Test Results
for
Power Module for 7 series Xilinx devices

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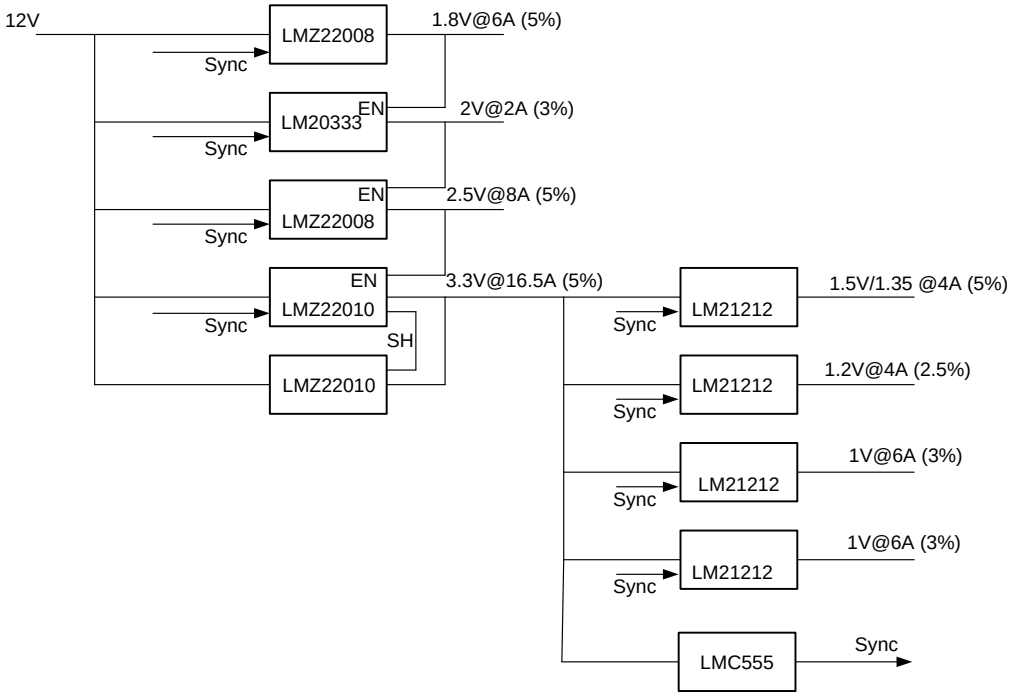
Overview Power Architecture

The approach for this reference design is based on “ease of use” and low risk to manufacture. Simple Switcher power modules along with the LM2121x low voltage synchronous buck regulators allow for fast turn prototyping and quick time to manufacturer with minimal technical issues. (Needs to be tweaked by the marketers?)

Power Architecture Block Diagram (total Tolerance in brackets shown); sync Frequency ~430kHz



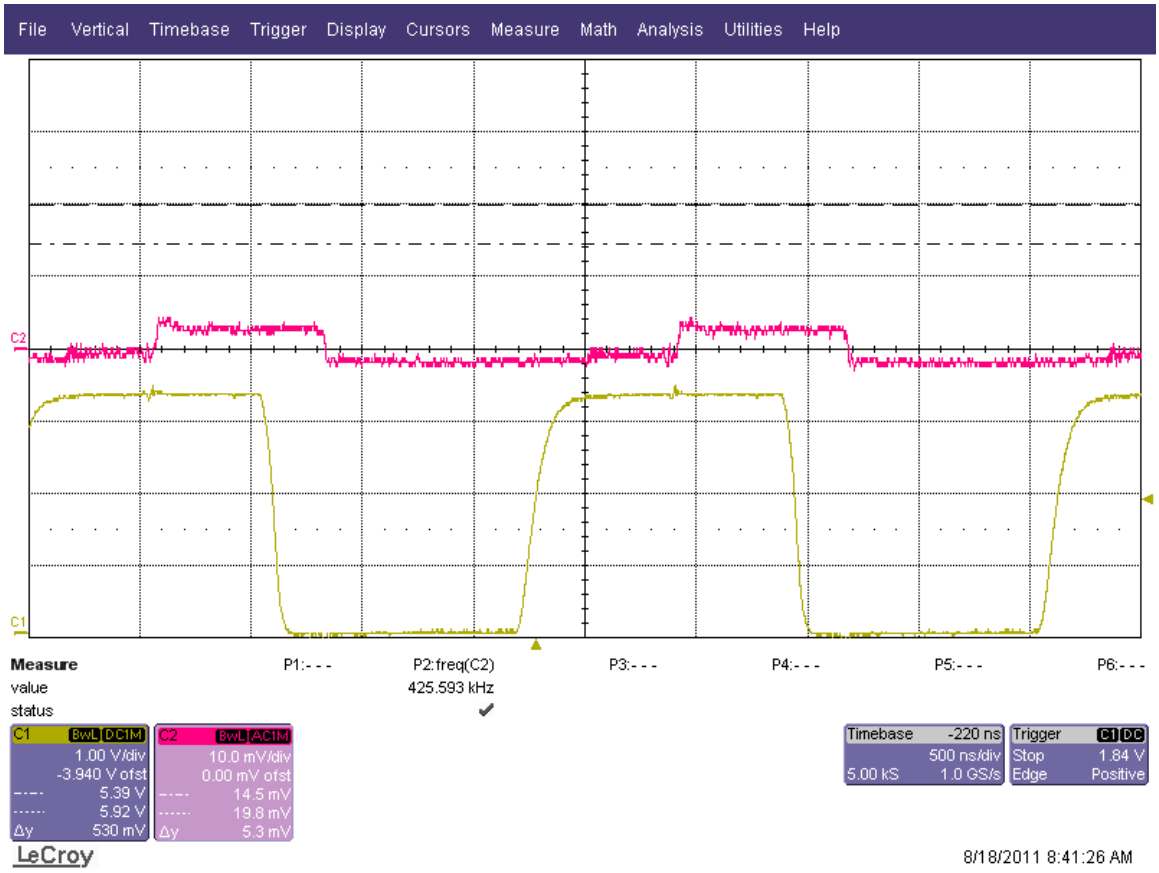
Results

Output Ripple Voltage

Load Conditions are Maximum
3.3 8 (Totaling 16A)
1.8V 6A
2.0V 2A
1.3V 4A
2.5V 8A
1.0V 6A
1.0V 6A
1.2V 4A

Comment
Channel one for all output ripple scope shots are the sync in pulse.

Vout Ripple 3.3V
(U6 and U7) Across Output Capacitor
Downstream Regulator Loads and 8A Load; total 16A
Output Capacitor = 4 X 470uF



Comment
Output ripple on the 3.3V rail at the input to downstream converters will be worse due to the input ripple requirements for a buck converter.

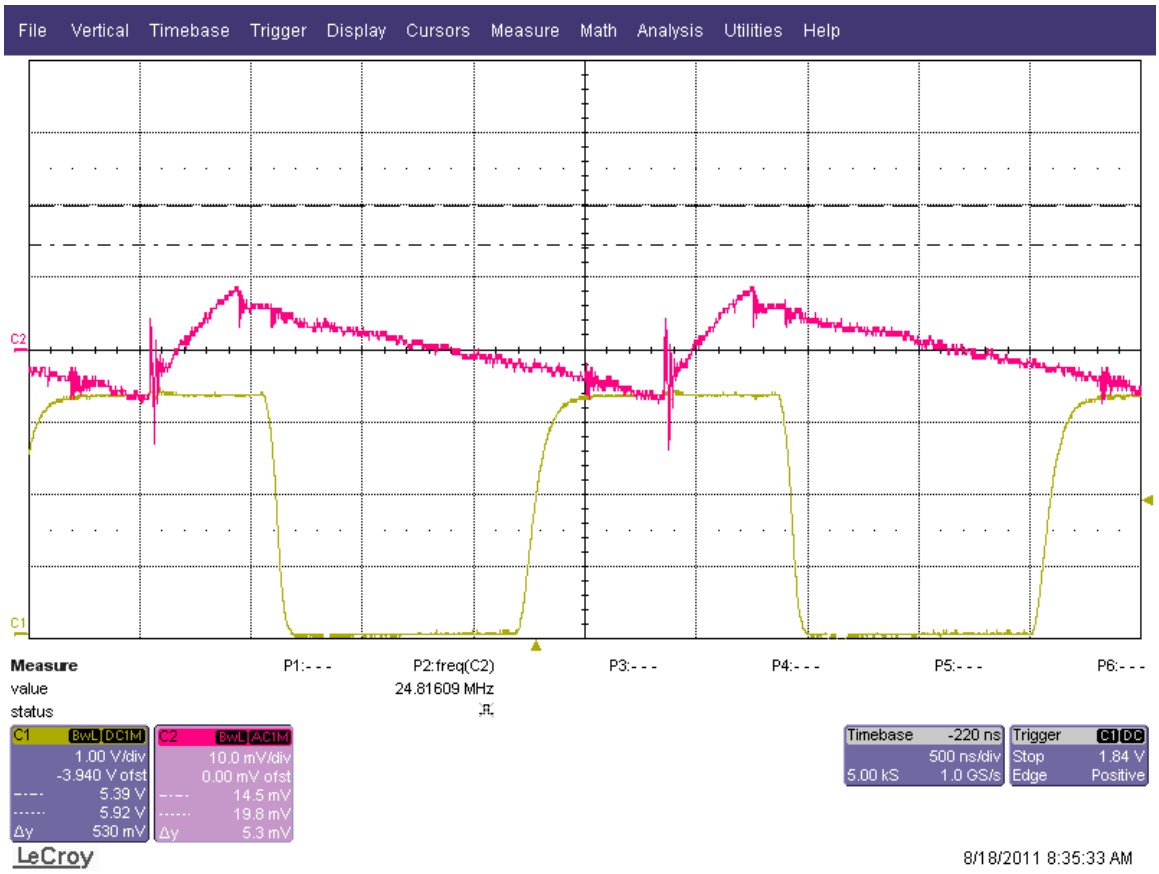
Ripple out load will be determine by the types and how much capacitance is present at load.
Result
Vout out ripple on is less than **10mV** peak to peak

3.3V Output Ripple (U6 and U7) measured across J Pins
Downstream Regulator Loads and 8A Load
Output Capacitor = 4 X 470uF

Comment
Voltage ripple seen here is much worse due to the input ripple current for the downstream buck converters. As mentioned, the 3.3V rail is off the board and is expected and is advised to install extra capacitance at load.

