

LTM8051EY

40V, 1.2A Quad Step-Down Silent Switcher µModule Regulator

DESCRIPTION

Demonstration circuit 2860A is a quad step-down DC/DC switching converter featuring the [LTM®8051](#) silent switcher µModule® regulator. The demo board is designed to deliver quad 5V/1.2A, 3.3V/1.2A, 2.5V/1.2A and 1.8V/1.2A outputs from a 7V to 40V input. The Silent Switcher® architecture minimizes EMI while achieving high efficiency at frequencies up to 3MHz. The modes of operation (Burst Mode® operation or discontinuous mode/SYNC) are jumper selectable. Burst Mode operation improves efficiency at light loads.

The LTM8051 is a fixed frequency PWM regulator with current mode control scheme. The switching frequency of channel 1 and channel 4 is set by an appropriate resistor (R11) from the RT14 pin to ground. The switching frequency of channel 2 and channel 3 is set by another

appropriate resistor (R23) from the RT23 pin to ground. The RUN14 pin (RUN14 terminal) can be used to set the LTM8051 channel 1 and channel 4 in micro power shutdown mode, while the RUN23 pin (RUN23 terminal) can be used to set the channel 2 and channel 3 in shutdown mode. Output tracking and soft start pins (TRSS1/TRSS2/TRSS3/TRSS4) allow user control of output voltage ramp rate during startup. The power good output of each channel (PG1/PG2/PG3/PG4) will be low when that channel's output voltage is outside of the ±7.5% regulation window.

The LTM8051 data sheet gives a complete description of the operation and application information. The data sheet must be read in conjunction with this demo manual.

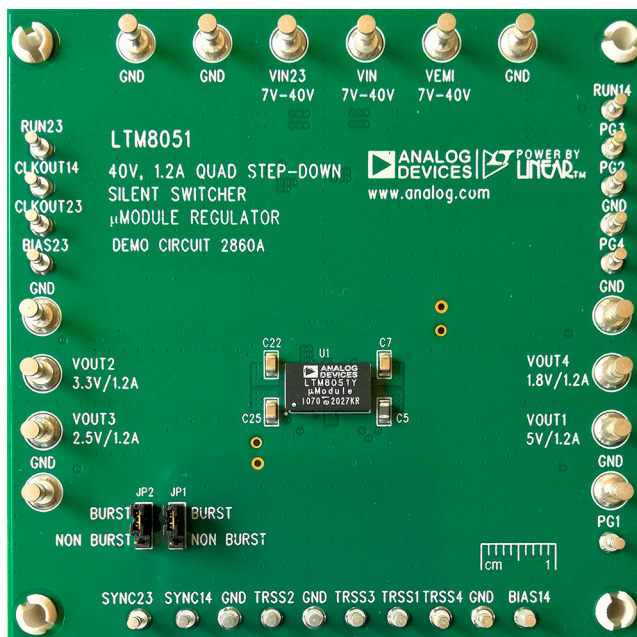
[Design files for this circuit board are available.](#)

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PERFORMANCE SUMMARY Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		7		40	V
Output Voltage, V _{OUT1}	V _{IN} = 7V to 40V, I _{OUT1} = 0A to 1.2A		5 ±2%		V
Output Voltage, V _{OUT2}	V _{IN} = 7V to 40V, I _{OUT2} = 0A to 1.2A		3.3 ±2%		V
Output Voltage, V _{OUT3}	V _{IN} = 7V to 40V, I _{OUT3} = 0A to 1.2A		2.5 ±2%		V
Output Voltage, V _{OUT4}	V _{IN} = 7V to 40V, I _{OUT4} = 0A to 1.2A		1.8 ±2%		V
Maximum Output Current, I _{OUT1}	V _{IN} = 7V to 40V, V _{OUT1} = 5V		1.2		A
Maximum Output Current, I _{OUT2}	V _{IN} = 7V to 40V, V _{OUT2} = 3.3V		1.2		A
Maximum Output Current, I _{OUT3}	V _{IN} = 7V to 40V, V _{OUT3} = 2.5V		1.2		A
Maximum Output Current, I _{OUT4}	V _{IN} = 7V to 40V, V _{OUT4} = 1.8V		1.2		A
Typical Efficiency	V _{IN} = 12V, with 1.2A at Each Output, Burst Mode Operation		87.5		%

BOARD PHOTO



QUICK START PROCEDURE

Demonstration circuit 2860A is easy to set up to evaluate the performance of the LTM8051. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply to V_{IN} (7V to 40V) and GND (input return).
2. Connect the 5V output load between V_{OUT1} and GND (Initial load: no load); connect the 3.3V output load between V_{OUT2} and GND (Initial load: no load); connect the 2.5V output load between V_{OUT3} and GND (Initial load: no load); and connect the 1.8V output load between V_{OUT4} and GND (Initial load: no load).
3. Connect the DVMs to the input and outputs.

