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.

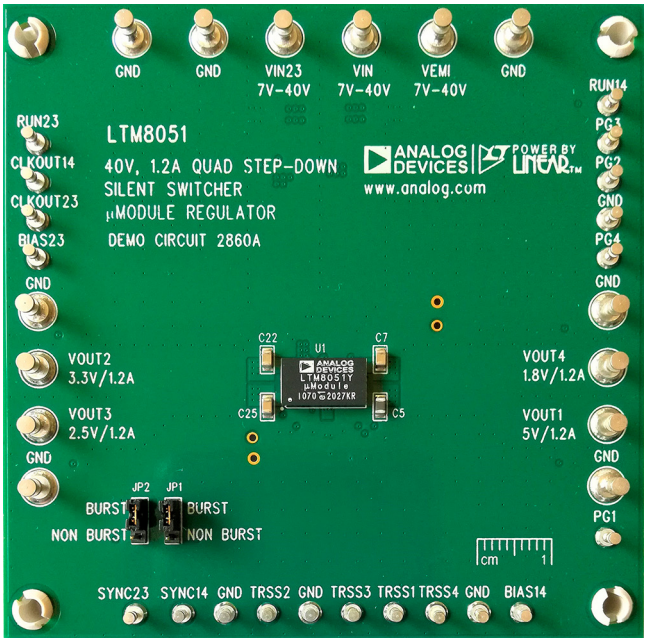
Design files for this circuit board are available.

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 ±2%; V_{OUT2} should be 3.3V ±2%; V_{OUT3} should be 2.5V ±2%; V_{OUT4} should be 1.8V ±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