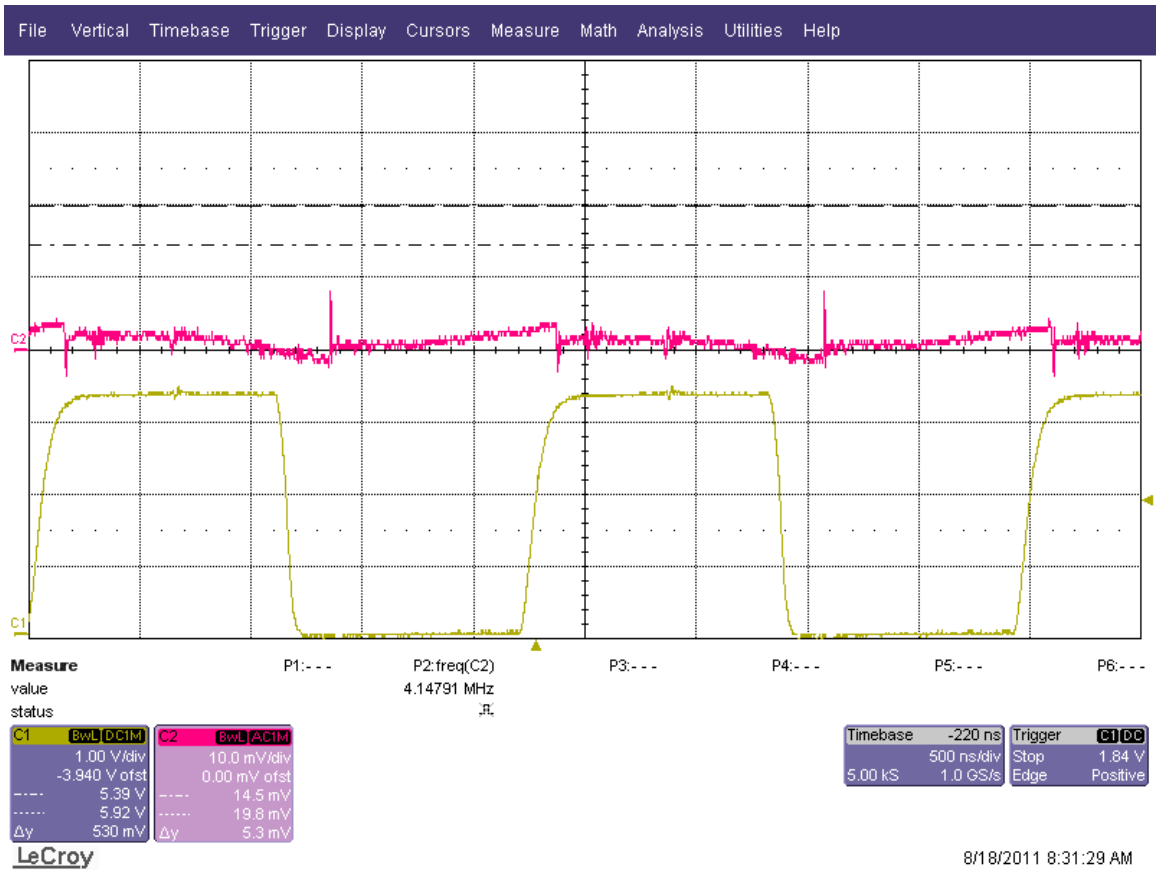
Result
Vout ripple **~ 100mV** peak to peak at the J pins on connector.

Vout Ripple 1.8V
(U1) Across Output Capacitor
1.8V @ 6A



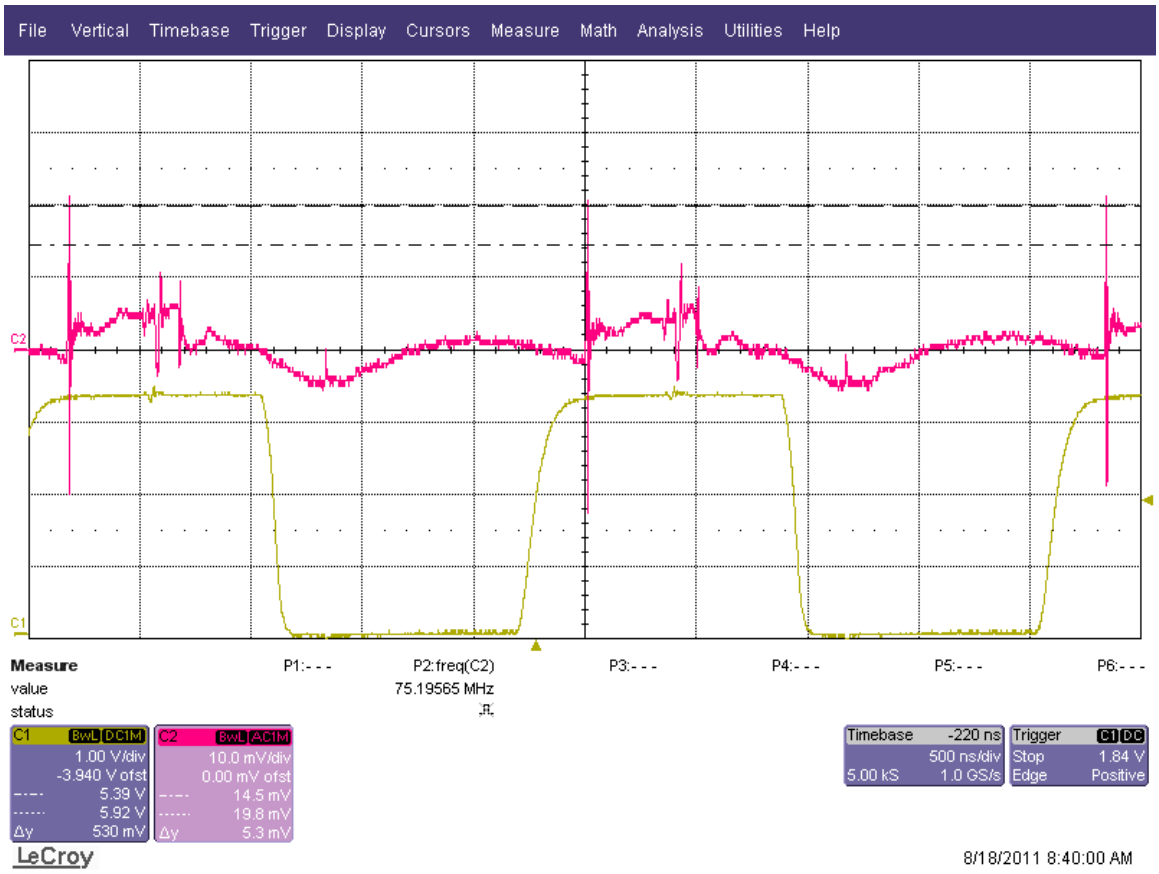
Result
~16mV Peak to peak

Vout Ripple 1.35V
(U3) Across Output Capacitor
1.35V @ 4A



Result
Less than **10mV** peak to peak

Vout Ripple 2V
(U2) Across Output Capacitor
2.0V @ 2A



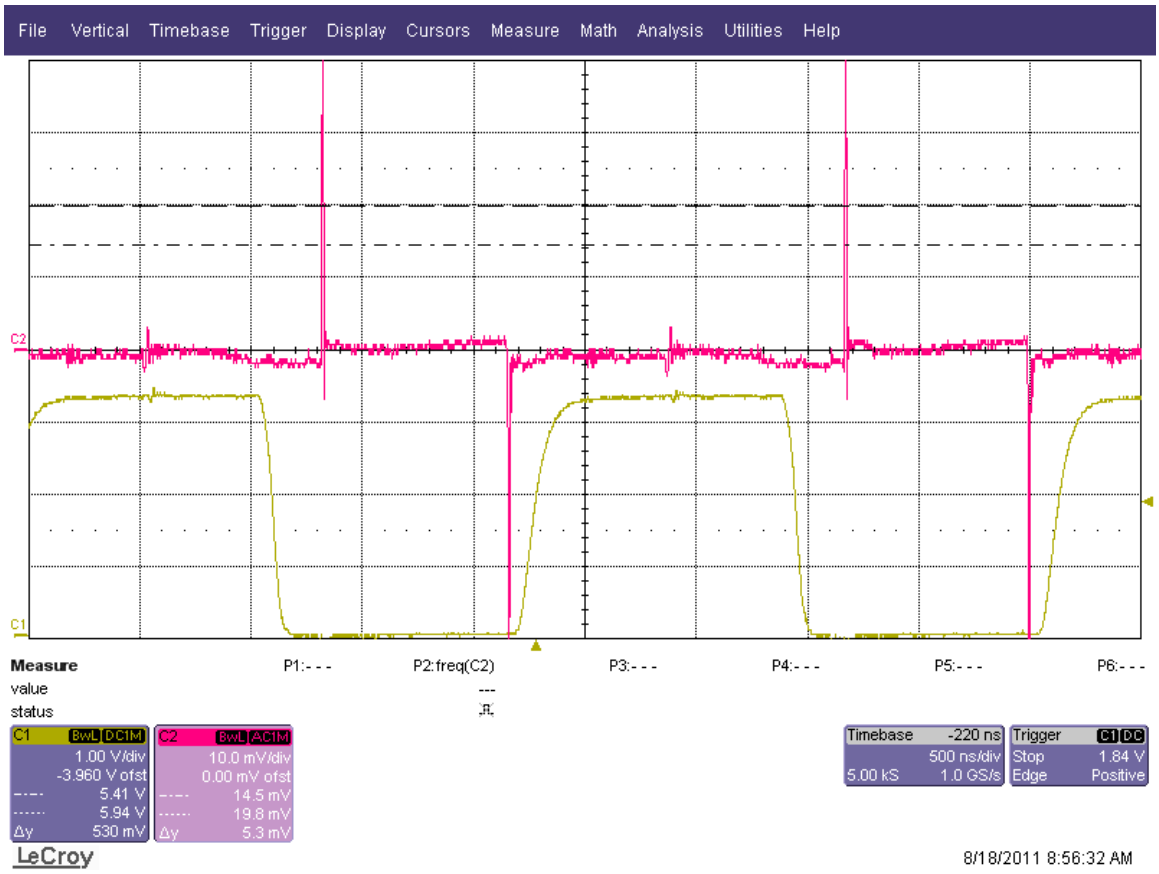
Result
~12mV peak to peak

Vout Ripple 1V
(U10) Across Output Capacitor
1.0V @ 6A

Comment
Spikes on output is due to noise pick up (see Switch node results)

Result
Less than **10mV** peak to peak

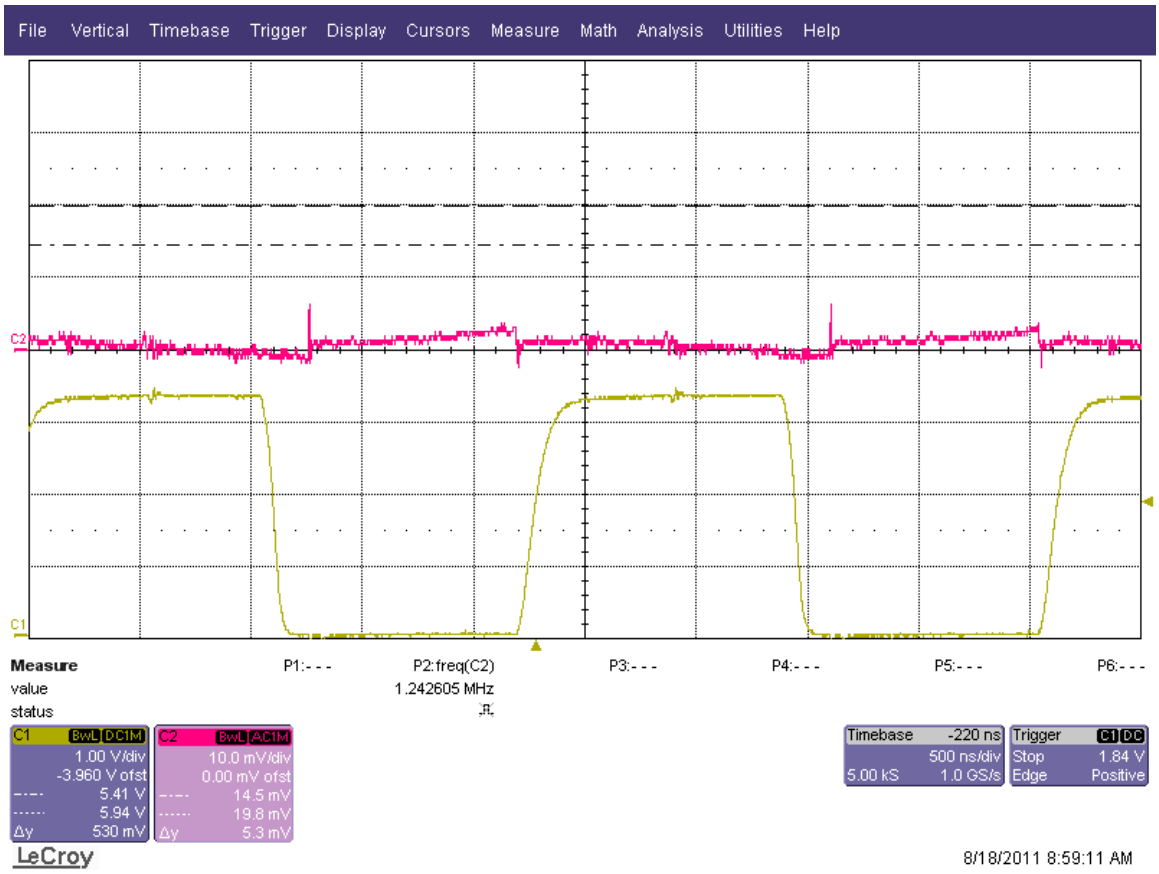
Vout Ripple 1V
(U8) Across Output Capacitor
1.0V @ 6A



