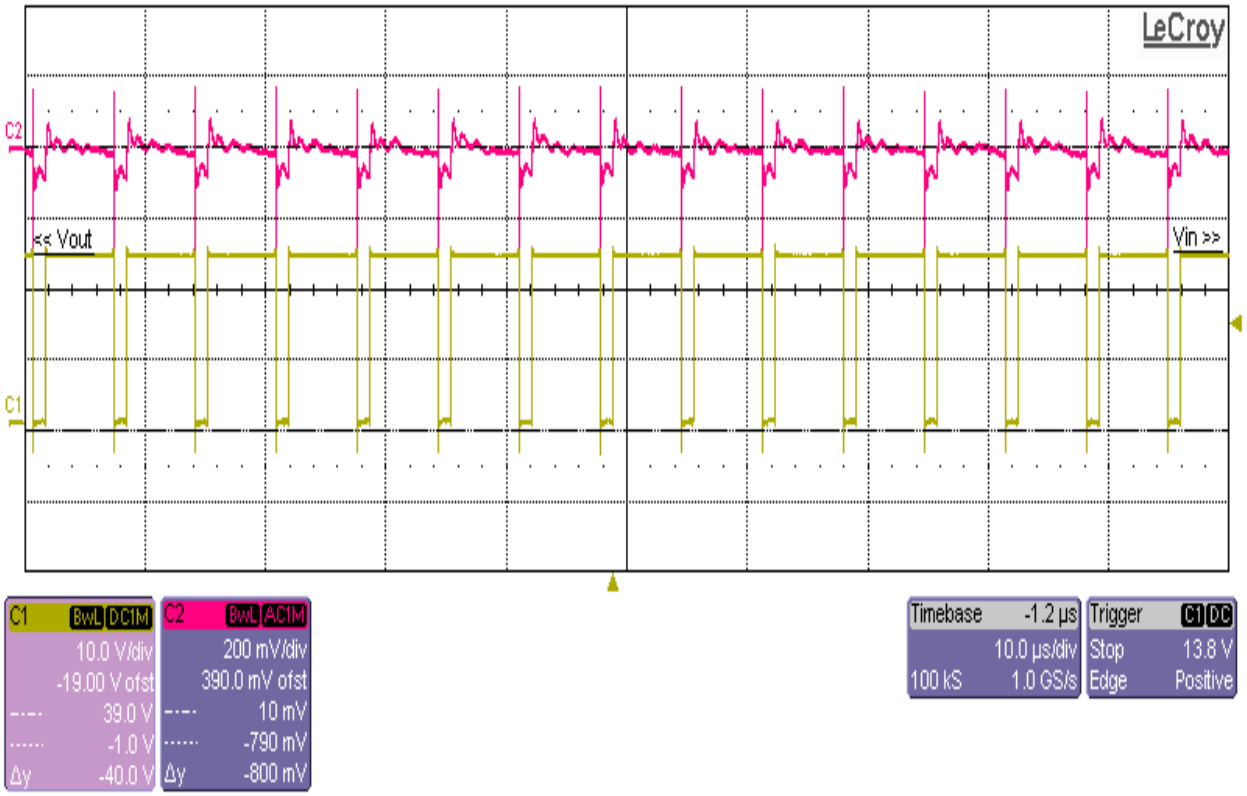
C1 - Switch Node Voltage and Ch2-Output Voltage Ripple at 10Vin and 5A Load (Vripple ≈ 275mVp-p)



C1 - Switch Node Voltage and Ch2-Output Voltage Ripple at 7.5Vin and 5A Load (Vripple ≈ 300mVp-p)



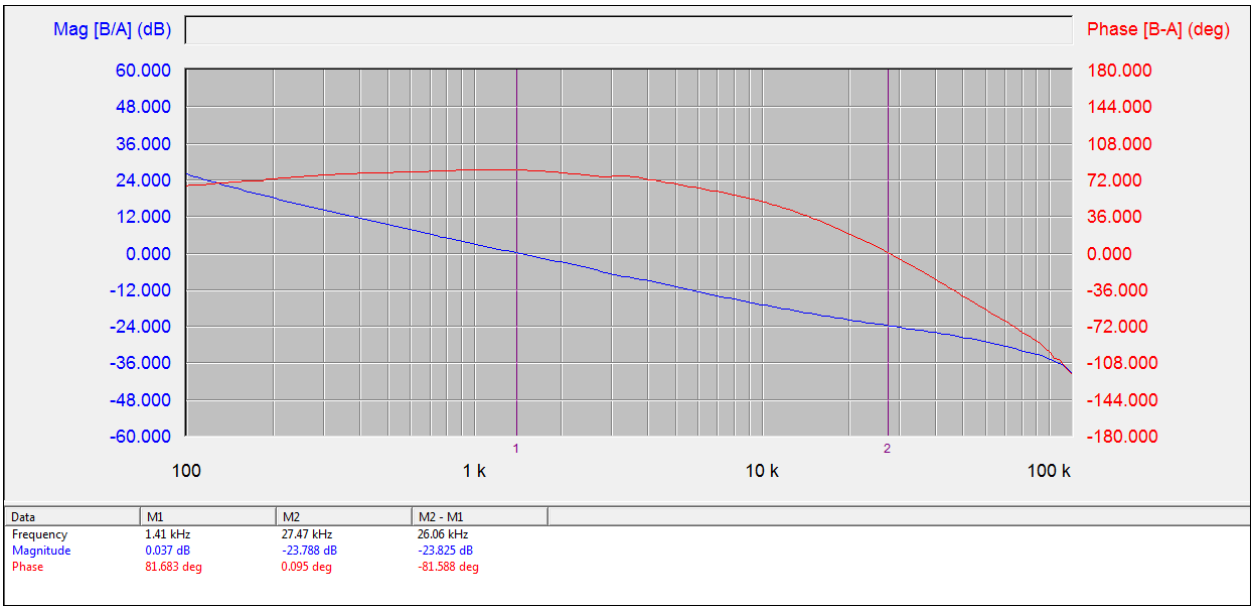
C1 - Switch Node Voltage and Ch2-Output Voltage Ripple at 15 Vin and 5A Load (Vripple ≈ 180mVp-p)