4. Turn on the input power supply and check for the proper output voltages. V_{OUT1} should be $5V \pm 2\%$; V_{OUT2} should be $3.3V \pm 2\%$; V_{OUT3} should be $2.5V \pm 2\%$; V_{OUT4} should be $1.8V \pm 2\%$.
5. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, efficiency and other parameters.

NOTE: When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (-) terminals of an output capacitor. The probe's ground ring needs to touch the (-) lead and the probe tip needs to touch the (+) lead.

QUICK START PROCEDURE

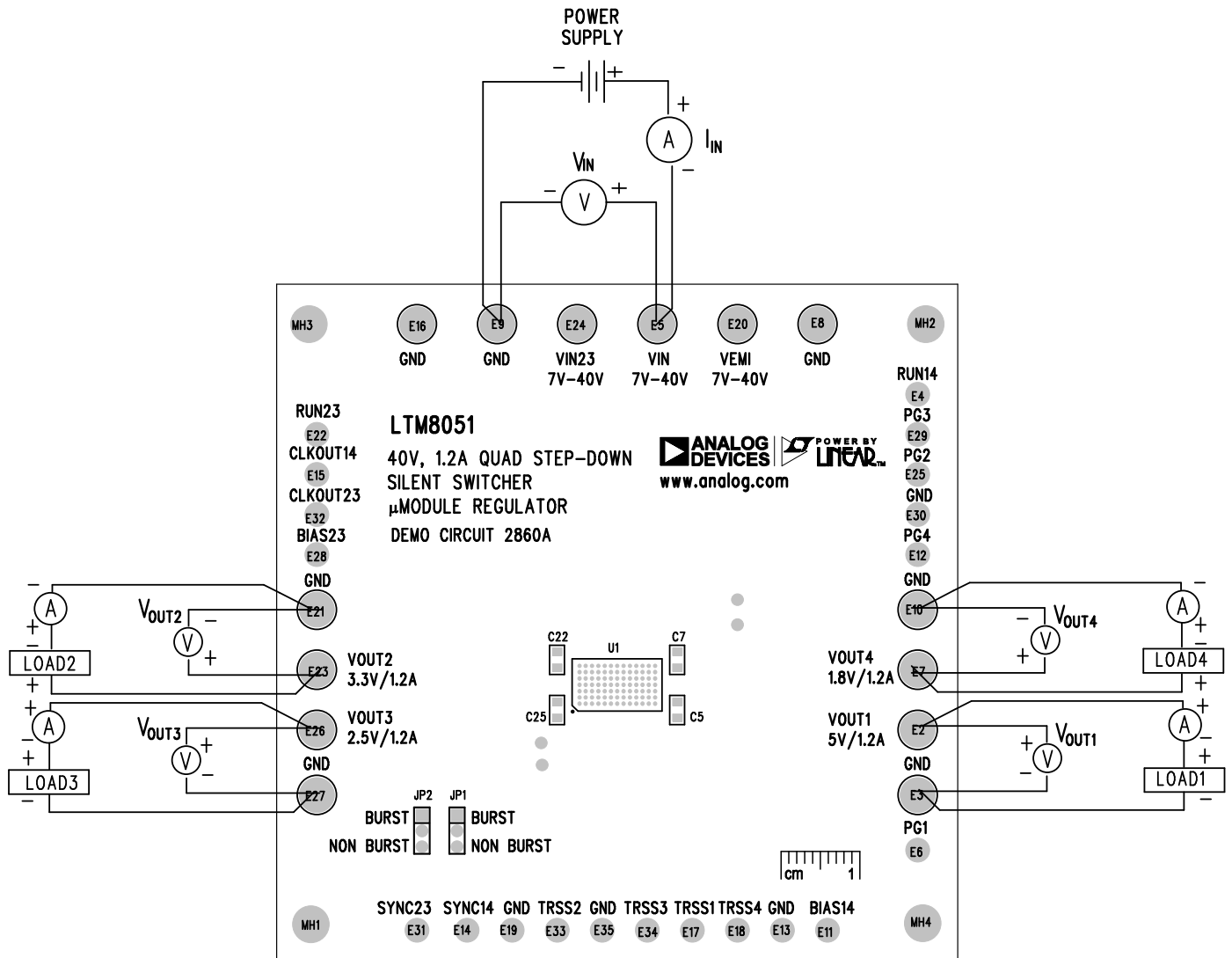


Figure 1. Proper Measurement Equipment Setup

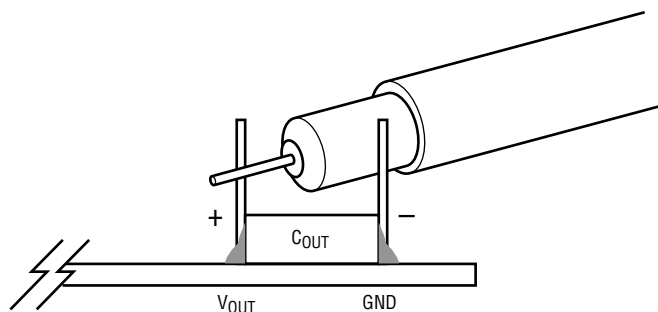


Figure 2. Measuring Output Voltage Ripple

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QUICK START PROCEDURE

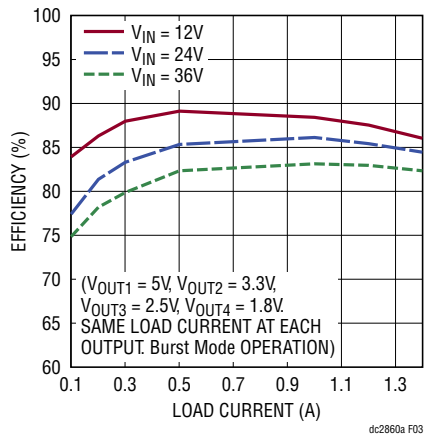
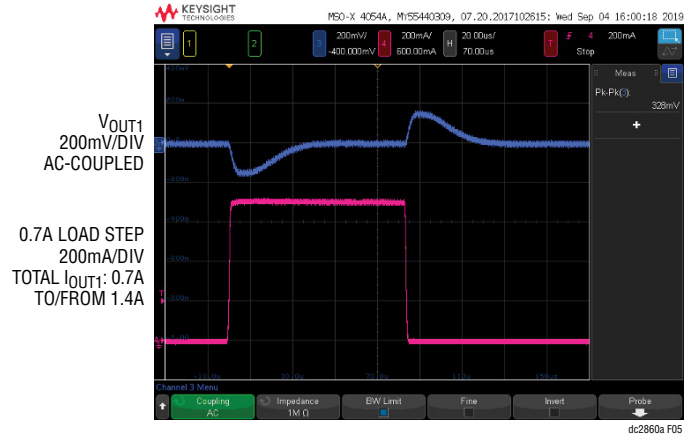