Comment
Spikes on output is due to noise pick up (see Switch node results)

Result
Less than **10mV** peak to peak

Vout Ripple 1.2V
(U5) Across Output Capacitor
1.2V @ 4A



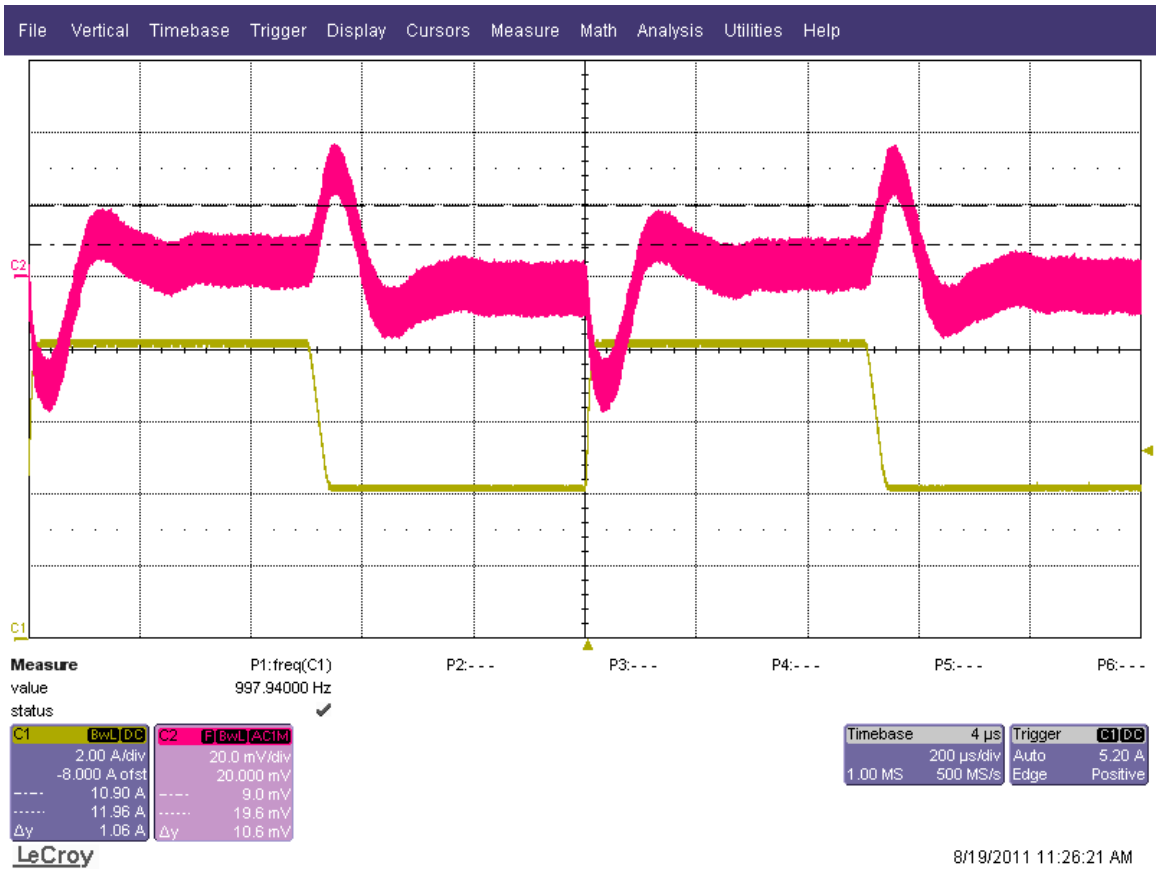
Result
Less than **10mV** peak to peak

Vout Ripple 2.5V
(U4) Across Output Capacitor
2.5V @ 8A

Result
Less than **20mV** peak to peak

Load Transient Performance

3.3V (U6 & U7) 4A to 8A; Slew Rate:1275mA/us



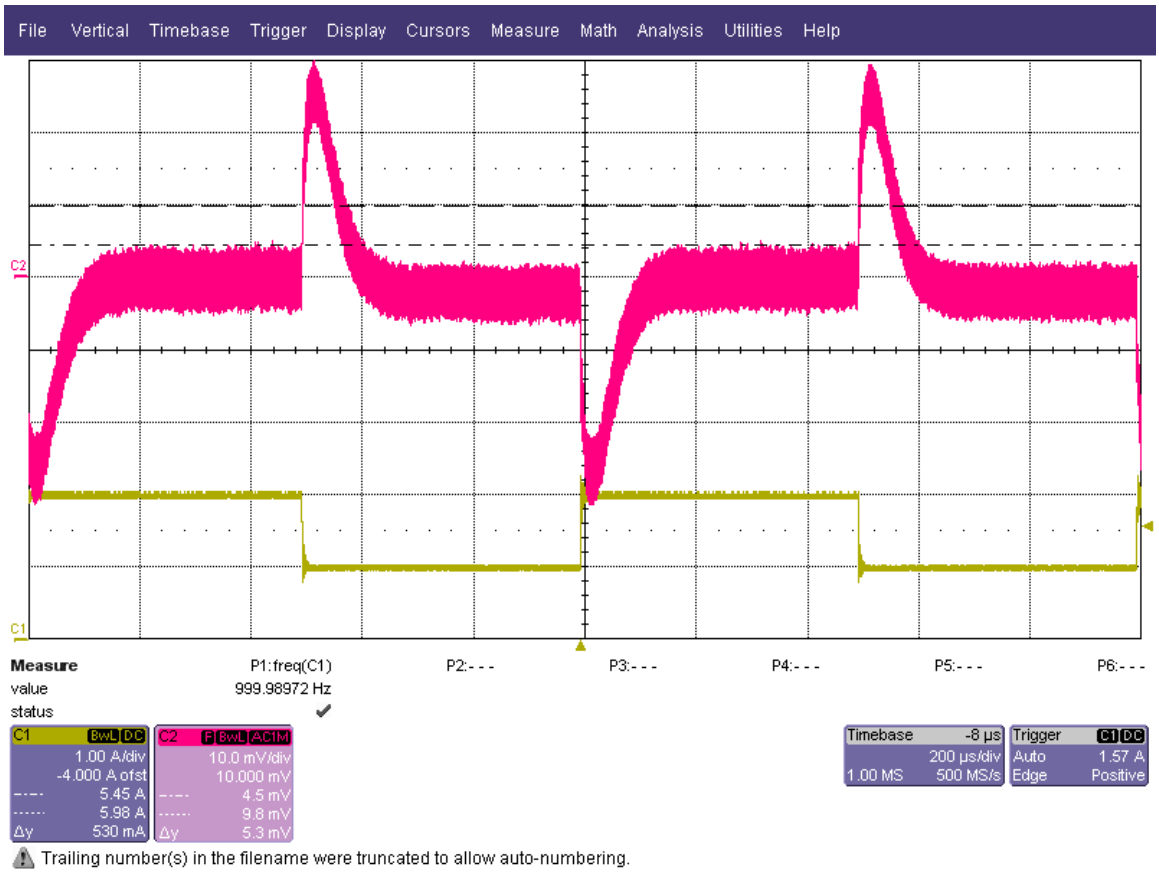
Result