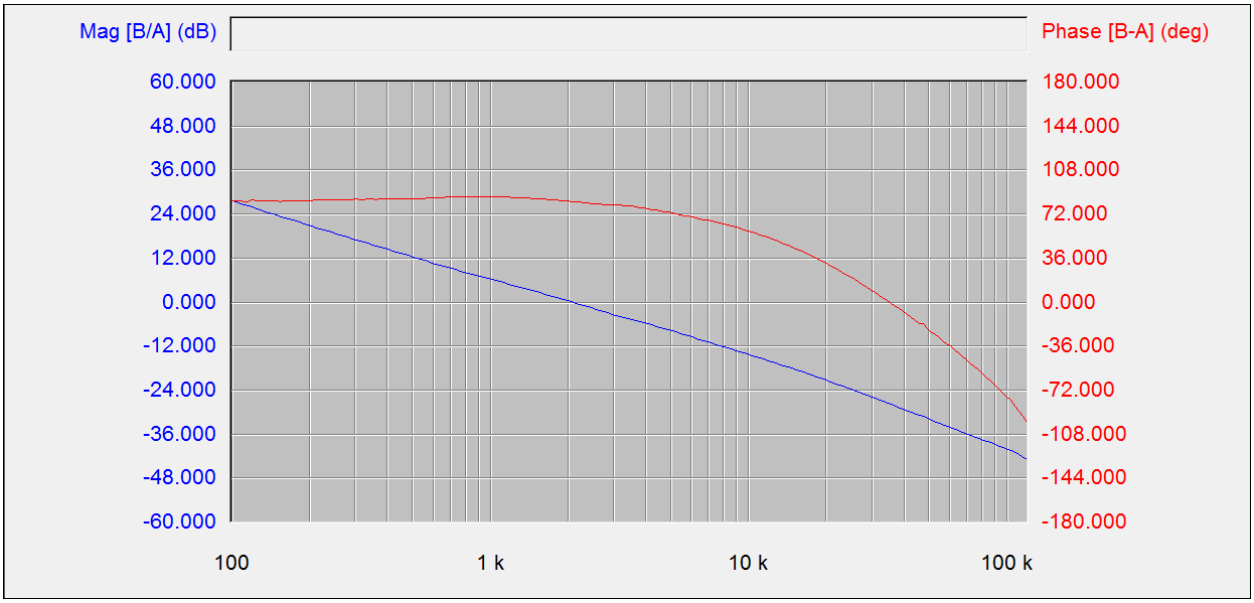
C1 - Switch Node Voltage and Ch2-Output Voltage Ripple at 20Vin and 5A Load (Vripple ≈ 110mVp-p)

4.4 Frequency Response

The output was loaded with 5A .For gain/phase plot 1 , the input was 12V and for gain/phase plot 2 , the input was 20V



Gain/Phase plot 1 at Vin =12V ,Vout =24V@5A

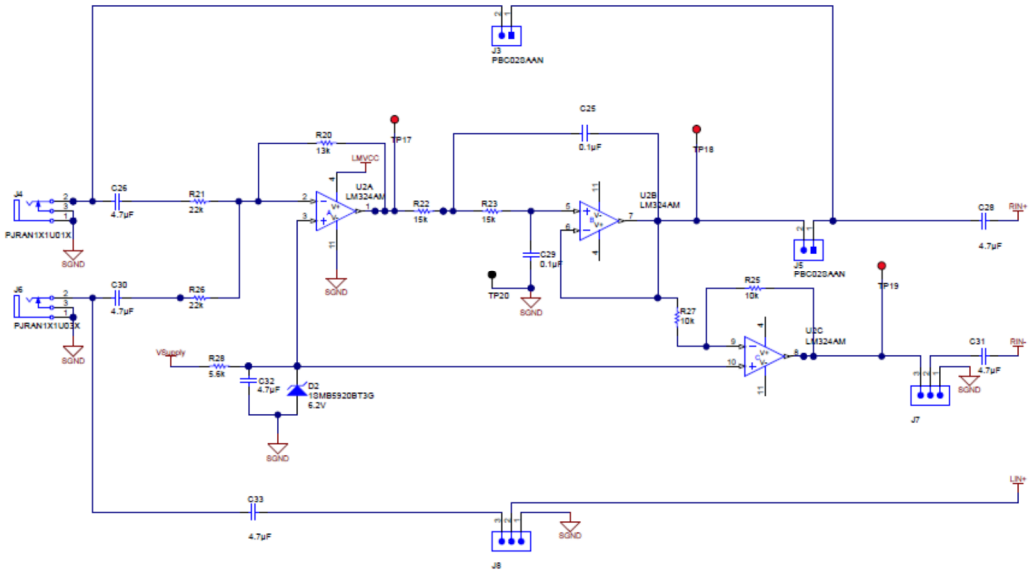


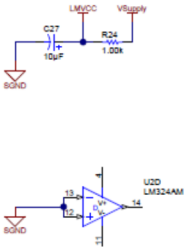
Gain/Phase plot 2 at Vin=20V, Vout =24V@5A