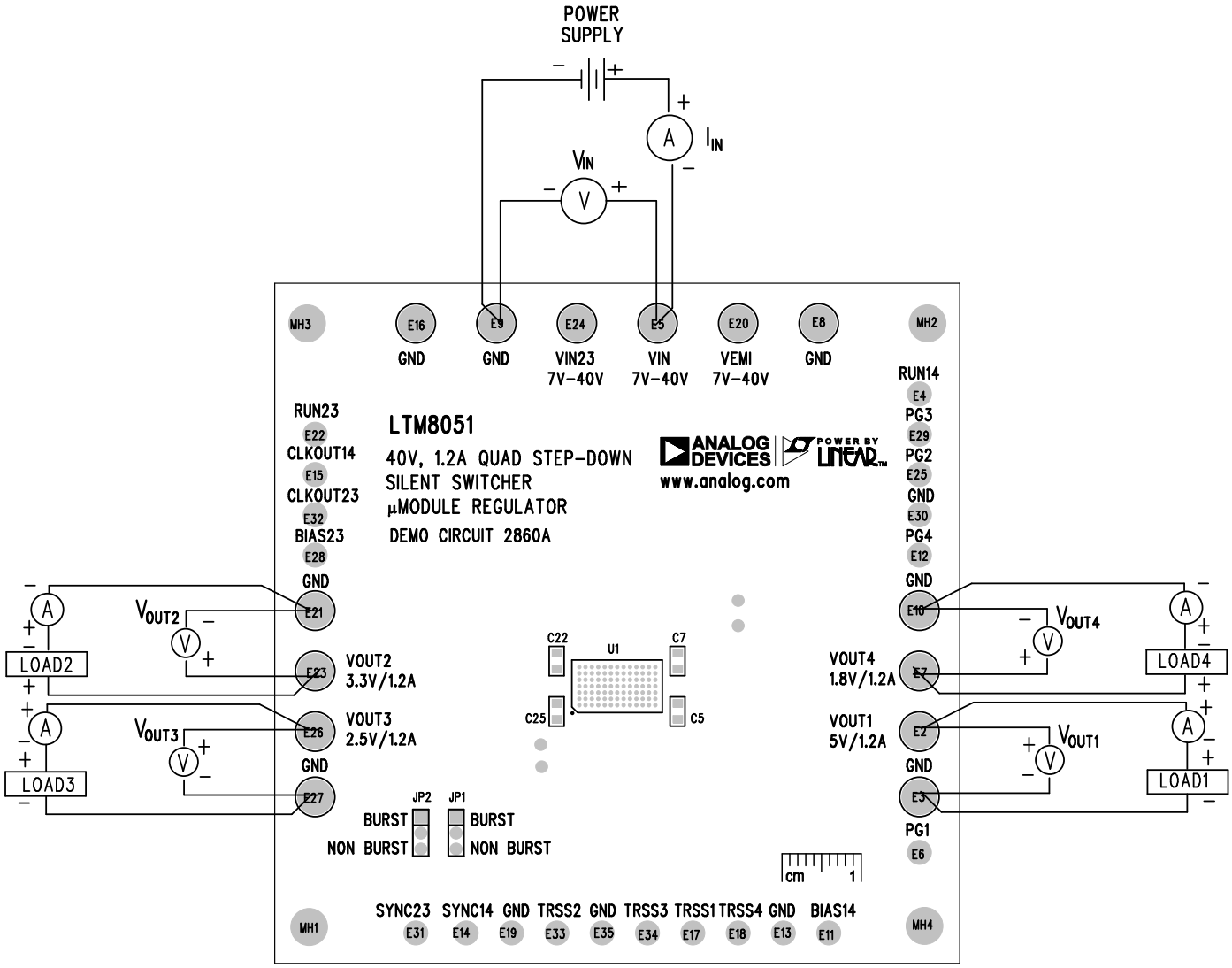


Figure 1. Proper Measurement Equipment Setup

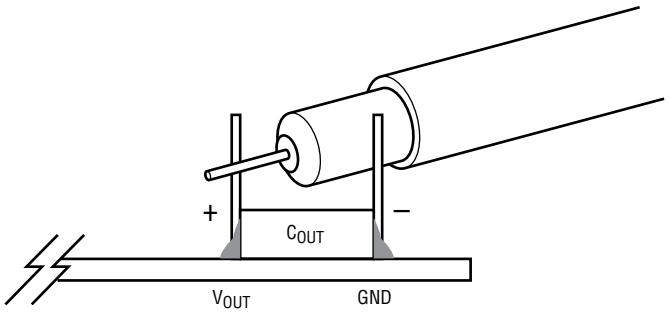


Figure 2. Measuring Output Voltage Ripple

QUICK START PROCEDURE

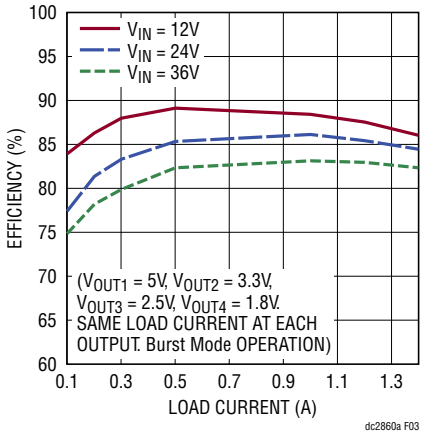
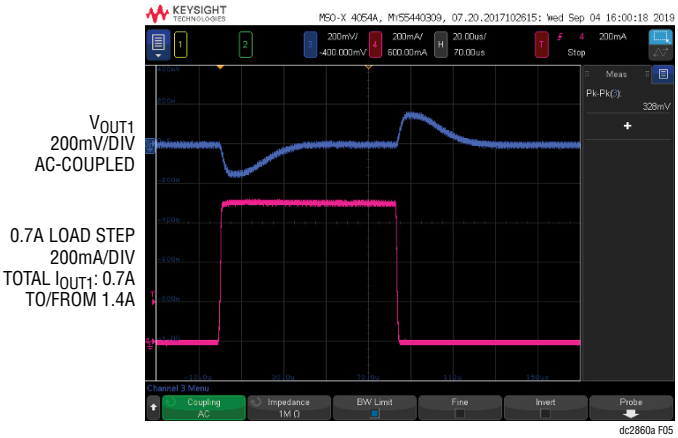


