LTM8060
Quad 40V_{IN}, 3A Step-Down Silent Switcher µModule Regulator

DESCRIPTION

Demonstration circuit 2820A features the LTM®8060 µModule® regulator, a quad output high-performance step-down Silent Switcher® µModule regulator in a thermally enhanced 11.9mm × 16mm × 3.32mm BGA package. DC2820A has a wide operating input voltage range of 5.4V to 40V. The output rails are configured for 5V, 3.3V, 1.5V, 1.2V and are resistor programmable from 0.8V to 8V. Each output can provide up to 3A and phases can also be paralleled together to satisfy higher rail current requirements. The LTM8060 is a complete multi-output DC/DC point of load regulator in a compact form factor, requiring only a few input and output capacitors and resistors to set the output voltages and operating frequency. Output voltage tracking is made available by the TRSS pins for supply rail sequencing. External clock synchronization is available through the SYNC pins, CLKOUT pins provide for optional synchronization of additional phases. For reduced noise, Spread Spectrum operation is available via SYNC pin programming. The LTM8060 data sheet must be read in conjunction with this demo manual for working on or modifying demo circuit 2820A.

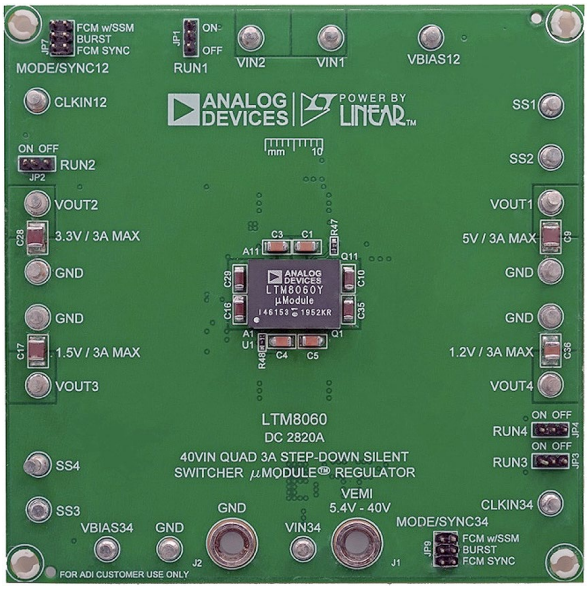
Design files for this circuit board are available.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		5.4		40	V
Output Voltage V_{OUT}	Jumper selectable				
	V_{OUT1}		5		V
	V_{OUT2}		3.3		V
	V_{OUT3}		1.5		V
	V_{OUT4}		1.2		V
Maximum Continuous Output Current per Phase	Derating is necessary for certain operating conditions. See data sheet for details		3		A
Default Operating Frequency	V_{OUT1}, V_{OUT2}, (R_T = 28kΩ)		1.2		MHz
	V_{OUT3}, V_{OUT4}, (R_T = 100kΩ)		400		kHz
Efficiency	V_{IN} = 12V		See Figure 2		
	V_{OUT} = 5V/3A		93		%
	V_{OUT} = 3.3V/3A		91		%
	V_{OUT} = 1.5V/3A		84		%
	V_{OUT} = 1.2V/3A		82		%

BOARD PHOTO



QUICK START PROCEDURE

Demonstration circuit 2820A provides an easy way to evaluate the performance of the LTM8060. Please refer to Figure 1 for test setup connections and follow the procedure below.

1. With power off, place the jumpers in the following positions:

JP1	JP2	JP3	JP4
RUN1	RUN2	RUN3	RUN4
ON	ON	ON	ON

JP7	JP9
MODE/SYNC12	MODE/SYNC34
FCM, SYNC	FCM, SYNC

2. Before connecting input supply, loads and meters, preset the input voltage supply to be between 5.4V to 40V. Preset the load currents to 0A.
3. With power off, connect the loads, input voltage supply and meters as shown in Figure 1.
4. Turn on input power supply. The output voltage meters for each phase should display the programmed output voltage ±2%.
5. Once the proper output voltages are established, adjust the load currents for each phase within the 0A to 3A range. Observe each output's load regulation, efficiency, and other performances. Output voltage ripples for each output should be measured across the furthest output capacitor with a BNC cable and oscilloscope.
6. To observe increased light load efficiency, place the MODE/SYNC pin jumpers (JP7, JP9) in the BURST position, for spread spectrum operation place the jumpers in the FCM W/SSM position.
7. To synchronize V_{OUT1} and V_{OUT2} rails to an external clock connect a clock to CLKIN12(E19) and to synchronize V_{OUT3} and V_{OUT4} to an external clock connect a clock to CLKIN34(E20). Set the clock voltage to 50% duty cycle with clock low level below 0.8V and clock high level above 1.5V. Do not exceed 6V on theses pins.