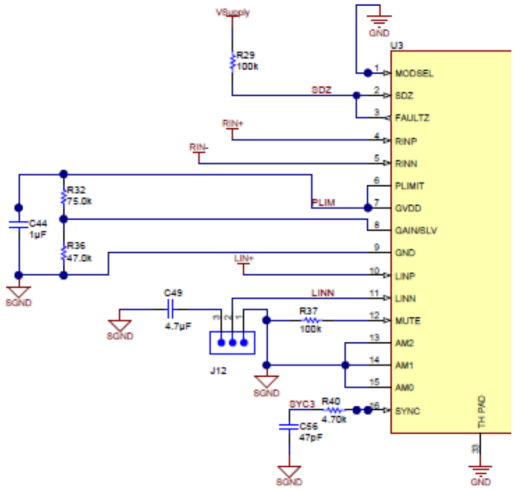
5. Audio Power Amplifier's Test Result and Jumper Connections

The entire test on Audio Amplifier was done with 10V input on DC/DC boost converter (output 24V). The results particularly THD Vs Power reveal that Audio performance remains excellent.

5.1 Jumper Connections







BTL – Stereo Amplifier Jumpers Position:

Place jumper on J3, remove Jumper on J5, Place Jumper in Position 1-2 on J7, Place Jumper in position 2-3 on J8 and place Jumper in position 2-3 on J12.

PBTL – Woofer Amplifier Jumpers Position:

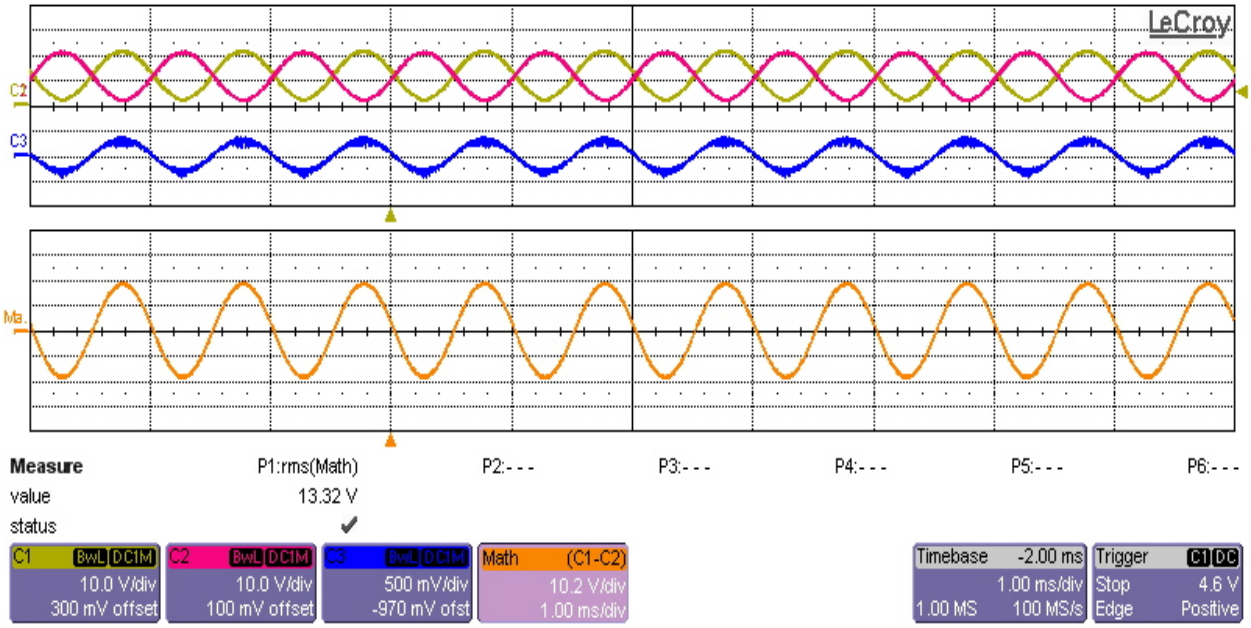
Remove jumper on J3, place Jumper on J5, Place Jumper in Position 2-3 on J7, Place Jumper in position 1-2 on J8 and place Jumper in position 1-2 on J12.

Connect J9 and J10 , Connect J11 and J12 and place 2 Ohm Load Across it for testing in PBTL mode

Simple Second order Low Pass Active filters is used in the design for extracting only Low frequency input for Woofer application.