Figure 3. DC2860A/LTM8051 Efficiency vs Load Current

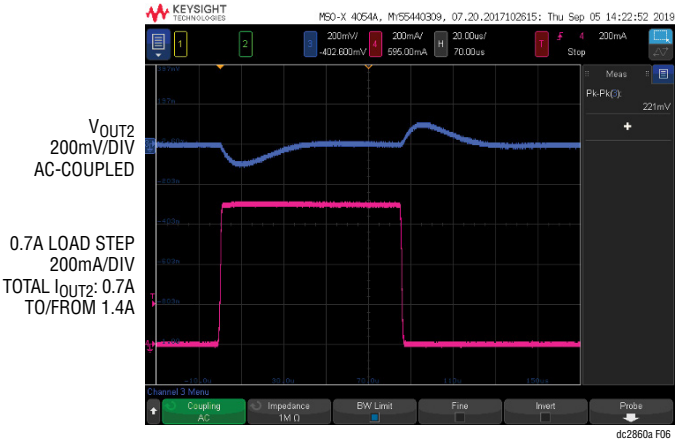
12V_{IN}, 1.2A LOAD ON EACH OUTPUT,
NON-Burst Mode, 10mV/DIV, 500ns/DIV

Figure 4. Output Voltage Ripples



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

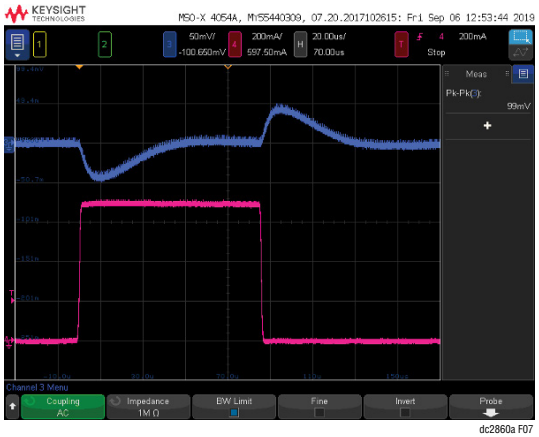
Figure 5. Load Step Transient Test



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

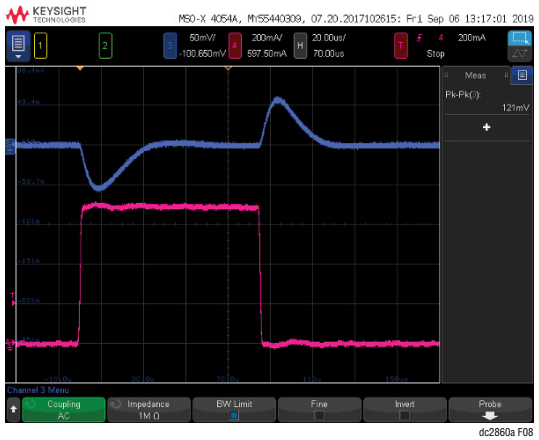
Figure 6. Load Step Transient Test

QUICK START PROCEDURE



V_{IN} = 12V, V_{OUT3} = 2.5V

Figure 7. Load Step Transient Test



V_{IN} = 12V, V_{OUT4} = 1.8V

Figure 8. Load Step Transient Test

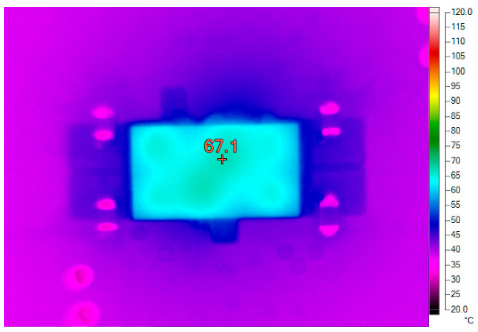


Figure 9. Thermal Picture (V_{IN} = 12V, 1.4A at Each Output. No Heat Sink, No Forced Airflow)