~**40mV** undershoot/Overshoot

1.8V (U1) 3A to 6A, Slew rate 200mA/us

Result

~**30mV** undershoot/Overshoot

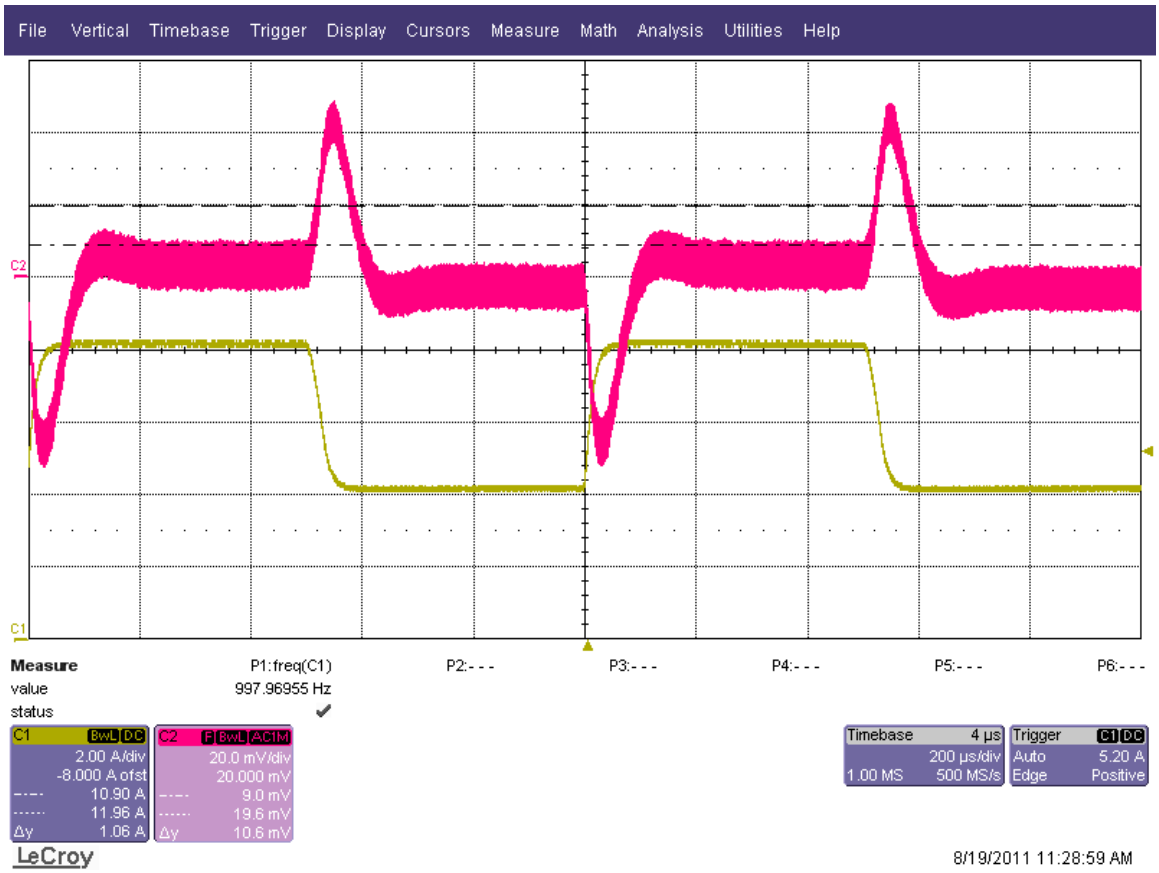
2.0V (U2) 1A to 2A, Slew rate 2500mA/us



Result

~**30mV** undershoot/Overshoot

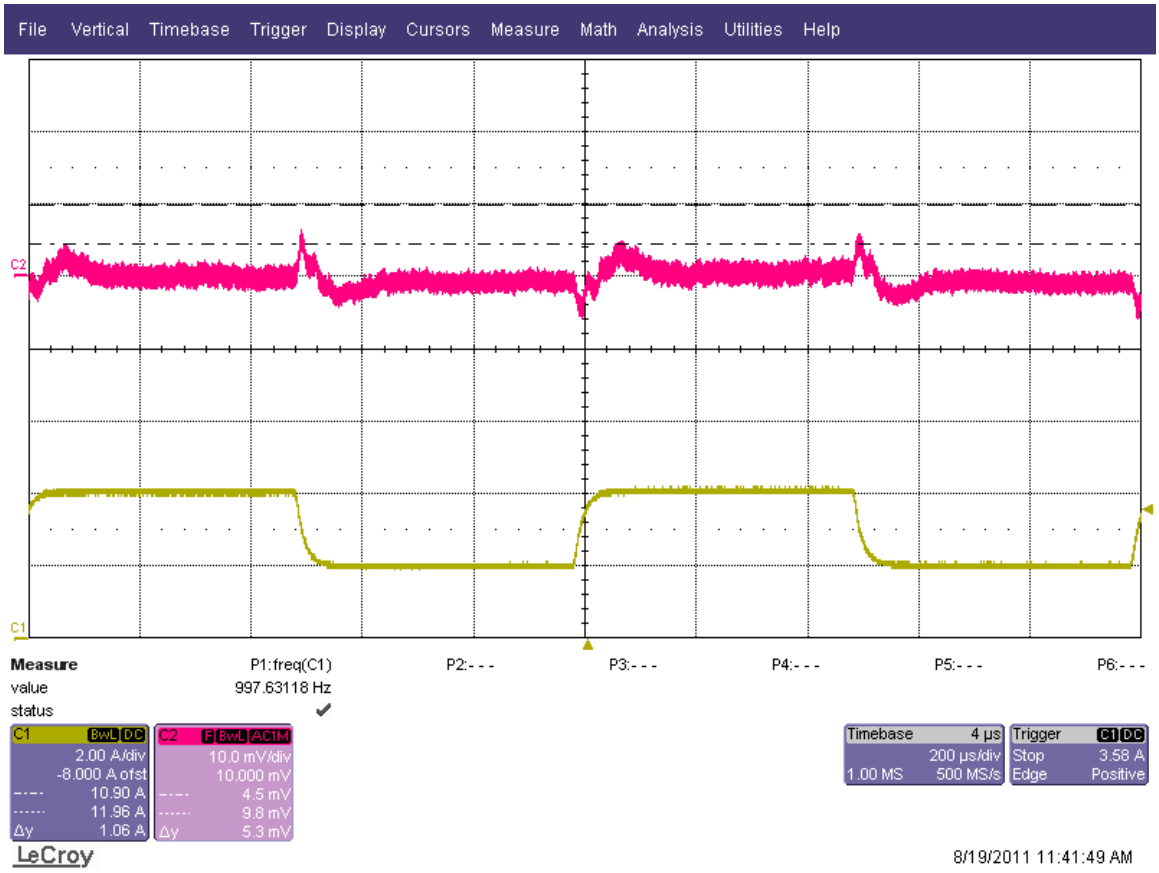
2.5V (U4) 4A to 8A, Slew rate 1275A/us



Results

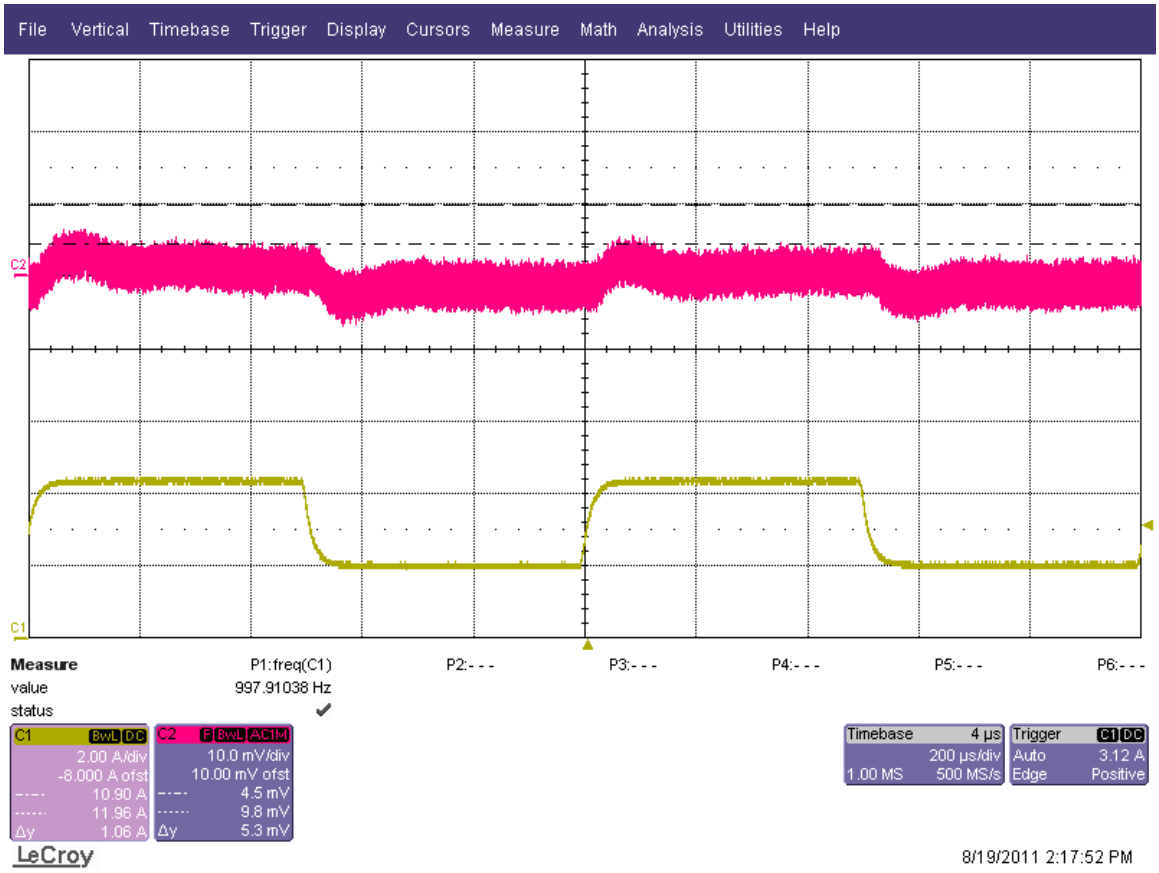
Less than **50mV** Overshoot/undershoot.

1.2V (U2) 2A to 4A, Slew rate 255mA/us



Result
Less than 10mV undershoot/overshoot.