5.2 BTL: Stereo Waveforms

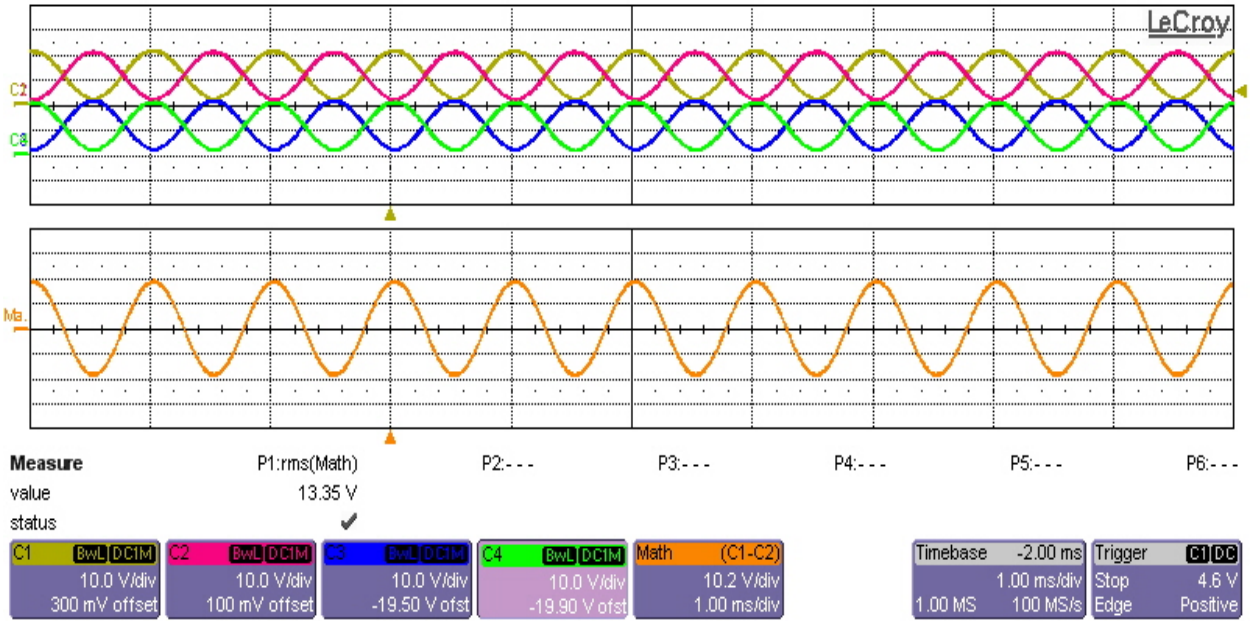
5.2.1 Input /Output Audio



CH1- Out L+ , CH2- Out L- , CH3-Input L ,Math- CH1-CH2 seen by the 4 Ohm Load

Input -220mV RMS 1 KHz Signal

5.2.2 All output Audio Signals

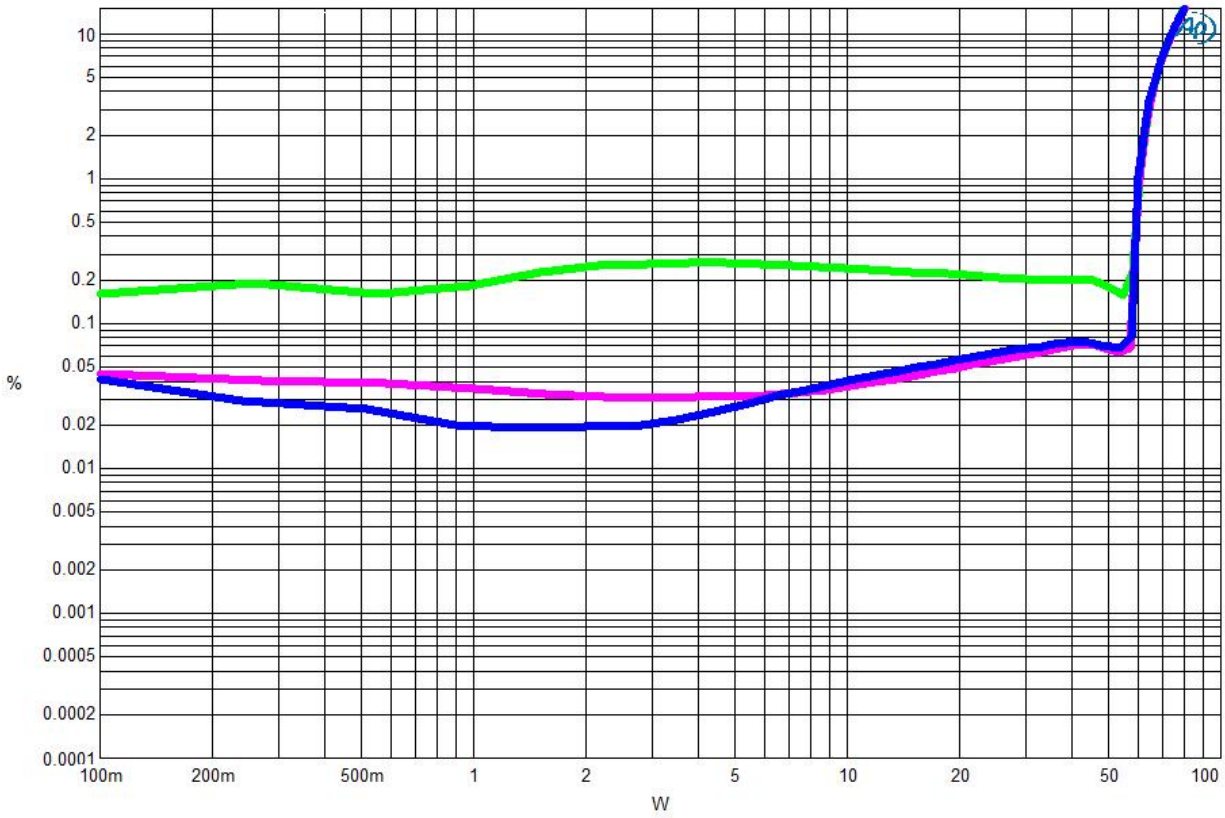


CH1- Out L+ , CH2- Out L- , CH3- Out R+, CH4- Out R- , Math- CH1-CH2 seen by the 4 Ohm Load