OPTIONAL: An input EMI filter is included on the board. To include this filter connect the input supply positive terminal to VEMI. To exclude the input EMI filter connect the input positive supply to VIN1, VIN2 or VIN34. VIN1 is the input for VOUT1 rail, VIN2 is the input for VOUT2 rail, VIN34 is the input for VOUT3 and VOUT4 rails.

QUICK START PROCEDURE

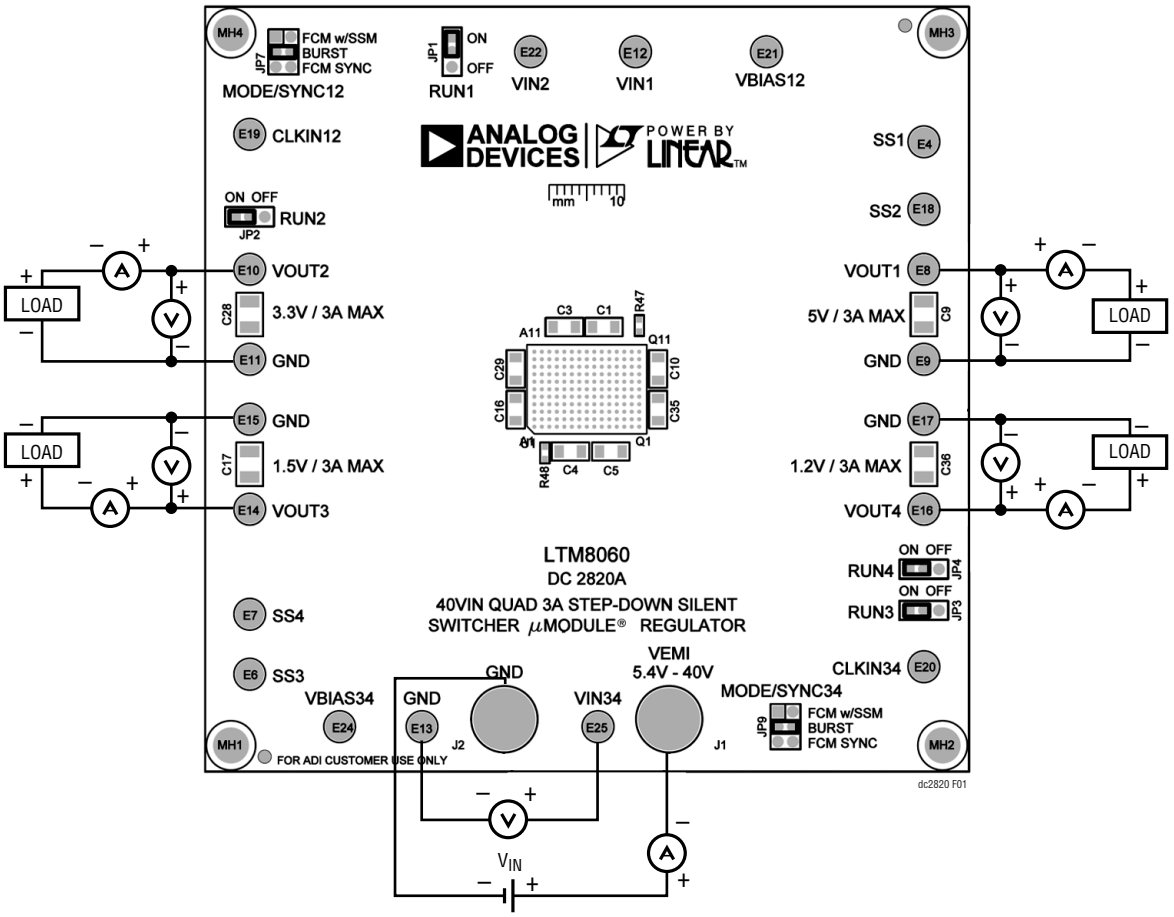


Figure 1. Test Setup of DC2820A