Figure 3. DC2860A/LTM8051 Efficiency vs Load Current



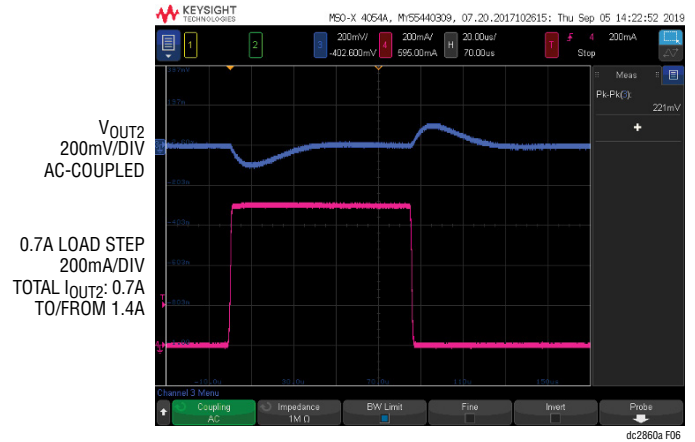
$V_{IN} = 12V, V_{OUT1} = 5V$

Figure 5. Load Step Transient Test



12V_{IN}, 1.2A LOAD ON EACH OUTPUT.
NON-Burst Mode, 10mV/DIV, 500ns/DIV

Figure 4. Output Voltage Ripples



$V_{IN} = 12V, V_{OUT2} = 3.3V$

Figure 6. Load Step Transient Test

QUICK START PROCEDURE

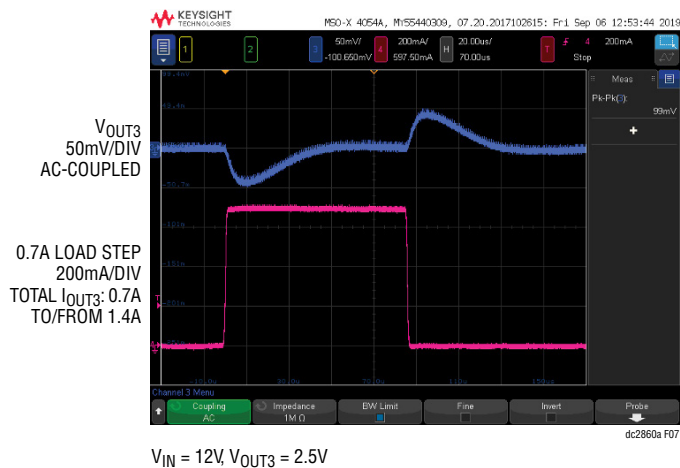


Figure 7. Load Step Transient Test

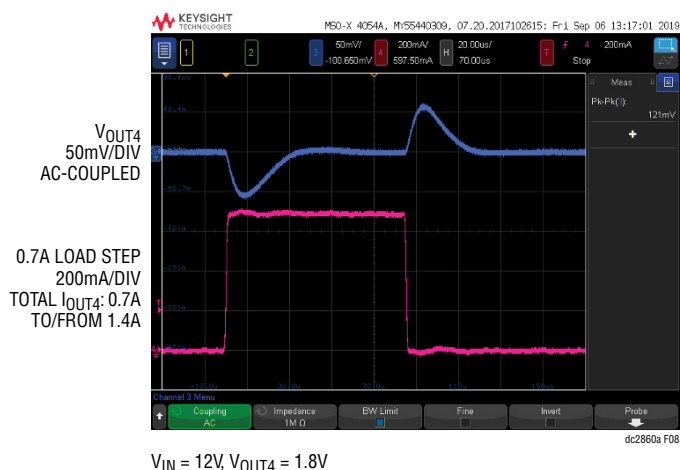


Figure 8. Load Step Transient Test

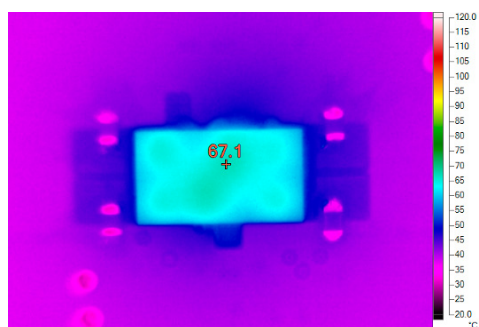


Figure 9. Thermal Picture ($V_{IN} = 12V, 1.4A$ at Each Output. No Heat Sink, No Forced Airflow)