Input -220mV RMS 1 KHz Signal

5.2.3 THD Vs Power: BTL mode

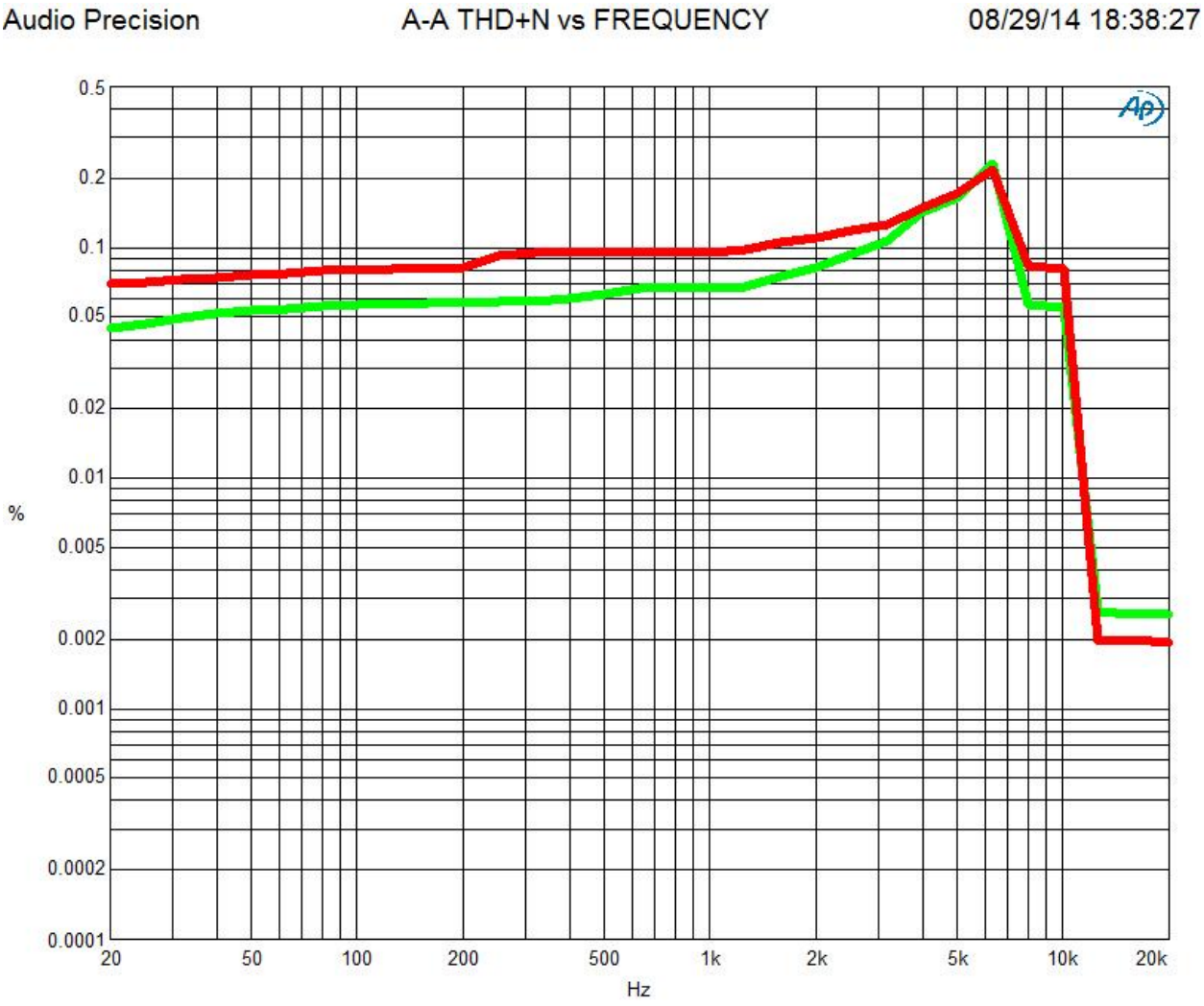
Audio Precision Hypex NC400 THDP



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Green	Solid	6	Anlr.THD+N Ratio	Left	THD vs Power into 4R at 6KHz
3	1	Magenta	Solid	6	Anlr.THD+N Ratio	Left	THD vs Power into 4R at 1KHz
4	1	Blue	Solid	6	Anlr.THD+N Ratio	Left	THD vs Power into 4R at 20Hz

Hypex THD+N VS POWER.at27

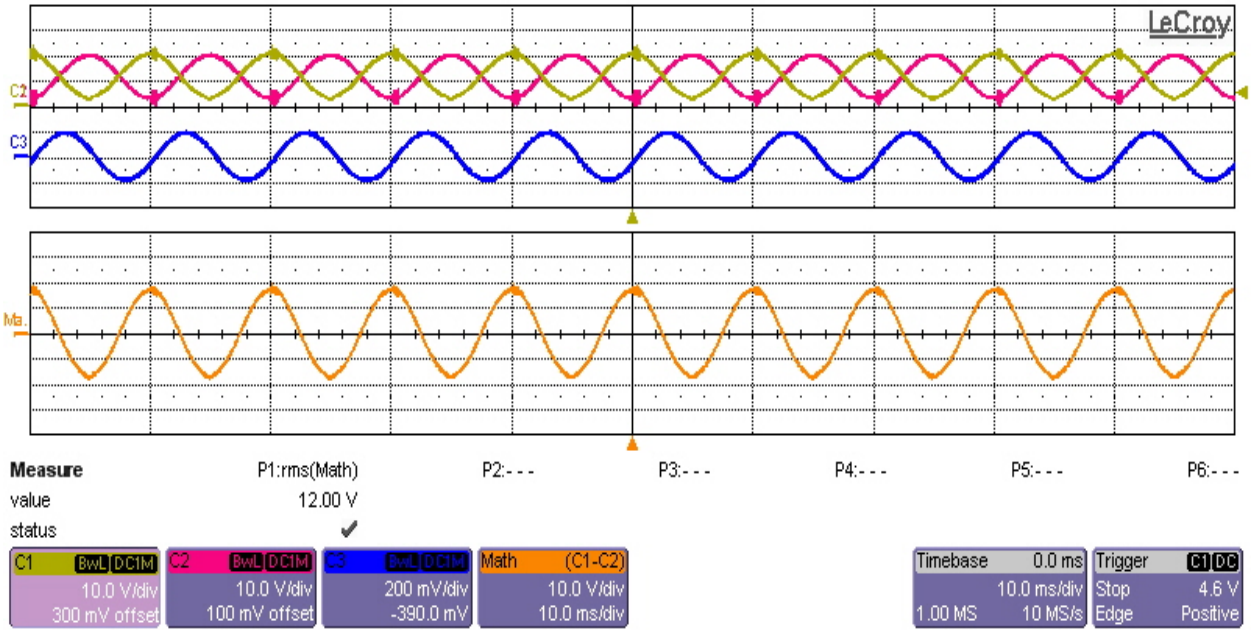
5.2.4 THD Vs Frequency: BTL mode



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Green	Solid	6	Anlr.THD+N Ratio	Left	20W
2	1	Red	Solid	6	Anlr.THD+N Ratio	Left	50W