QUICK START PROCEDURE

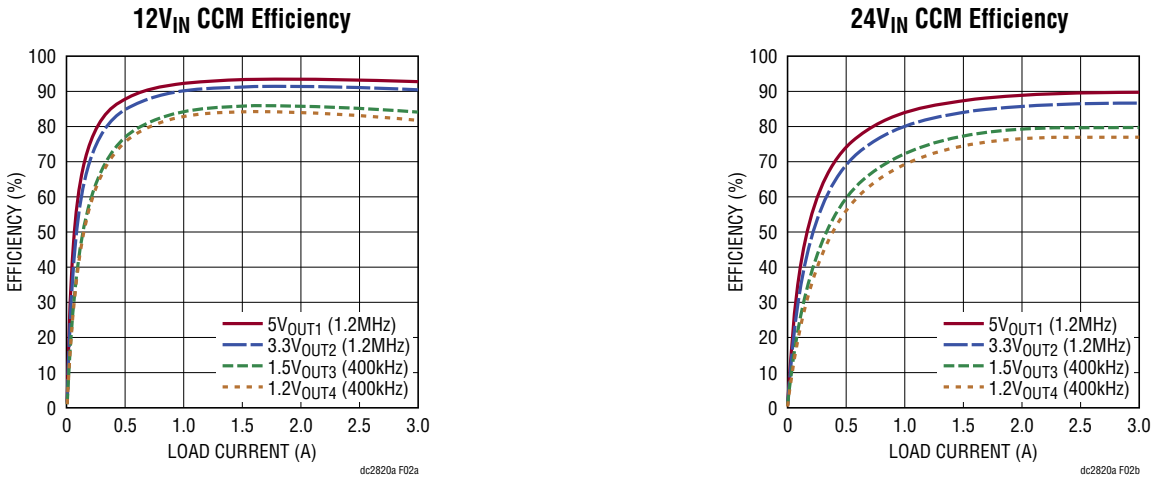


Figure 2. Measured Supply Efficiency at $12V_{IN}$ and $24V_{IN}$

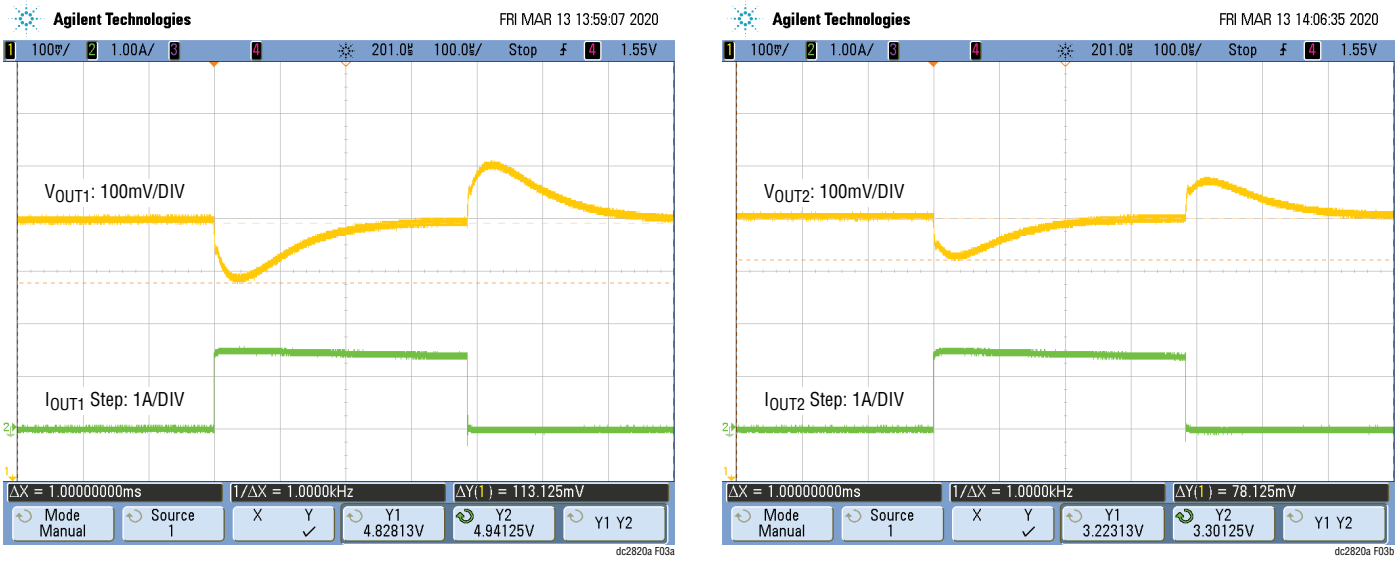


Figure 3. $12V_{IN}$ Measured V_{OUT1} = 