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PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	3	C1, C6, C21	CAP, 4.7 μ F, X5R, 50V, 10%, 0805	MURATA GRM21BR61H475KE51L SAMSUNG CL21A475KBQNNNE TDK C2012X5R1H475K125AB
2	4	C2, C8, C23, C26	CAP, 22 μ F, X5R, 10V, 20%, 0603	AVX 0603ZD226MAT2A MURATA GRM188R61A226ME15D SAMSUNG CL10A226MP8NUNE
3	2	C4, C20	CAP, 22 μ F, ALUM. ELECT., 63V, 20%, 6.3 \times 7.7mm, CE-BS	SUN ELECTRONIC INDUSTRIES CORP 63CE22BS
4	1	C5	CAP, 47 μ F, X5R, 6.3V, 20%, 0805	MURATA GRM21BR60J476ME15L SAMSUNG CL21A476MQYNNNE TAIYO YUDEN JMK212BBJ476MG-T TDK C2012X5R0J476M125AC TAIYO YUDEN JMK212BJ476MG-T
5	3	C7, C22, C25	CAP, 100 μ F, X5R, 6.3V, 20%, 0805	MURATA GRM21BR60J107ME15K
6	4	C11, C12, C29, C30	CAP, 0.1 μ F, X5R, 16V, 10%, 0603	AVX 0603YD104KAT2A NIC NMCAVX 0603X5R104K16TRPF
7	1	C13	CAP, 1 μ F, X5R, 50V, 10%, 0603	AVX 06035D105KAT2A MURATA GRM188R61H105KAALD TAIYO YUDEN UMK107BJ105KA-T TDK C1608X5R1H105K080AB
8	4	C14, C15, C18, C19	CAP, 0.1 μ F, X7R, 50V, 10%, 0402	AVX 04025C104KAT2A MURATA GRM155R71H104KE14D MURATA GRM155R71H104KE14J TAIYO YUDEN UMK105B7104KV-FR TDK C1005X7R1H104K050BB
9	2	C16, C17	CAP, 10 μ F, X5R, 50V, 10%, 1210	TDK C3225X5R1H106K250AB MURATA GRM32ER61H106KA12L
10	2	R1, R15	RES., 1M, 1%, 1/10W, 0603, AEC-Q200	VISHAY CRCWAVX 06031M00FKEA VISHAY CRCWAVX 06031M00FKED NIC NRC06F1004TRF PANASONIC ERJ3EKF1004V
11	4	R2, R6, R16, R18	RES., 100k, 1%, 1/10W, 0603, AEC-Q200	VISHAY CRCWAVX 0603100KFKEA NIC NRC06F1003TRF PANASONIC ERJ3EKF1003V
12	2	R3, R13	RES., 0 Ω , 1/8W, 0805	VISHAY CRCW08050000Z0EA YAGEO RC0805JR-070RL
13	1	R5	RES., 47.5k, 1%, 1/10W, 0603	VISHAY CRCWAVX 060347K5FKEA YAGEO RCAVX 0603FR-0747K5L
14	4	R7, R12, R19, R24	RES., 0 Ω , 1/10W, 0603, AEC-Q200	VISHAY CRCWAVX 06030000Z0EA VISHAY CRCWAVX 06030000Z0EB NIC NRC06Z0TRF
15	1	R8	RES., 200k, 1%, 1/10W, 0603	NIC NRC06F2003TRF VISHAY CRCWAVX 0603200KFKEA YAGEO RCAVX 0603FR-07200KL
16	1	R11	RES., 23.2k, 1%, 1/10W, 0603	KOA SPEER RK73H1JTTD2322F PANASONIC ERJ3EKF2322V VISHAY CRCWAVX 060323K2FKEA
17	1	R17	RES., 78.7k, 1%, 1/10W, 0603	NIC NRC06F7872TRF STACKPOLE ELECTRONICS, INC. RMCFAVX 0603FT78K7 YAGEO RCAVX 0603FR-0778K7L

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
18	1	R20	RES., 118k, 1%, 1/10W, 0603, AEC-Q200	VISHAY CRCWAVX 0603118KFKEA
19	1	R23	RES., 24.9k, 1%, 1/10W, 0603, AEC-Q200	NIC NRC06F2492TRF VISHAY CRCWAVX 060324K9FKEA PANASONIC ERJ3EKF2492V
20	1	FB1	IND., 100Ω AT 100MHz, FERRITE BEAD, 25%, 8A, 6mΩ, 1812	WURTH ELEKTRONIK 74279226101
21	1	L1	IND., 0.22μH, PWR, SHIELDED, 30%, 9.5A, 7.3mΩ, 4020	WURTH ELEKTRONIK 744373240022
22	1	U1	IC, 40V, 1.2A QUAD STEP-DOWN μModule REGULATOR, BGA	ANALOG DEVICES LTM8051EY#PBF