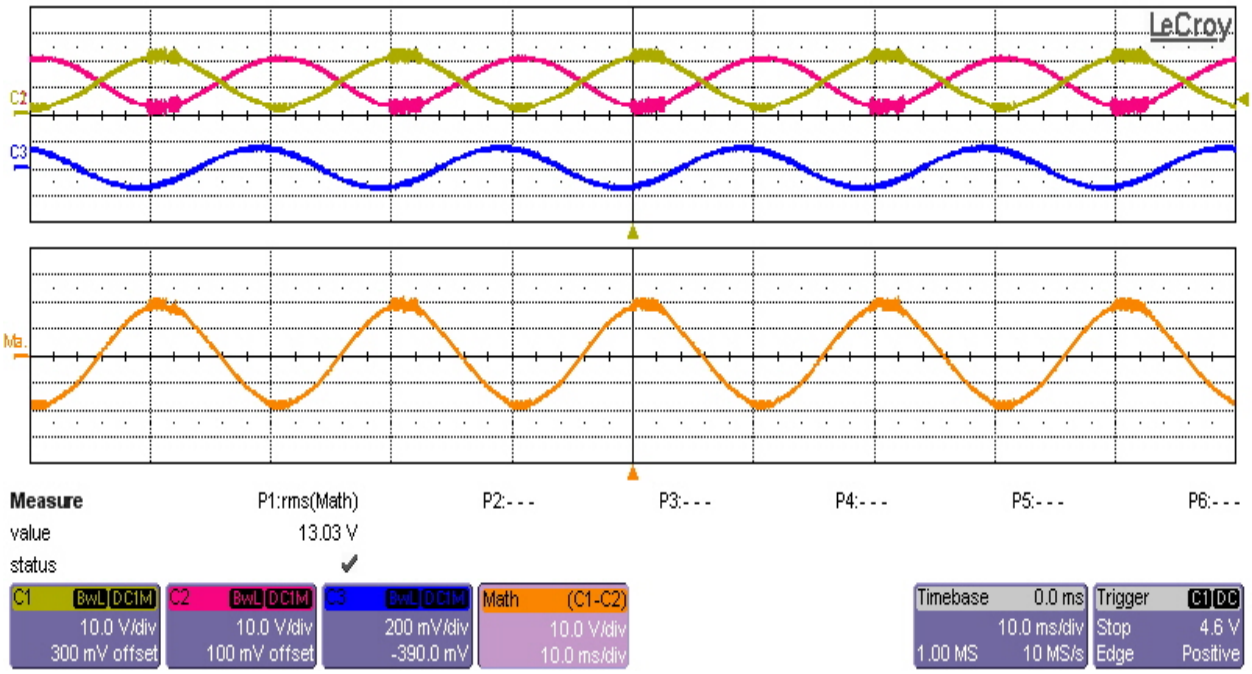
5.3 PBTL: Woofer Waveforms

5.3.1 Input /Output Audio Signals



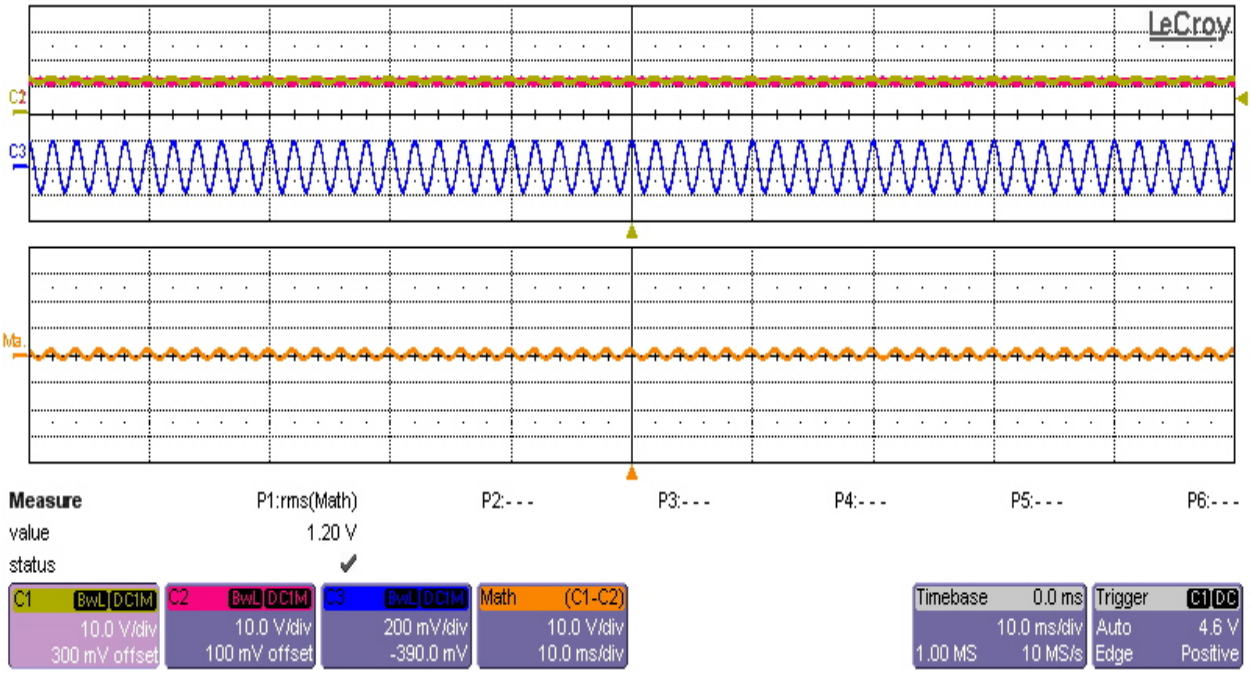
CH1- Out W+(L+ and L- Connected together) , CH2- Out W-(R+ and R- Connected together) , CH3- Input Audio Signal, Math- CH1-CH2 seen by the 2 Ohm Load