5V and V_{OUT2} = 3.3V Transient Responses at 1.5A to 3A Load Step

QUICK START PROCEDURE

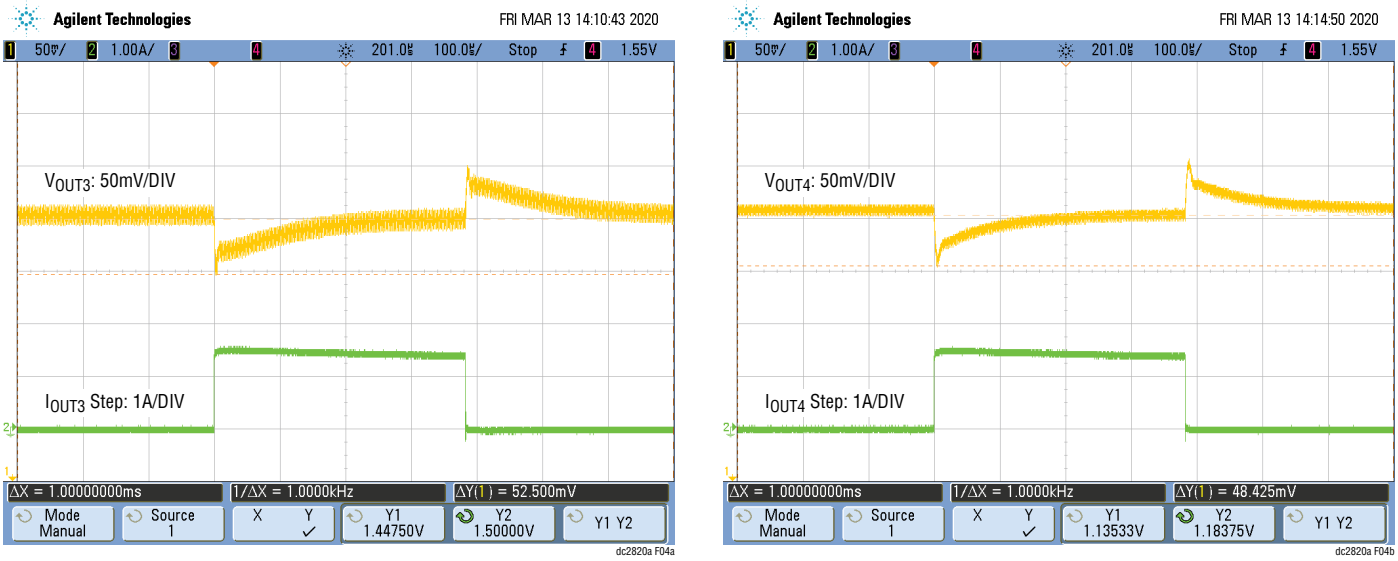
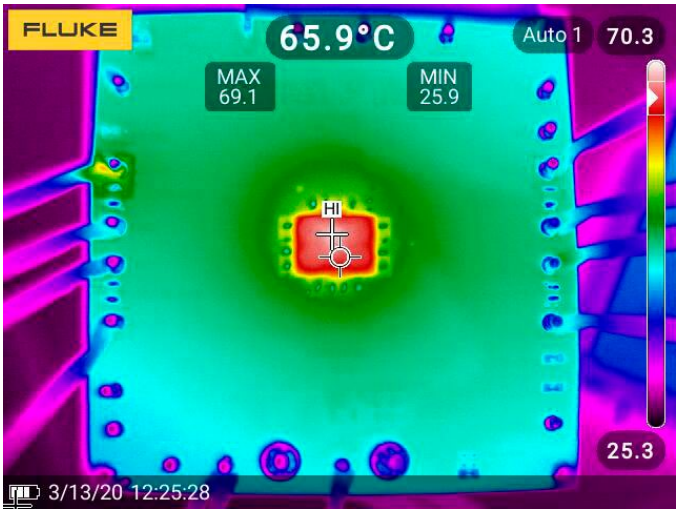
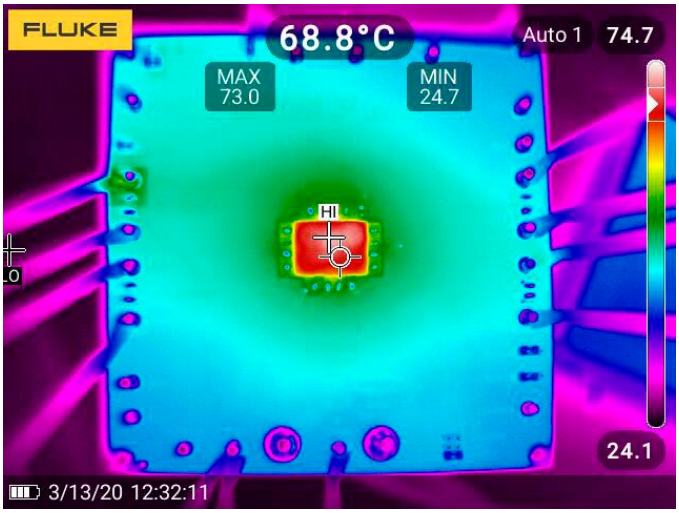