1.35V (U3) 2A to 4A, Slew rate 255mA/us

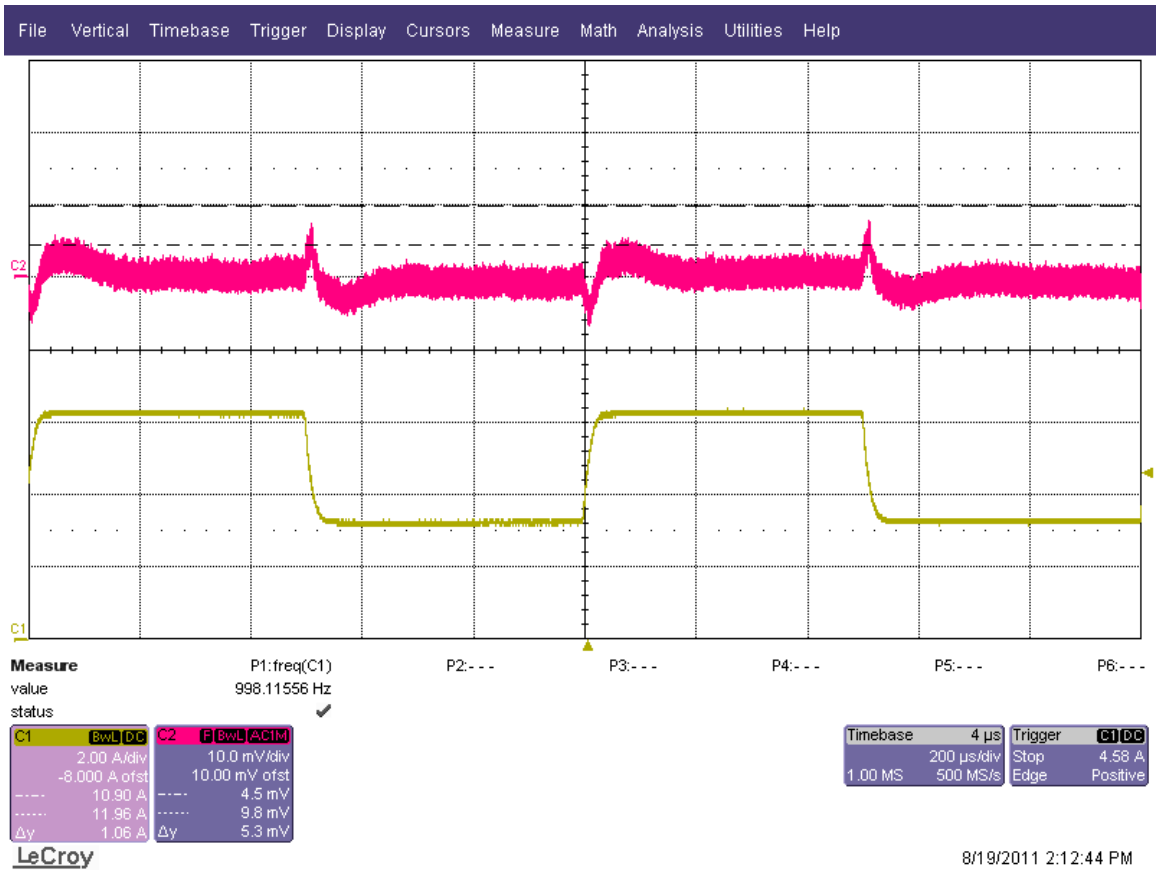


Result
Less than **10mV** overshoot/undershoot

1.0V MGT (U8) 3A to 6A, Slew rate 200mA/us

Result
~**10mV** overshoot/Undershoot

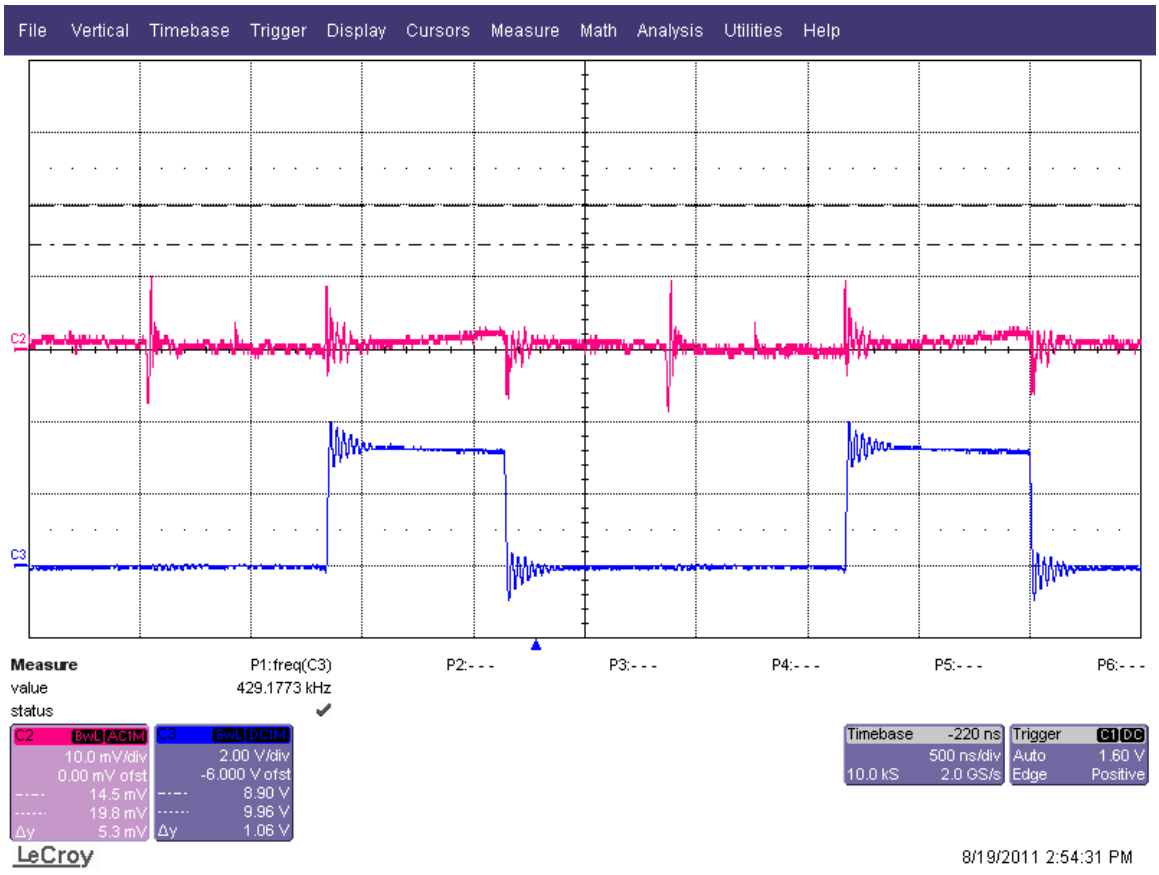
1.0V (U10) 3A to 6A, Slew rate 200mA/us



Result
~**10mV** overshoot/Undershoot

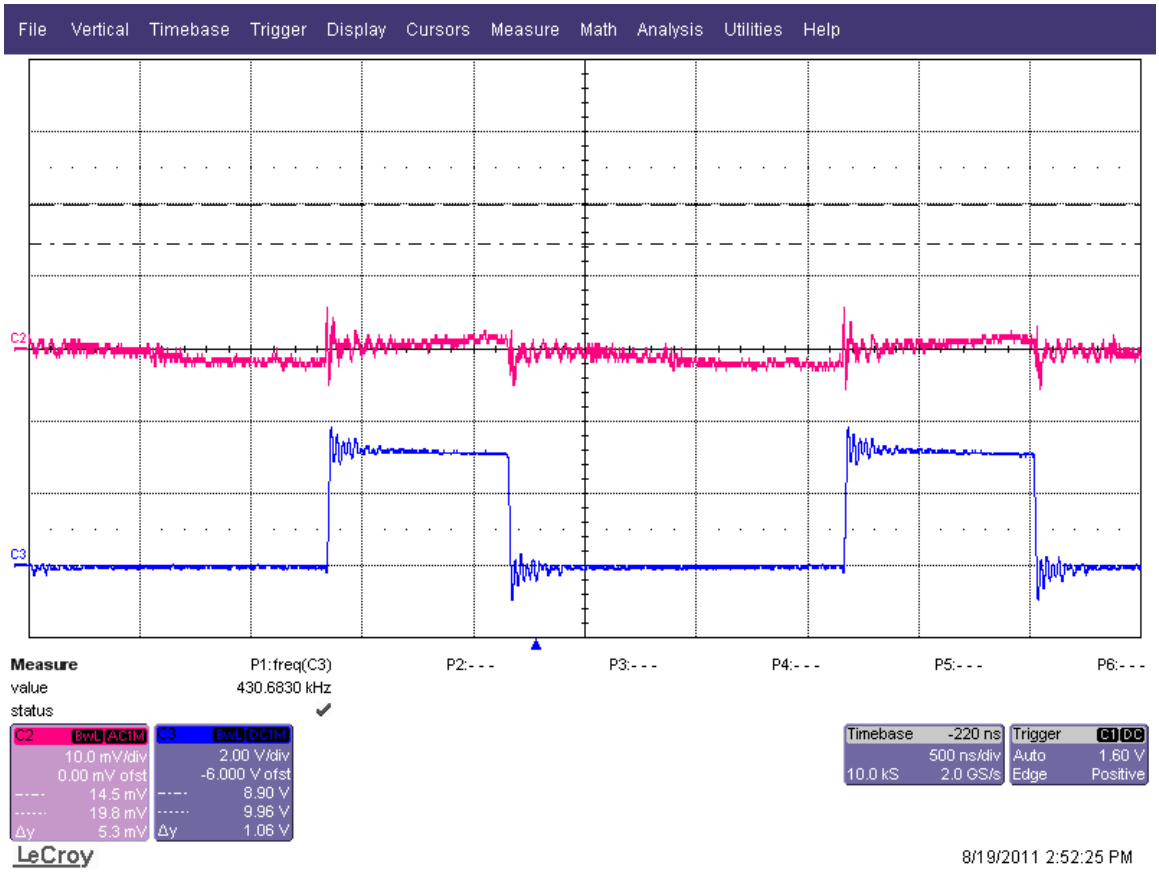
Switch Node Scope Shots

1.0V MGT IL = 6A



Switch Node Scope Shots

1.0V IL = 6A

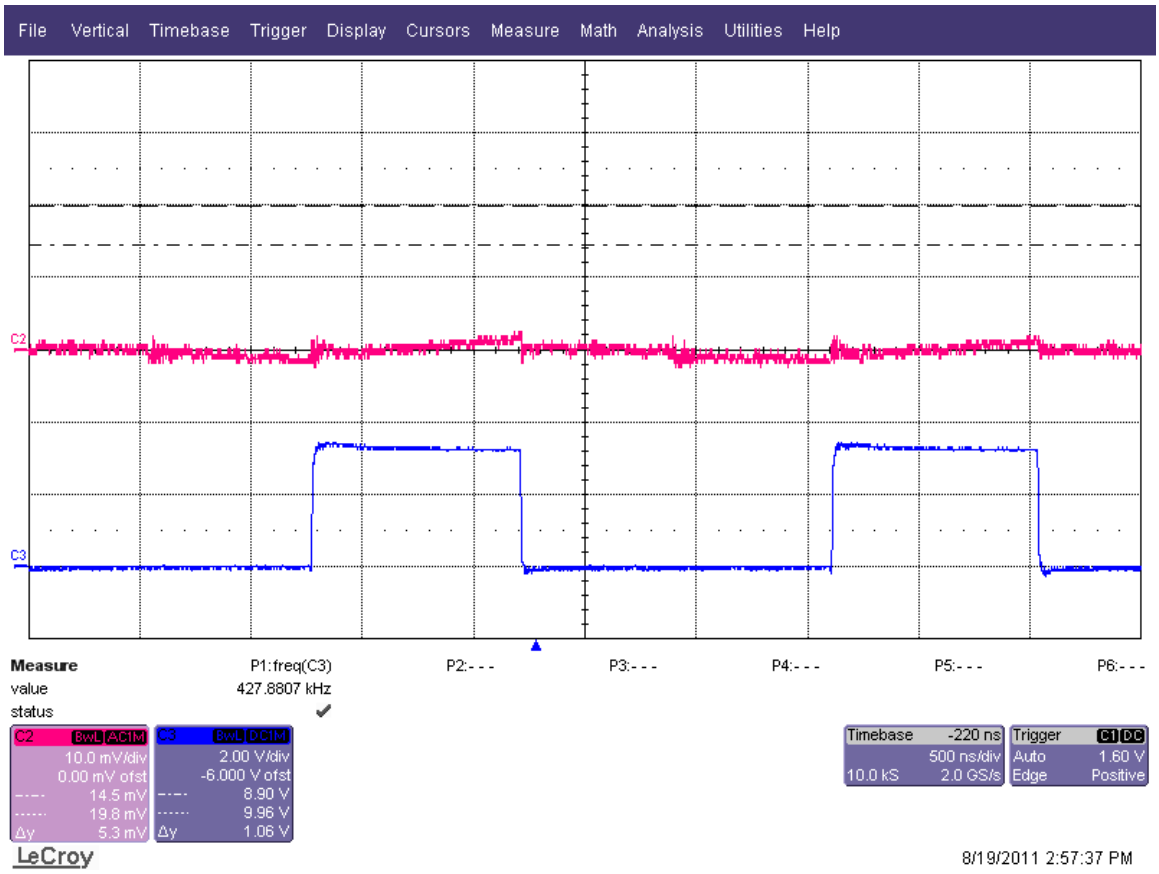


Note:

Channel 2, Vout ripple lower noise spikes…

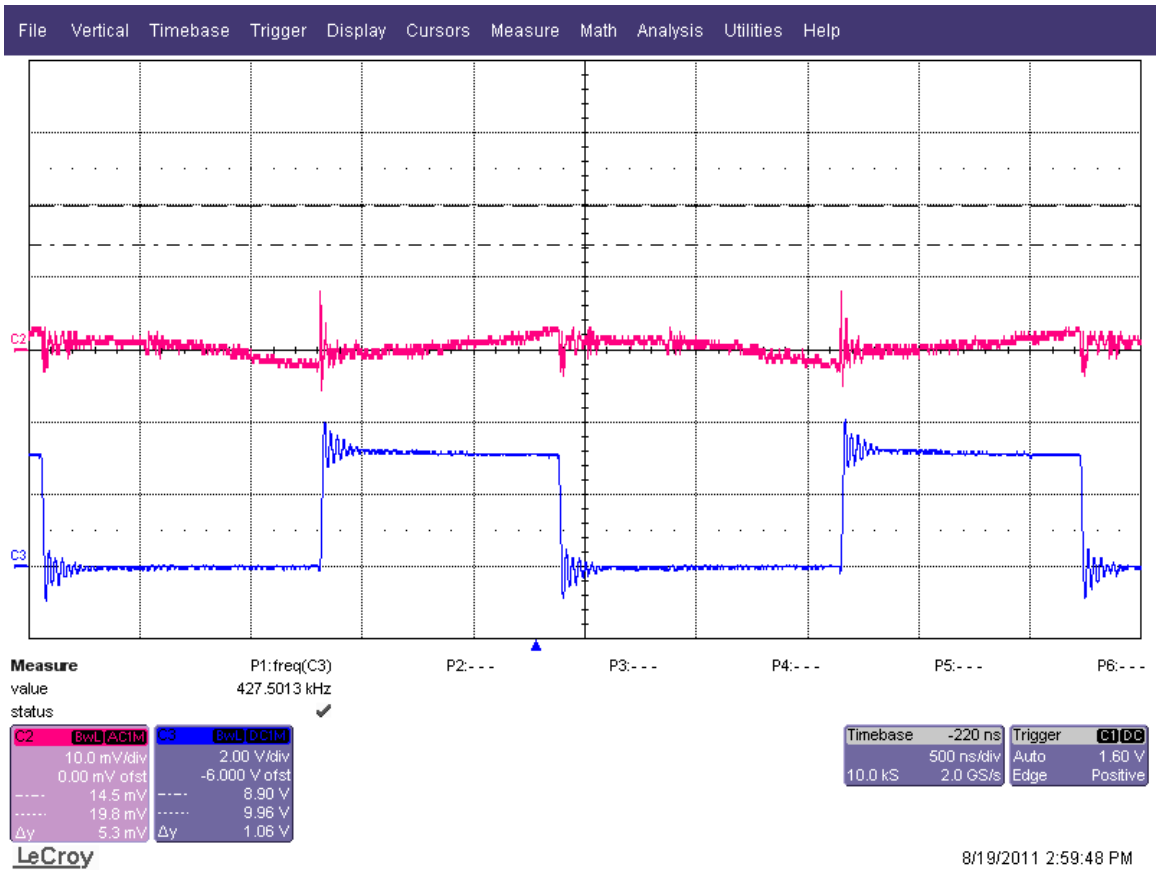
Switch Node Scope Shots

1.2V IL = 4A



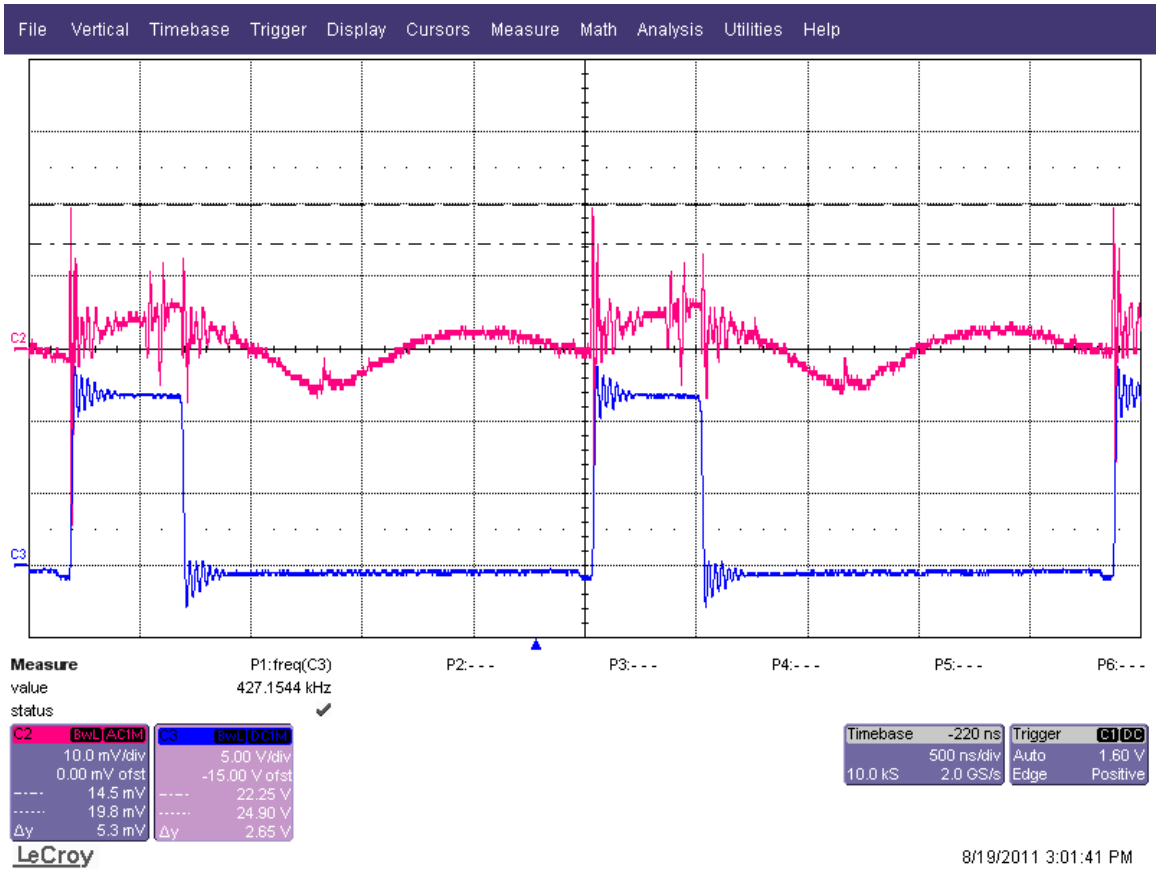
Switch Node Scope Shots

1.35V MGT IL = 4A

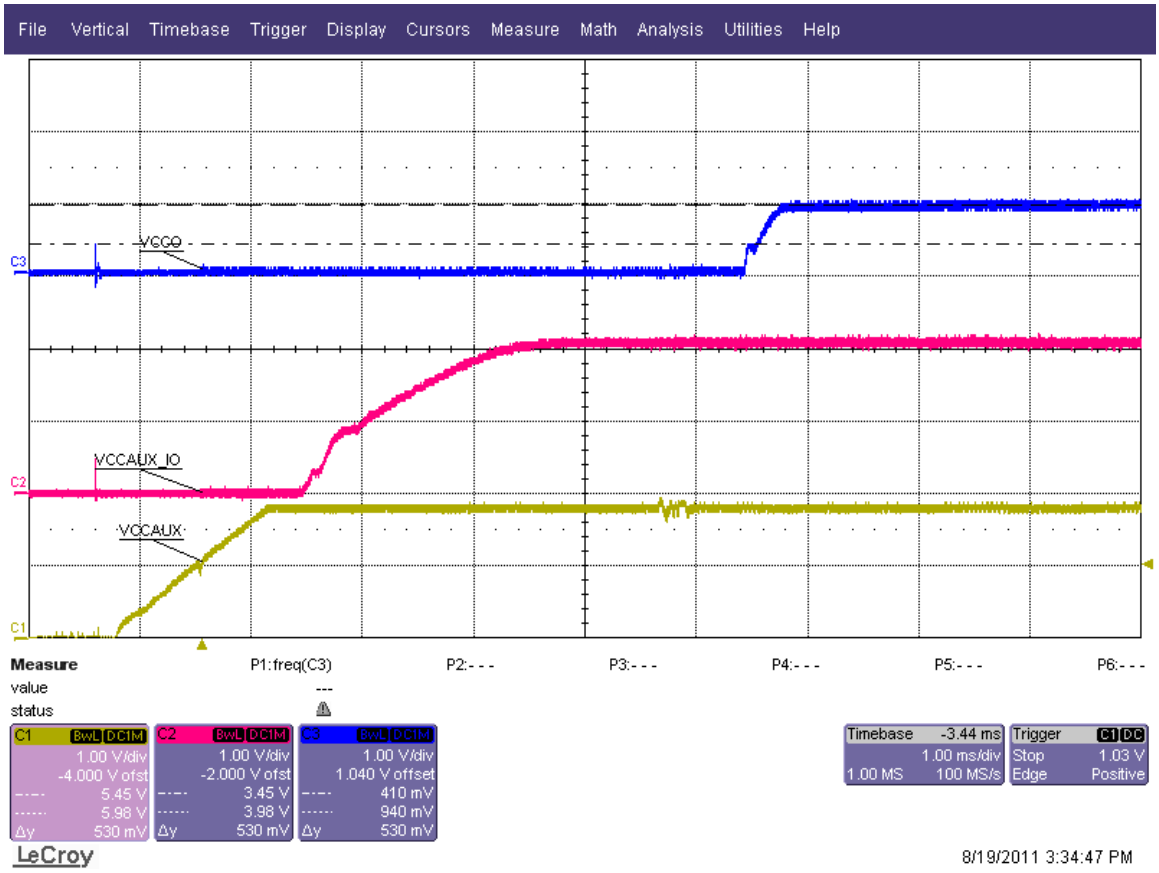


Switch Node Scope Shots

2.0V IL = 2A



Start Up Sequence



Efficiency Data

		V Measured	Iload	Power	Power	Efficiency
10%	Input	12.006	0.939		11.273634	**76.08 %**
	Output					
	1.8V	1.7914	0.600	1.075		
	1.0V	1.0602	0.600	0.636		
	1.0V	1.0622	0.606	0.644		
	1.35V	1.4046	0.400	0.562		
	2.5V	2.5028	0.801	2.005		
	2.0V	2.0859	0.200	0.417		
	3.3V	3.4023	0.801	2.725		
	1.2V	1.2605	0.407	0.513		
					8.5766638	
	Ploss					**2.6969702 W**

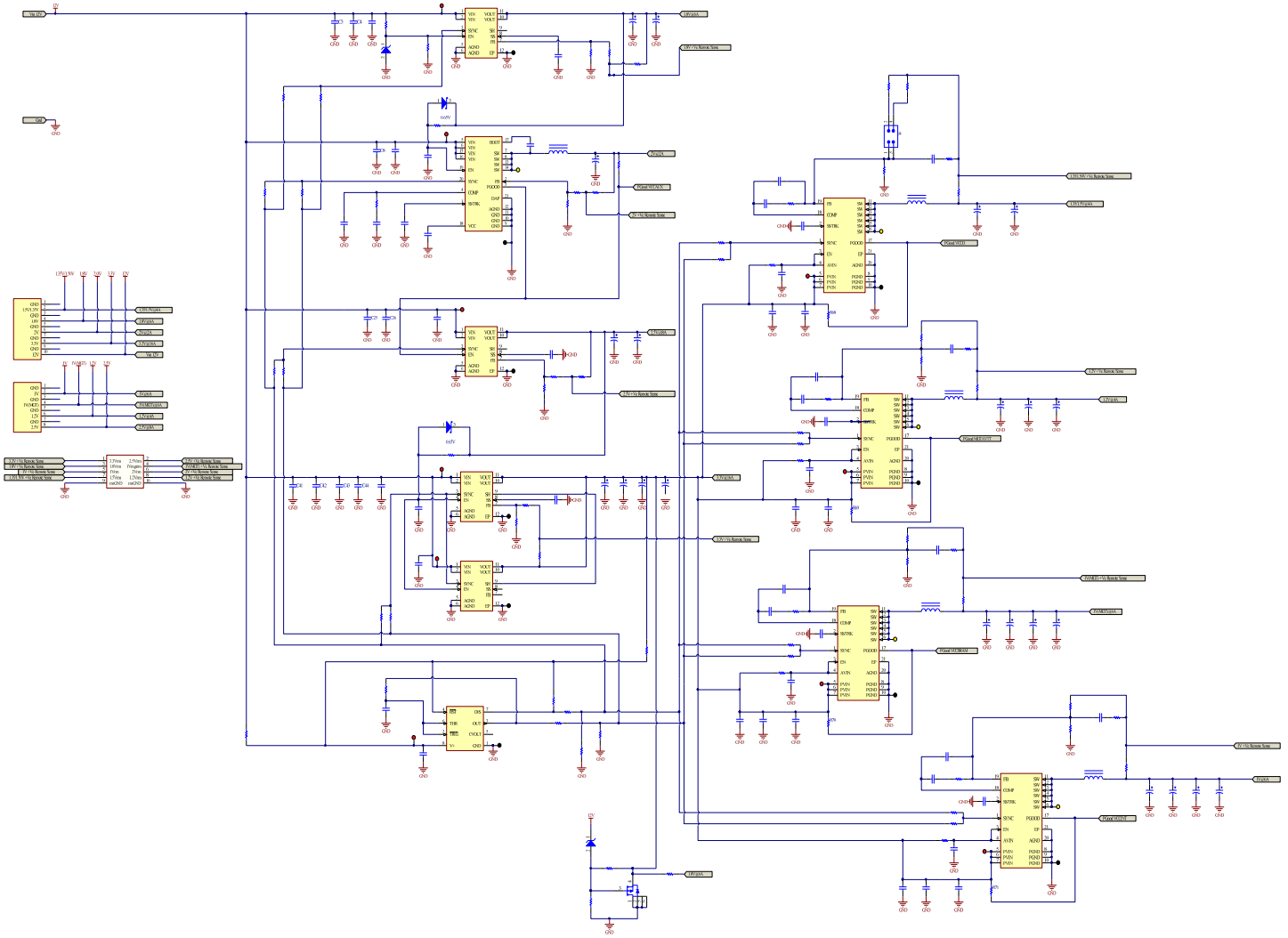
		V Measured	Iload	Power	Power	Efficiency
50%	Input	12.008	4.334		52.042672	**82.18 %**
	Output					
	1.8V	1.7934	3.000	5.380		
	1.0V	1.0591	2.992	3.169		
	1.0V	1.0607	3.000	3.182		
	1.35V	1.4040	2.002	2.811		
	2.5V	2.5019	4.005	10.020		
	2.0V	2.0852	1.000	2.085		
	3.3V	3.4005	4.003	13.612		
	1.2V	1.2547	1.999	2.508		
					42.7677313	
	Ploss					**9.2749407 W**

		V Measured	Iload	Power	Power	Efficiency
100%	Input	12.002	8.980		107.77796	**79.27**
	Output					
	1.8V	1.7944	6.010	10.784		
	1.0V	1.0577	5.997	6.343		
	1.0V	1.0584	6.005	6.356		
	1.35V	1.4043	4.000	5.617		
	2.5V	2.4980	8.000	19.984		
	2.0V	2.0819	2.000	4.164		
	3.3V	3.3967	8.000	27.174		
	1.2V	1.2543	3.999	5.016		
					85.43764882	
	Ploss					**22.3403112 W**

Thermal Data at room temp all loads running at max Iout

IC	Output Voltage	Load Current	Temperature (Deg C)
U1	1.80	6	75.5
U2	2.00	2	91.4
U3	1.35	4	60
U4	2.50	4	104
U5	1.20	4	70.5
U6, U7	3.30	16	104.1
U7			104.2
U8	1.00	6	58.2
U10	1.00	6	62.1