Input -140mV RMS 100 Hz Signal



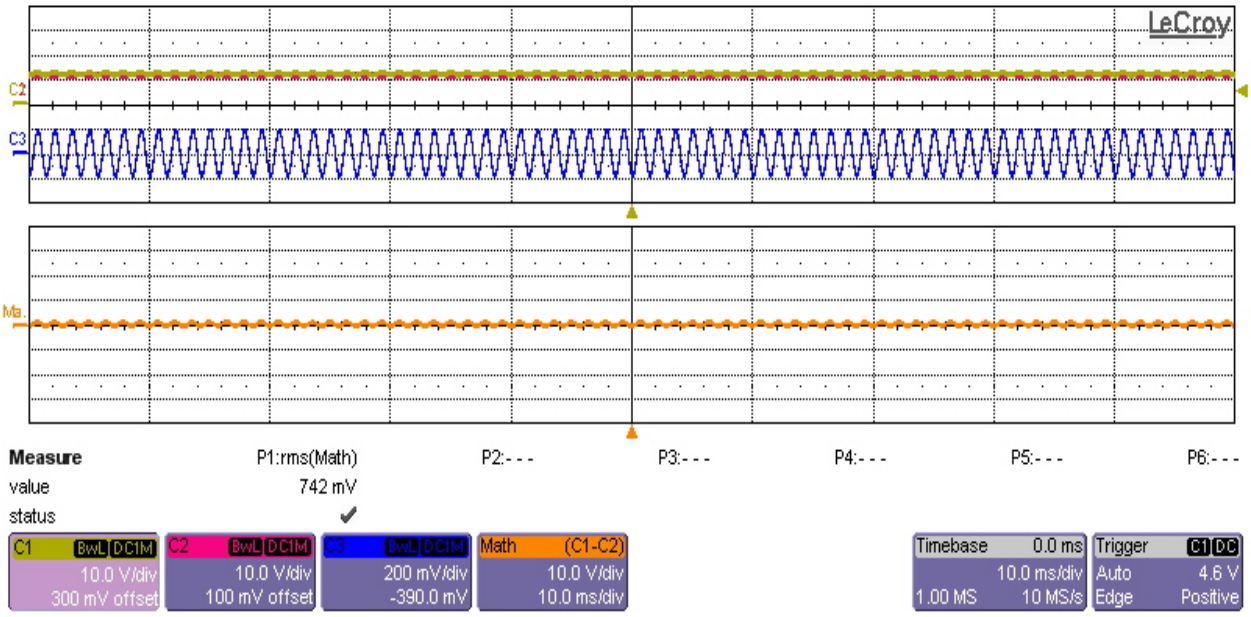
CH1- Out W+(L+ and L- Connected together) , CH2- Out W-(R+ and R- Connected together) , CH3- Input Audio Signal, Math- CH1-CH2 seen by the 2 Ohm Load

Input -140mV RMS 50 Hz Signal



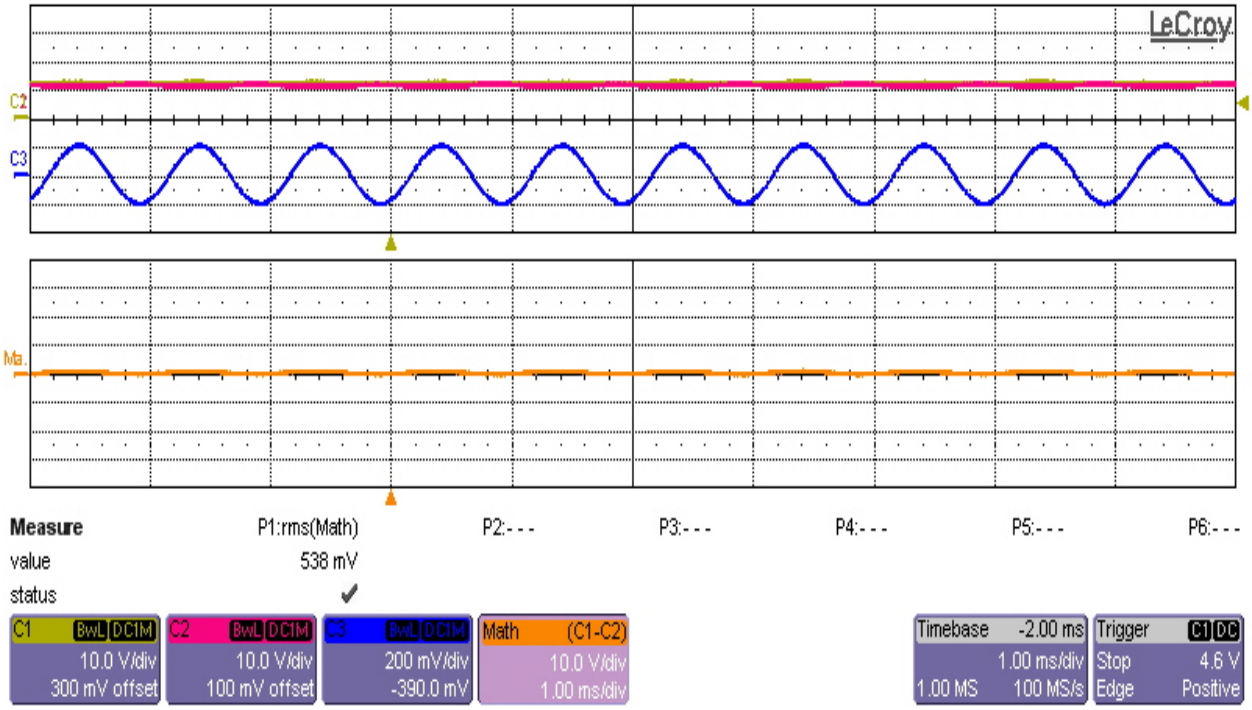
CH1- Out W+(L+ and L- Connected together) , CH2- Out W-(R+ and R- Connected together) , CH3- Input Audio Signal, Math- CH1-CH2 seen by the 2 Ohm Load