Figure 4. 12V_{IN} Measured V_{OUT3} = 1.5V and V_{OUT4} =1.2V Load Transient Responses at 1.5A to 3A Load Step



V_{IN} (V)	AIRFLOW	HEATSINK	AMBIENT (°C)
12	Natural Convection	None	25



V_{IN} (V)	AIRFLOW	HEATSINK	AMBIENT (°C)
24	Natural Convection	None	25

Figure 5. 12V_{IN} and 24V_{IN} Measured Thermal Captures with 3A Load on Each Output

QUICK START PROCEDURE

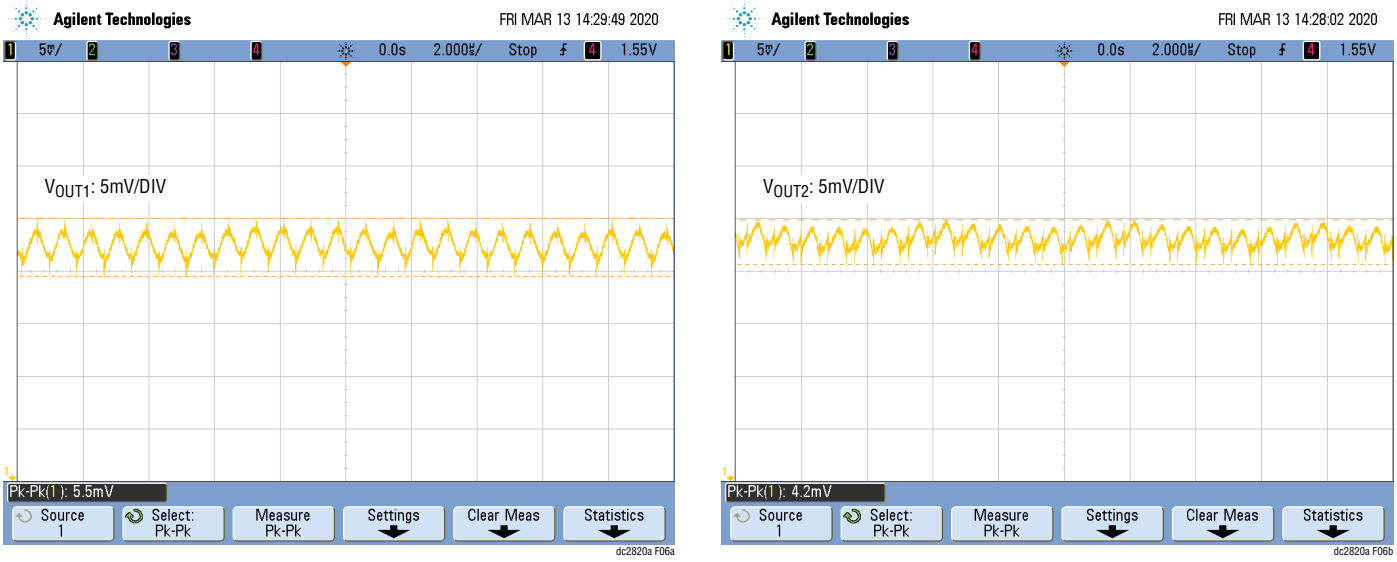
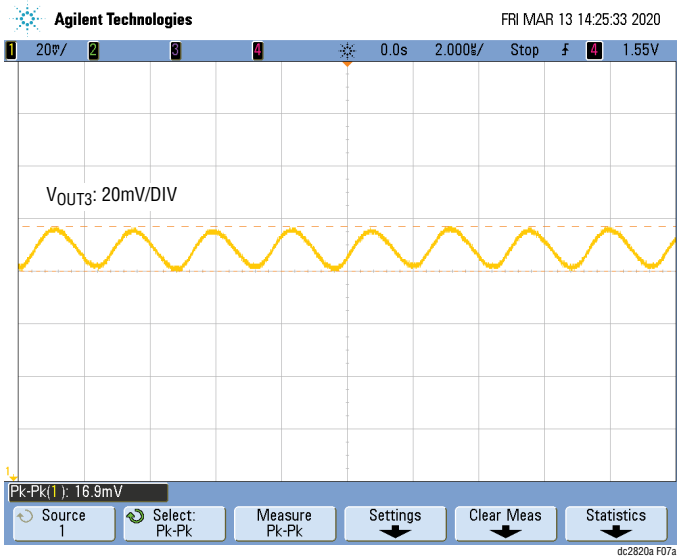


Figure 6. 12V_{IN} Measured Output Ripple for V_{OUT1} = 5V and V_{OUT2} = 3.3V at 3A Load