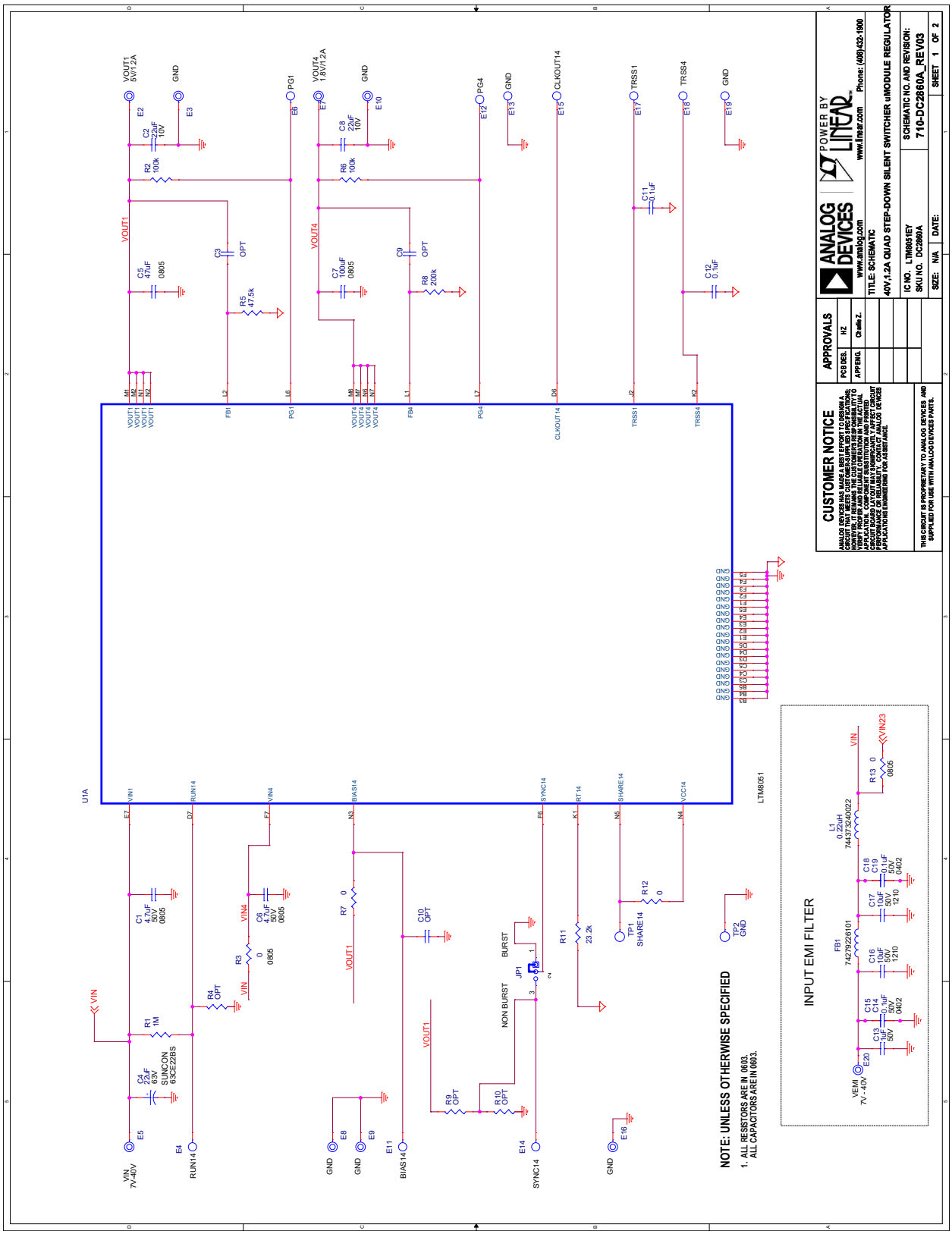
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	3	C1, C6, C21	CAP., 4.7µF, X5R, 50V, 10%, 0805	MURATA GRM21BR61H475KE51L SAMSUNG CL21A475KBQNNNE TDK C2012X5R1H475K125AB
2	4	C2, C8, C23, C26	CAP., 22µF, X5R, 10V, 20%, 0603	AVX 0603ZD226MAT2A MURATA GRM188R61A226ME15D SAMSUNG CL10A226MP8NUNE
3	2	C4, C20	CAP., 22µF, ALUM. ELECT., 63V, 20%, 6.3×7.7mm, CE-BS	SUN ELECTRONIC INDUSTRIES CORP 63CE22BS
4	1	C5	CAP., 47µF, 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., 100µF, X5R, 6.3V, 20%, 0805	MURATA GRM21BR60J107ME15K
6	4	C11, C12, C29, C30	CAP., 0.1µF, X5R, 16V, 10%, 0603	AVX 0603YD104KAT2A NIC NMCAVX 0603X5R104K16TRPF
7	1	C13	CAP., 1µF, X5R, 50V, 10%, 0603	AVX 06035D105KAT2A MURATA GRM188R61H105KAALD TAIYO YUDEN UMK107BJ105KA-T TDK C1608X5R1H105K080AB
8	4	C14, C15, C18, C19	CAP., 0.1µF, X7R, 50V, 10%, 0402	AVX 04025C104KAT2A MURATA GRM155R71H104KE14D MURATA GRM155R71H104KE14J TAIYO YUDEN UMK105B7104KV-FR TDK C1005X7R1H104K050BB
9	2	C16, C17	CAP., 10µF, 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., 0Ω, 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., 0Ω, 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