Schematic



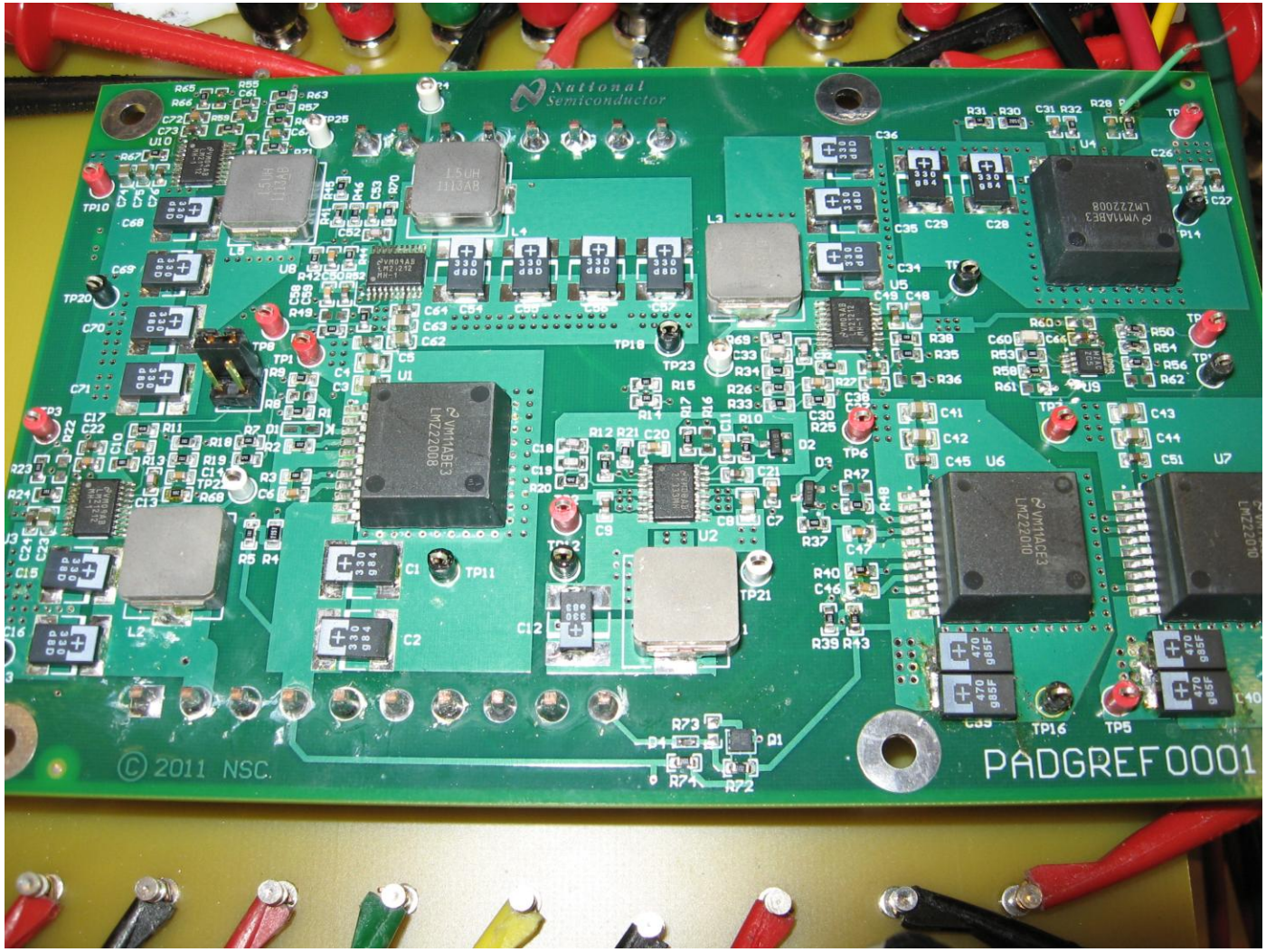
BOM

Comment	Designator	Footprint	Manufacturer	Quantity
4TPE330MI	C1, C2, C28, C29	D2E	Sanyo	4
C2012X5R0J106M	C3, C4, C8, C25, C26, C41, C42, C43, C44	0805_HV	TDK	9
C0603C105K4PACTU	C5, C9, C22, C24, C27, C38, C45, C49, C51, C59, C64, C66, C73, C76	0603	Kemet	14
C0603C103J1RACTU	C6, C11, C17, C20, C31, C33, C37, C46, C47, C58, C72	0603	Kemet	11
C1608Y5V1E104Z	C7	0603	TDK	1
GRM188R71H392KA01D	C10, C14, C50, C61	0603	MuRata	4
2R5TPE330M9C2	C12	D2E	Sanyo	1
06033C101KAT2A	C13, C18, C32, C52, C65	0603	AVX	5
2TPE330M6	C15, C16, C34, C35, C36, C54, C55, C56, C57, C68, C69, C70, C71	D2E	Sanyo	13
GRM1885C1H222JA01D	C19	0603	MuRata	1
C0603C105K8PACTU	C21	0603	Kemet	1
JMK212BJ476MG-T	C23, C48, C62, C63, C74, C75	0805_HV	Taiyo Yuden	6
C0603C472J5RACTU	C30	0603	Kemet	1
4TPF470ML	C39, C40, C77, C78	D3L	Sanyo	4
C0603C332K5RACTU	C53, C67	0603	Kemet	2
C0603C470J5GACTU	C60	0603	Kemet	1
Used in BOM report	D1	SOD-323	Used in BOM report	1
BAT54-7-F	D2, D3	SOT-23	Diodes Inc.	2
VDZT2R7.5B	D4	VMD2	Rohm Semiconductor	1
HPM-10-05-T-S	J1	HPM-10-05-T-S	SAMTEC	1
HPM-08-05-T-S	J2	HPM-08-05-T-S	Samtec	1
FW-05-05-F-D-361-085	J3	FW-05-05-F-D-361-085	Samtec	1
TSW-102-07-G-D	J4	TSW-102-07-G-D	Samtec, Inc.	1
IHLP4040DZER100M01	L1	IHLP-4040DZ	Vishay/Dale	1
IHLP4040DZER2R2M01	L2, L3	IHLP-4040DZ	Vishay-Dale	2
IHLP4040DZER1R5M01	L4, L5	IHLP-4040DZ	Vishay/Dale	2
SIA419DJ-T1-GE3	Q1	POWER PACK SC-70-6L	Vishay/Siliconix	1
CRCW060349K9FKEA	R1, R10, R12, R34, R37	0603	Vishay-Dale	5
CRCW060312K1FKEA	R2	0603	Vishay-Dale	1
CRCW06031K00FKEA	R3, R13, R21, R25, R27, R32, R40, R44, R59	0603	Vishay-Dale	9
CRCW06031K15FKEA	R4	0603	Vishay-Dale	1
CRCW0603100RJNEA	R5, R15, R18, R31, R33, R43, R45, R63	0603	Vishay-Dale	8
CRCW06031K24FKEA	R6	0603	Vishay-Dale	1
CRCW06031K50FKEA	R7, R14	0603	Vishay-Dale	2
CRCW06030000Z0EA	R8, R9, R16, R17, R22, R23, R28, R29, R35, R36, R47, R48, R49, R50, R51, R56, R58, R60, R61, R62, R65, R66, R74	0603	Vishay-Dale	23
CRCW0603453RFKEA	R11, R26, R42, R57	0603	Vishay-Dale	4

BOM Continued

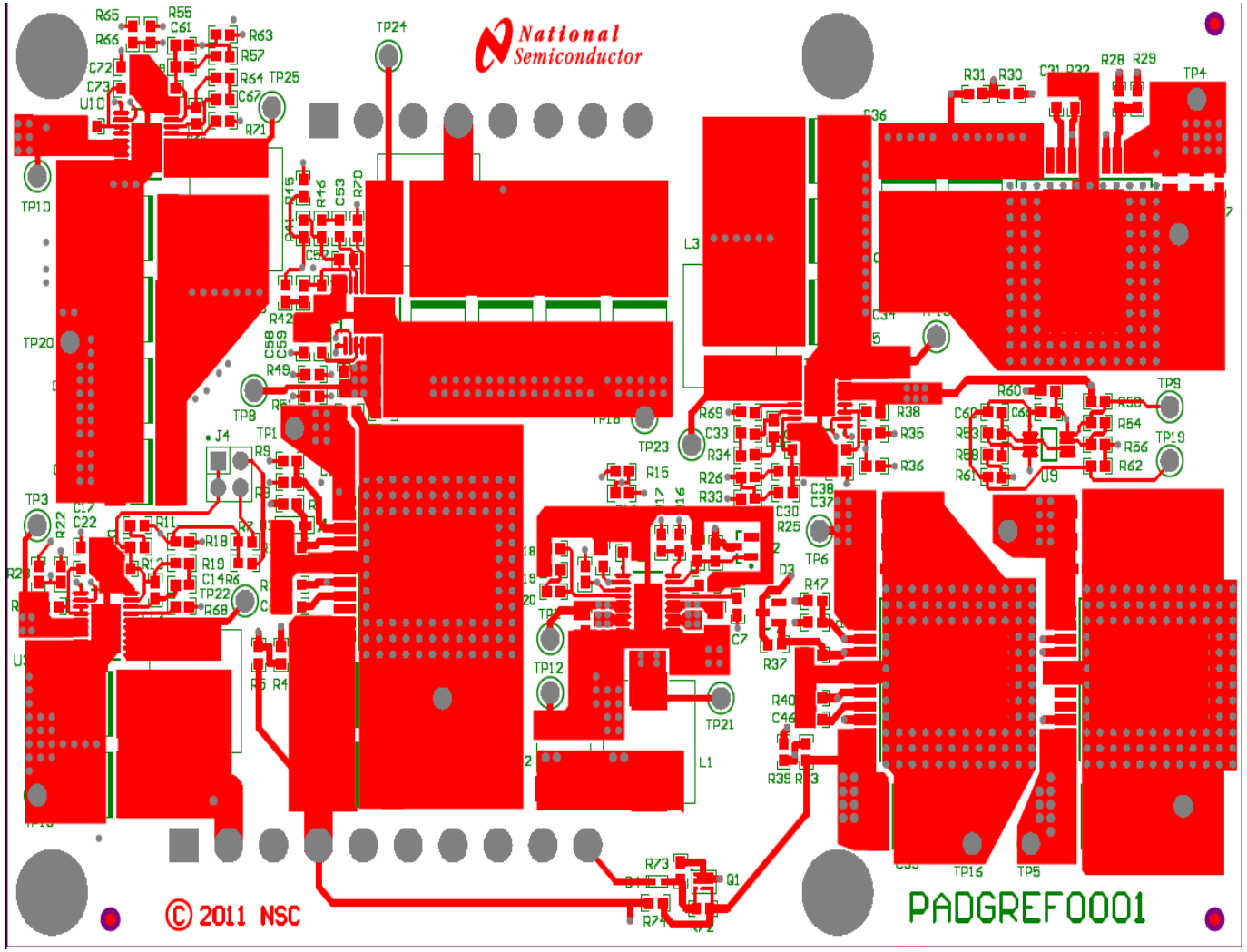
Comment	Designator	Footprint	Manufacturer	Quantity
CRCW060319K1FKEA	R19	0603	Vishay-Dale	1
CRCW060320K0FKEA	R20, R53, R54	0603	Vishay-Dale	3
CRCW06031R00JNEA	R24, R38, R52, R67	0603	Vishay-Dale	4
RT0603BRD072K03L	R30	0603	Yageo America	1
CRCW06033K16FKEA	R39	0603	Vishay-Dale	1
CRCW0603665RFKEA	R41, R55	0603	Vishay-Dale	2
CRCW060324K9FKEA	R46, R64	0603	Vishay-Dale	2
CRCW060310K0FKEA	R68, R69, R70, R71	0603	Vishay-Dale	4
CRCW060322K1FKEA	R72	0603	Vishay-Dale	1
CRCW060314K3FKEA	R73	0603	Vishay-Dale	1
5000	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10	Keystone5000	Keystone	10
5001	TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20	Keystone5001	Keystone	10
5004	TP21, TP22, TP23, TP24, TP25	Keystone5004	Keystone	5
LMZ22008TZ/NOPB	U1, U4	TZA11A	National Semiconductor	2
LM20333MH/NOPB	U2	MXA20A_N	National Semiconductor	1
LM21212MH-1/NOPB	U3, U5, U8, U10	MYB20AA_N	National Semiconductor	4
LMZ22010TZ/NOPB	U6, U7	TZA11A	National Semiconductor	2
LMC555CMM/NOPB	U9	MUA08A_N	National Semiconductor	1