QUICK START PROCEDURE



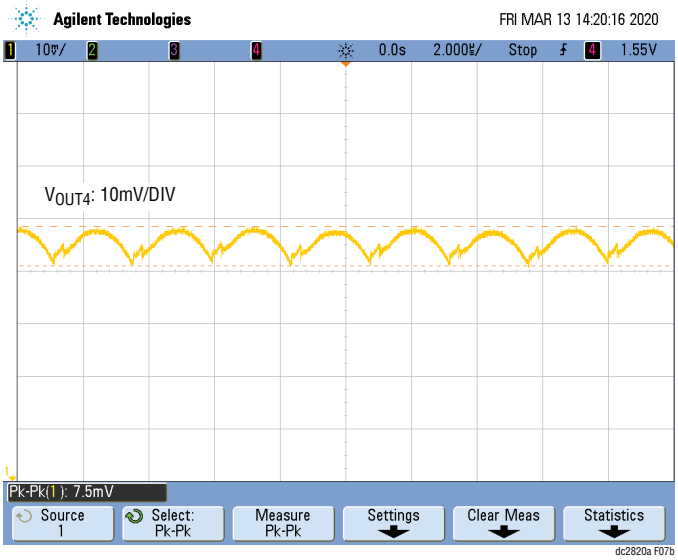
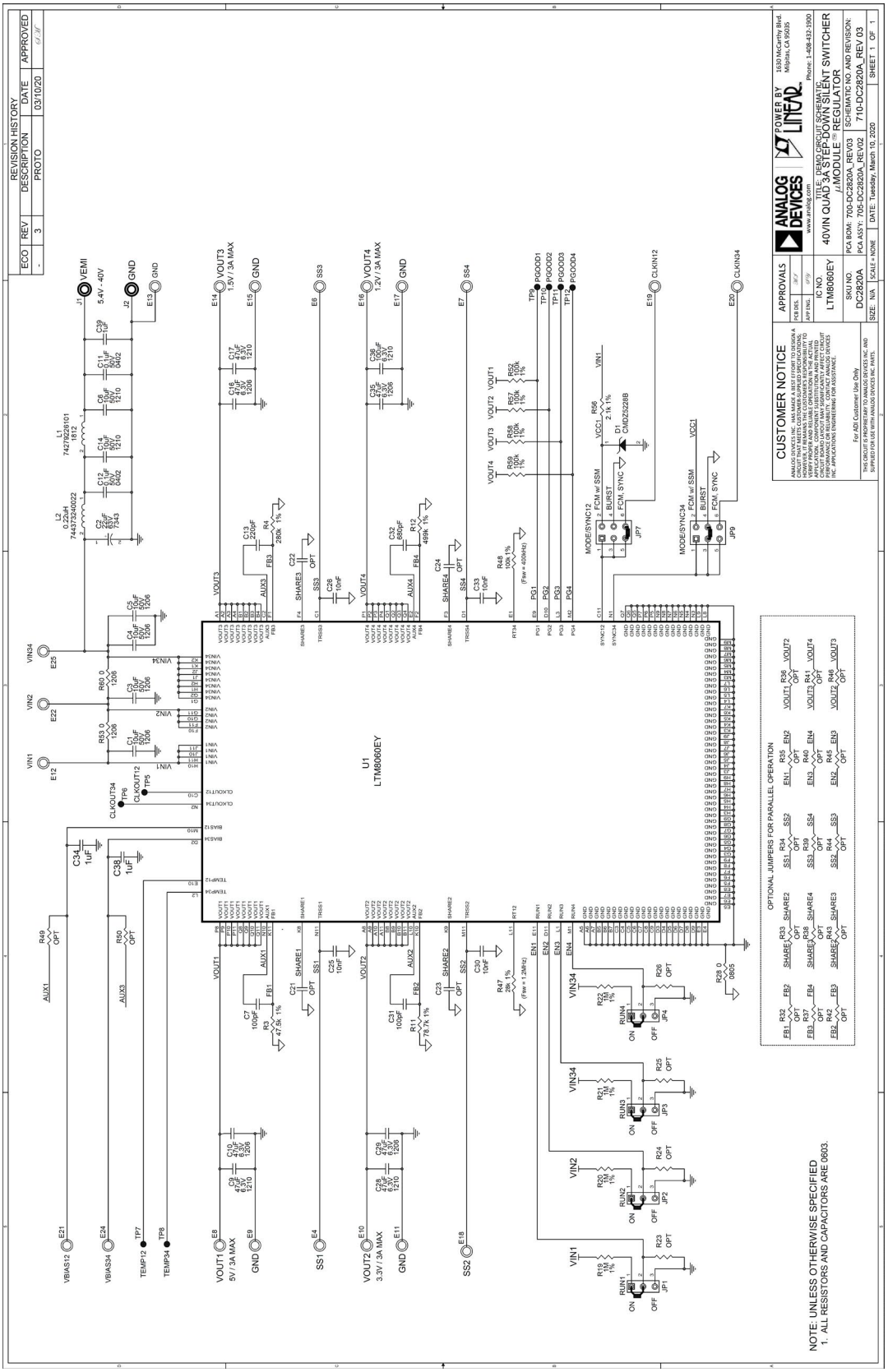


Figure 7. 12V_{IN} Measured Output Ripple for V_{OUT3} = 1.5V and V_{OUT4} = 1.2V at 3A Load