Additional Demo Board Circuit Components

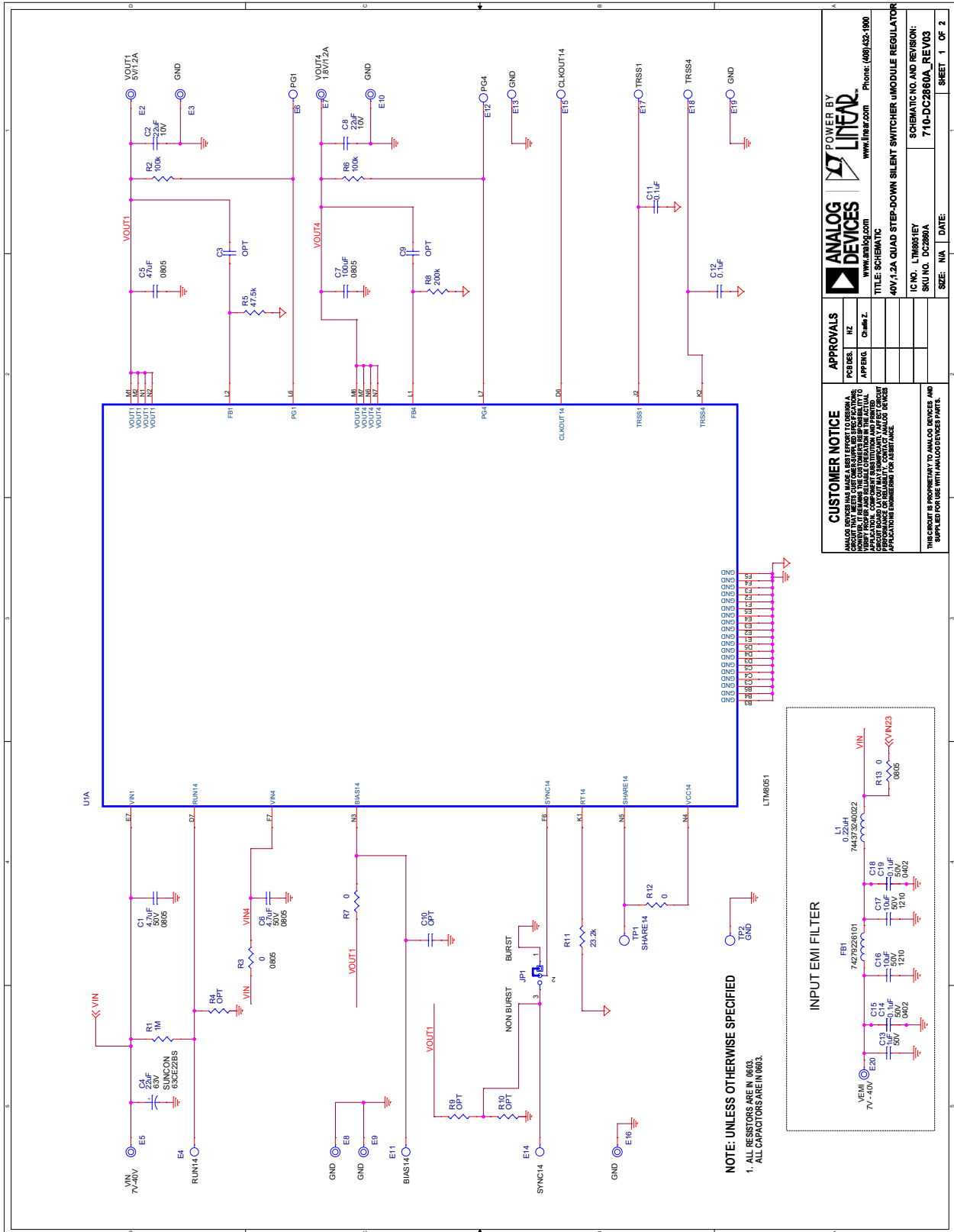
23	0	C3, C9, C10, C24, C27, C28	CAP, OPTION, 0603	
24	0	R4, R9, R10, R14, R21, R22	RES., OPTION, 0603	