Input -140mV RMS 500 Hz Signal (out of Woofer Range)



CH1- Out W+(L+ and L- Connected together) , CH2- Out W-(R+ and R- Connected together) , CH3- Input Audio Signal, Math- CH1-CH2 seen by the 2 Ohm Load

Input -140mV RMS 700 Hz Signal (out of Woofer Range)

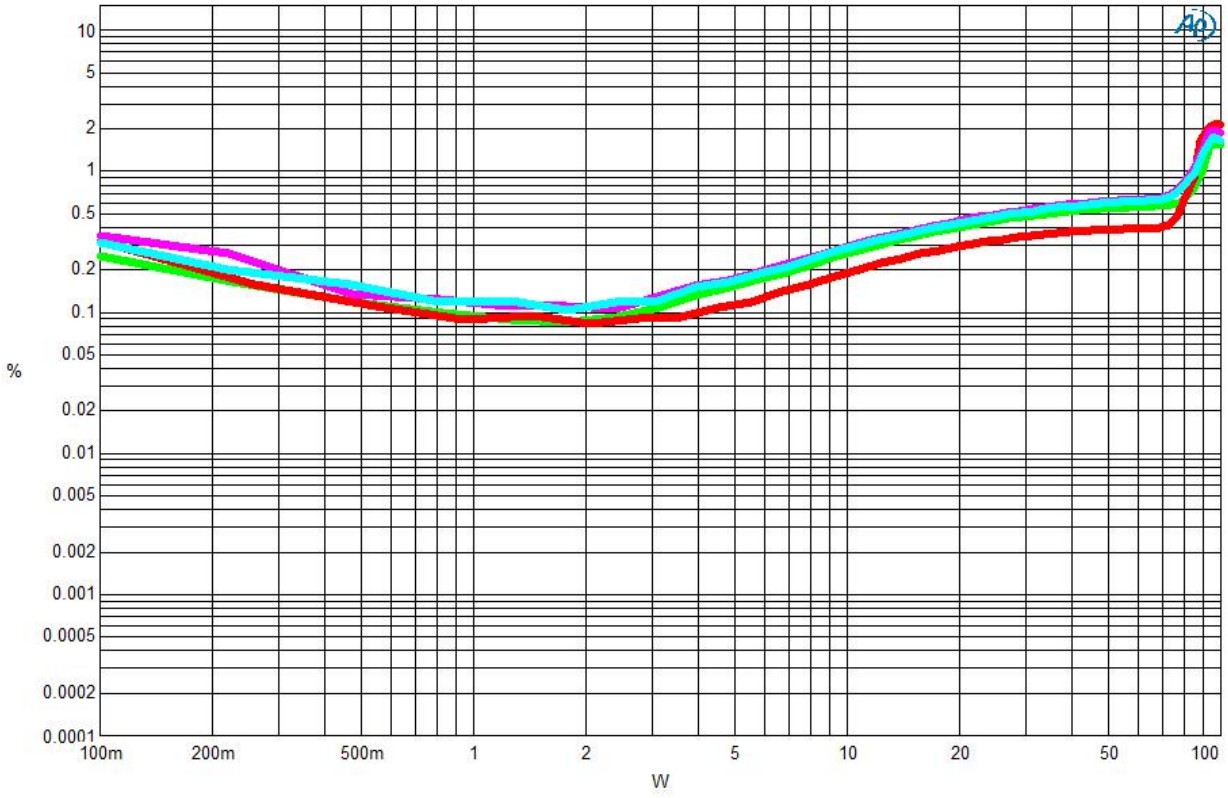


CH1- Out W+(L+ and L- Connected together) , CH2- Out W-(R+ and R- Connected together) , CH3- Input Audio Signal, Math- CH1-CH2 seen by the 2 Ohm Load

Input -140mV RMS 1000 Hz Signal (out of Woofer Range)

5.3.2 THD Vs Power: PBTL into 2 Ohm

Audio Precision Hypex NC400 THDP



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Green	Solid	6	Anlr.THD+N Ratio	Left	50Hz PBTL
2	1	Red	Solid	6	Anlr.THD+N Ratio	Left	20Hz PBTL
3	1	Magenta	Solid	6	Anlr.THD+N Ratio	Left	80Hz PBTL
5	1	Cyan	Solid	6	Anlr.THD+N Ratio	Left	100Hz PBTL

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