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	4	C1, C3, C4, C5	CAP., 10µF, X5R, 50V, 10%, 1206	MURATA GRM31CR61H106KA12L
2	4	C10, C16, C29, C35	CAP., 47µF, X5R, 6.3V, 20%, 1206	MURATA GRM31CR60J476ME19L
3	1	R3	RES., 47.5k, 1%, 1/10W, 0603	VISHAY CRCW060347K5FKEA
4	1	R4	RES., AEC-Q200, 280k, 1%, 1/10W, 0603	PANASONIC ERJ3EKF2803V
5	1	R11	RES., AEC-Q200, 78.7k, 1%, 1/10W, 0603	PANASONIC ERJ3EKF7872V
6	1	R12	RES., AEC-Q200, 499k, 1%, 1/10W, 0603	VISHAY CRCW0603499KFKEA
7	1	R47	RES., AEC-Q200, 28k, 1%, 1/10W, 0603	VISHAY CRCW060328K0FKEA
8	1	R48	RES., AEC-Q200, 100k, 1%, 1/10W, 0603	VISHAY ERJ3EKF1003V
9	1	U1	LTM8060IY#PBF QUAD 3A MODULE, BGA 11.9X16-3.32	ANALOG DEVICES INC. LTM8060IY#PBF
Additional Demo Board Circuit Components				
1	1	C2	CAP., 22µF, TANT POLY, 63V, 10%, 7343	KEMET T543X226K063ATW075
2	2	C6, C14	CAP., 10µF, X7R, 50V, 10%, 1210, NO SUBS. ALLOWED	MURATA GRM32ER71H106KA12L
3	2	C7, C31	CAP., 100pF, X7R, 16V, 10%, 0603	AVX 0603YC101KAT2A
4	3	C9, C17, C28	CAP., 47µF, X7R, 6.3V, 10%, 1210, AEC-Q200, NO SUBS ALLOWED	MURATA GCM32ER70J476KE19L
5	2	C11, C12	CAP., 0.1µF, X7R, 50V, 10%, 0402, AEC-Q200, NO SUBS. ALLOWED	MURATA GCM155R71H104KE02D
6	1	C13	CAP., 220pF, X7R, 25V, 10%, 0603	AVX 06033C221KAT2A
7	4	C25, C26, C30, C33	CAP., 0.01µF, X7R, 25V, 10%, 0603, AEC-Q200	AVX 06033C103K4Z2A
8	1	C32	CAP., 680pF, C0G, 25V, 5%, 0603	AVX 06033A681JAT2A
9	3	C34, C38, C39	CAP., 1µF, X5R, 50V, 10%, 0603	AVX 06035D105KAT2A
10	1	C36	CAP., 100µF, X5R, 6.3V, 20%, 1210	AVX 12106D107MAT2A
11	1	D1	DIODE, ZENER, 3.9V, 250mW, SOD-323	
12	1	L1	IND., 100Ω AT 100MHz, FERRITE BEAD, 25%, 8A, 6mΩ, 1812	WURTH ELEKTRONIK 74279226101
13	1	L2	IND., 0.22µH, SMD POWER INDUCTOR, 30%, 9.5A, 7.3mΩ	WURTH ELEKTRONIK 744373240022
14	4	R19, R20, R21, R22	RES., AEC-Q200, 1M, 1%, 1/10W, 0603	VISHAY CRCW06031M00FKEA
15	1	R28	RES., 0Ω, 1/8W, 0805	VISHAY CRCW08050000Z0EA
16	4	R52, R57, R58, R59	RES., AEC-Q200, 100k, 1%, 1/10W, 0603	VISHAY CRCW0603100KFKEA
17	2	R53, R60	RES., AEC-Q200, 0Ω, 1/4W, 1206	VISHAY CRCW12060000Z0EA
18	1	R56	RES., 2.1k, 1%, 1/10W, 0603, AEC-Q200	VISHAY CRCW06032K10FKEA
Hardware: For Demo Board Only				
1	20	E4, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E20, E21, E22, E24, E25	TEST POINT, TURRET, 0.094", MTG. HOLE	MILL-MAX 2501-2-00-80-00-00-07-0
2	2	J1, J2	CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE	KEYSTONE 575-4
3	4	JP1, JP2, JP3, JP4	CONN., HDR, MALE, 1x3, 2mm, STR, THT, NO SUBS. ALLOWED	WURTH ELEKTRONIK 62000311121
4	2	JP7, JP9	CONN., HDR, MALE, 2x3, 2mm, VERT, STR, THT	WURTH ELEKTRONIK 62000621121
5	4	MH1, MH2, MH3, MH4	STANDOFF, NYLON, SNAP-ON, 0.25" (6.4mm)	KEYSTONE 8831
6	6	XJP1, XJP2, XJP3, XJP4, XJP7, XJP9	CONN., SHUNT, FEMALE, 2 POS, 2mm	WURTH ELEKTRONIK 60800213421

SCHEMATIC DIAGRAM



ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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