Hardware: For Demo Board Only

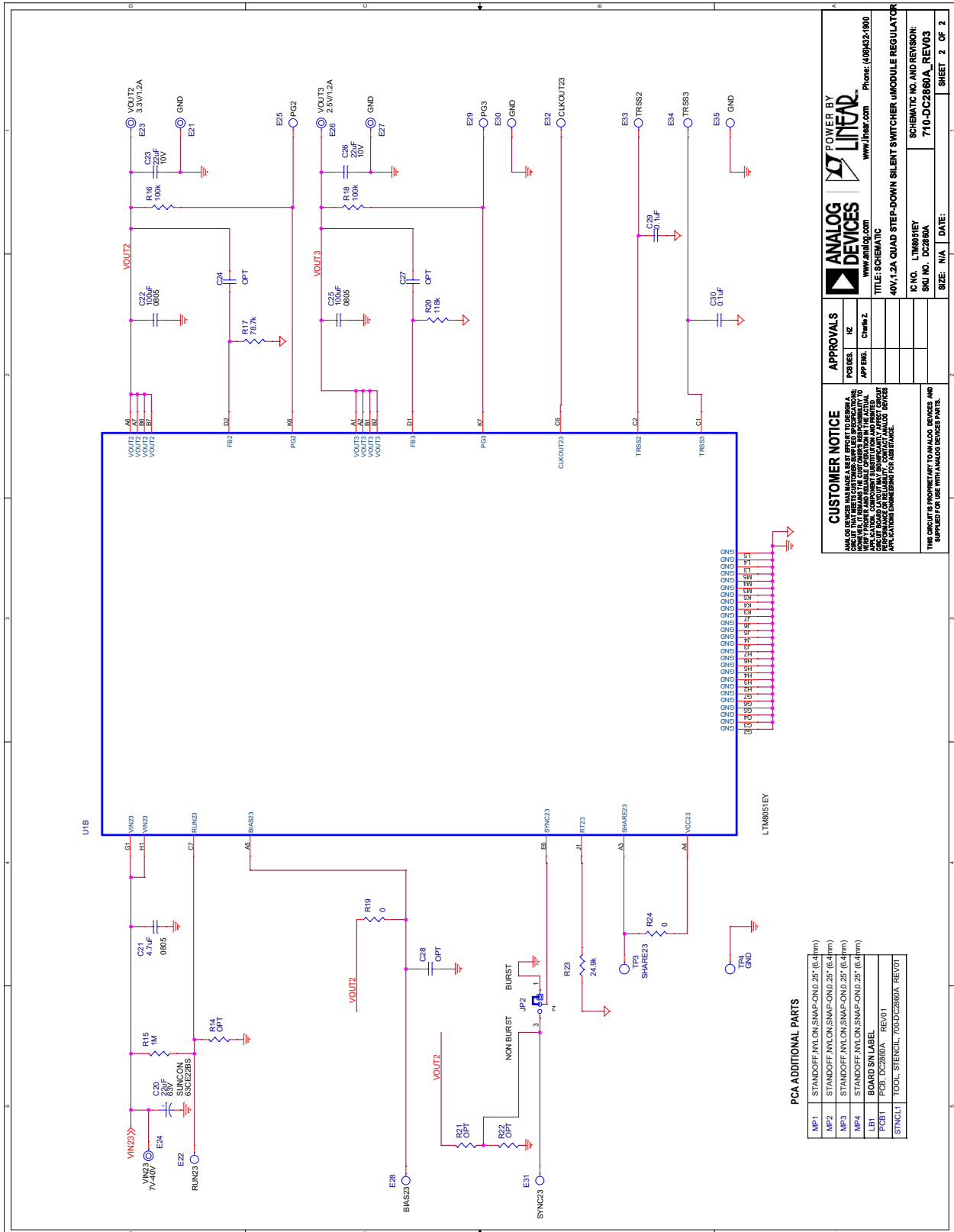
25	14	E2, E3, E5, E7, E8, E9, E10, E16, E20, E21, E23, E24, E26, E27	TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK	MILL-MAX 2501-2-00-80-00-00-07-0
26	20	E4, E6, E11, E12, E13, E14, E15, E17, E18, E19, E22, E25, E28, E29, E30, E31, E32, E33, E34, E35	TEST POINT, TURRET, 0.064" MTG. HOLE, PCB 0.062" THK	MILL-MAX 2308-2-00-80-00-00-07-0
27	2	JP1, JP2	CONN., HDR., MALE, 1×3, 2mm, THT, STR, NO SUBS. ALLOWED	SAMTEC TMM-103-02-L-S
28	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT 2860A
29	1	STNCL1	TOOL, STENCIL, 700-DC2860A	ANALOG DEVICES 830--DC2860A
30	4	MP1, MP2, MP3, MP4	STANDOFF, NYLON, SNAP-ON, 0.25" (6.4mm)	KEYSTONE 8831 WURTH ELEKTRONIK 702931000
31	2	XJP1, XJP2	CONN., SHUNT, FEMALE, 2-POS, 2mm	SAMTEC 2SN-BK-G

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SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



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