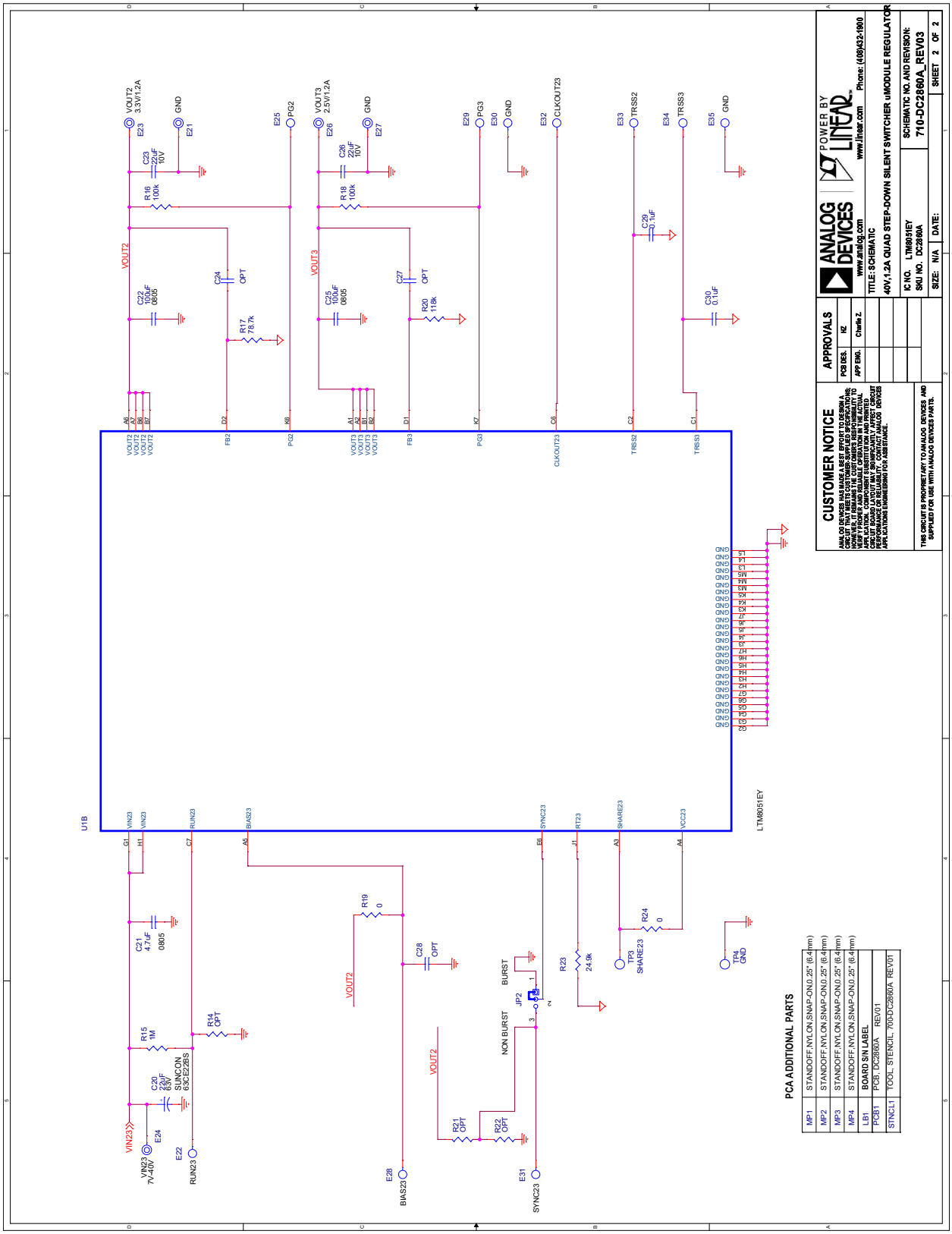
PARTS LIST

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

SCHEMATIC DIAGRAM



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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