Photo of the board

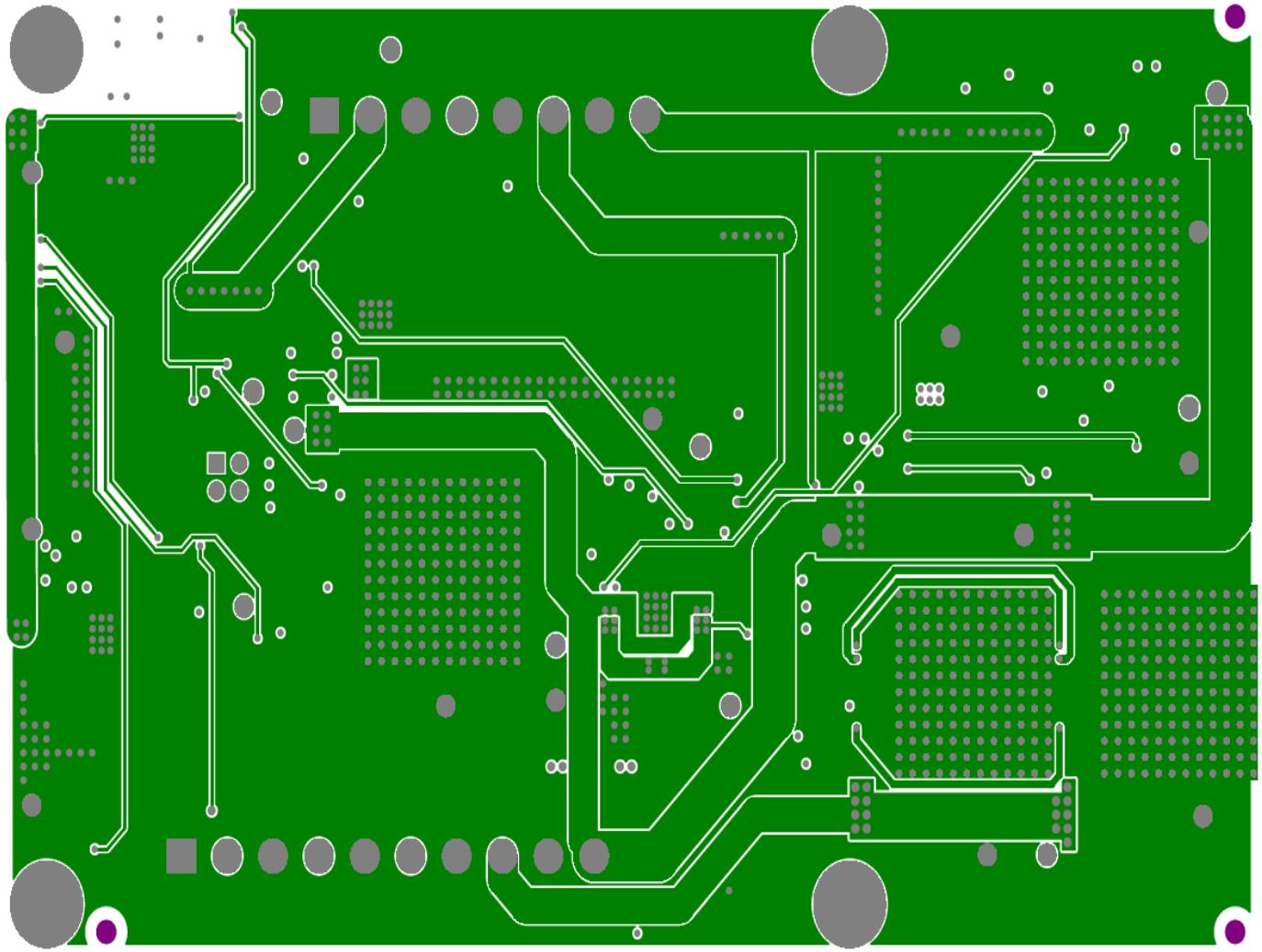


PCB Layers

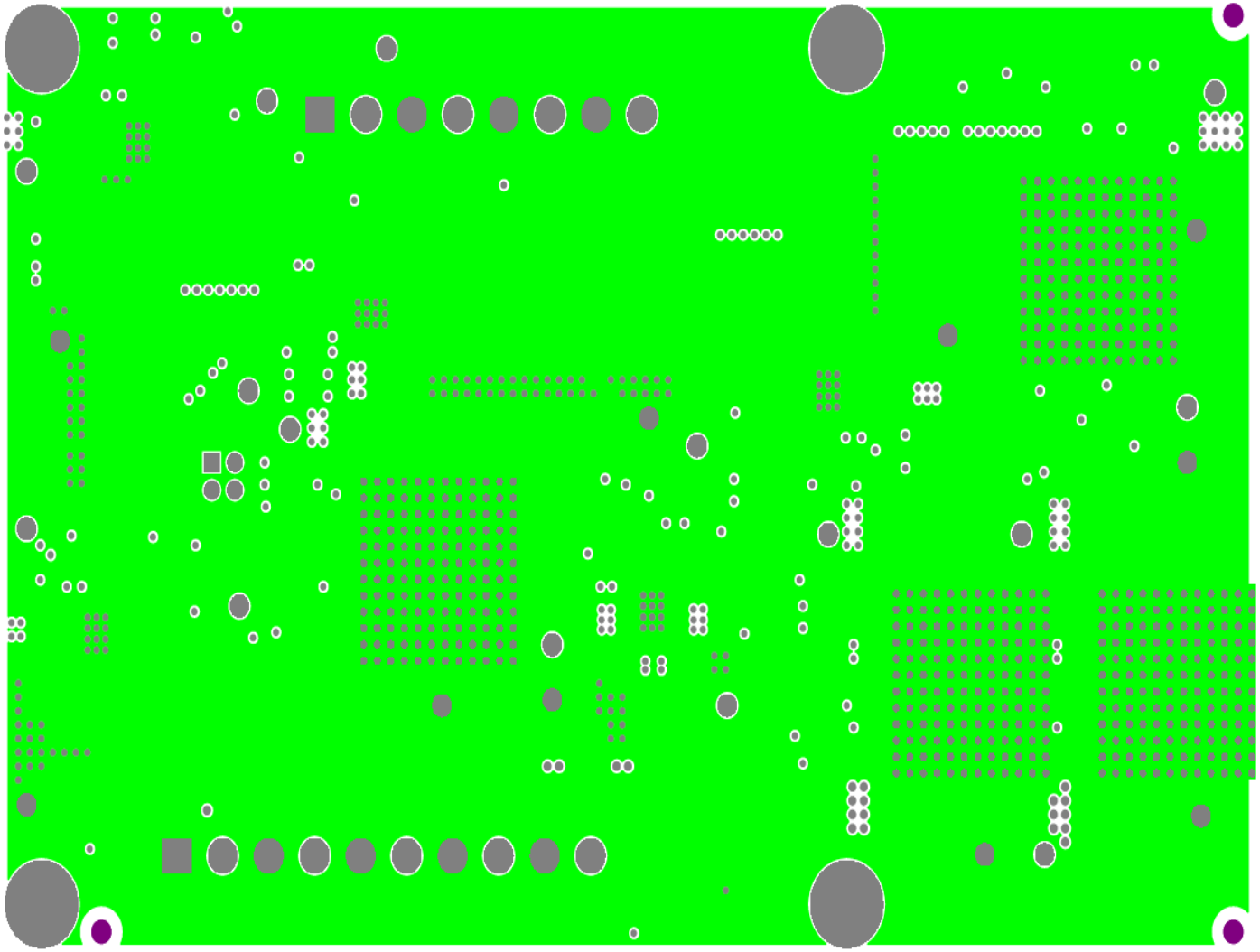
PCB Layers
Top



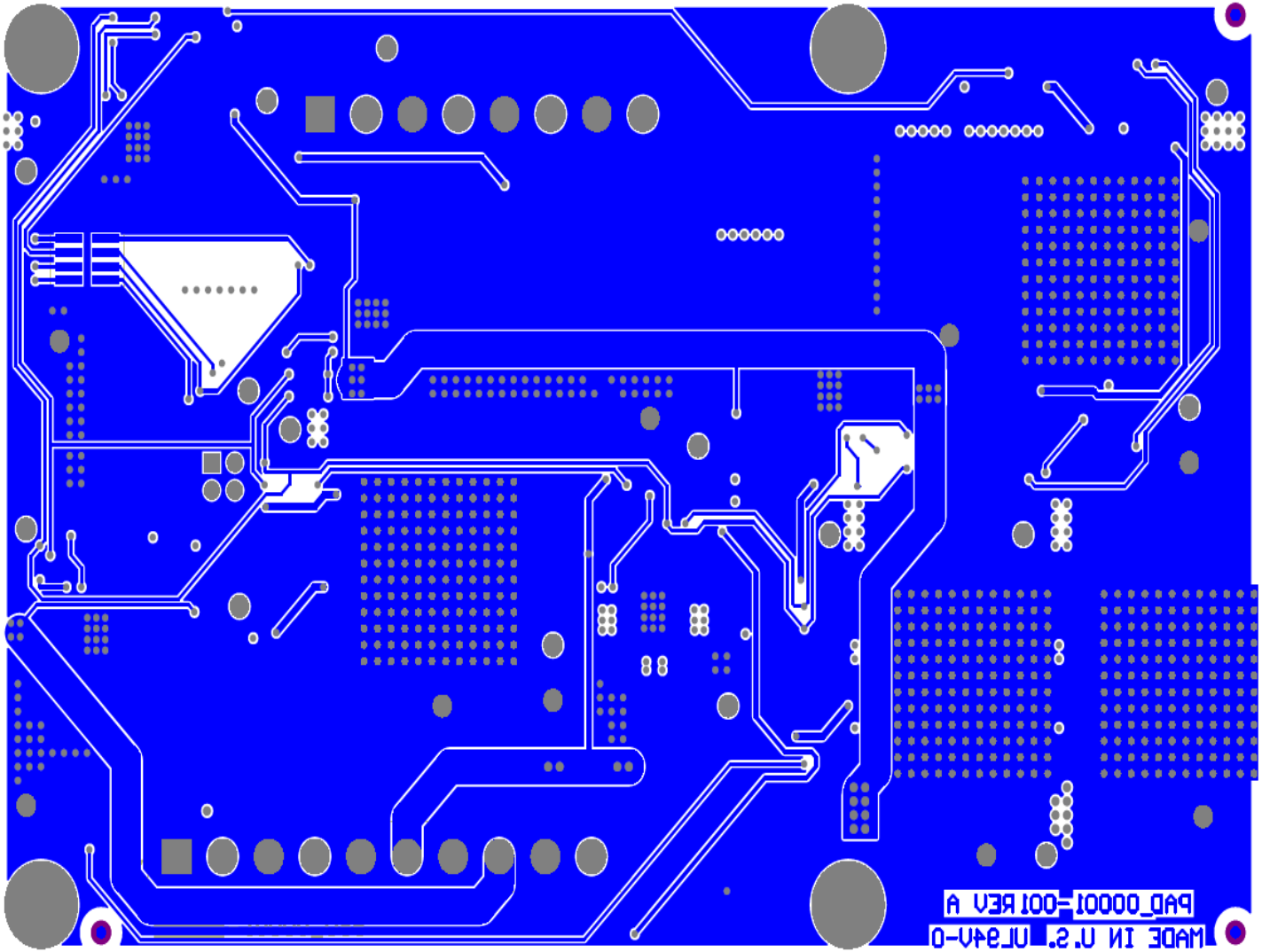
Mid layer 1



Mid layer 2



Bottom Layer



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