LT8637
42V, 5A Synchronous Step-Down Silent Switcher with 2.5μA Quiescent Current

DESCRIPTION

Demonstration circuit 3020A is a 42V, 5A (7A Peak) synchronous step-down Silent Switcher® with spread spectrum frequency modulation featuring the LT®8637. The demo board is designed for 5V output from a 5.8V to 42V input. The wide input range allows a variety of input sources, such as automotive batteries and industrial supplies. The LT8637 is a compact, low emission, high efficiency, and high frequency synchronous monolithic step-down switching regulator. The LT8637 is the same as the LT8636, except it has a VC pin for external compensation. This allows the customer to optimize the loop response, or to parallel multiple regulators for higher current applications. The proprietary Silent Switcher architecture minimizes electromagnetic emissions with simplified filter and reduced layout sensitivity. Selectable spread spectrum mode further improves EMI performance, making it perfect solution to the noise sensitive applications. The regulator's ultralow 2.5μA quiescent current–with the output in full regulation–enables applications requiring highest efficiency at very light load currents, such as automotive and battery powered portable instruments.

Peak current mode control with minimum on-time of as small as 30ns allows high step-down conversion even at high frequency. The LT8637 switching frequency can be programmed either via oscillator resistor or external clock over a 200kHz to 3MHz range. The default frequency of demo circuit 3020A is 2MHz.

The SYNC/MODE pin on the demo board DC3020A is grounded (JP1 at BURST position) by default for low ripple Burst Mode® operation. To synchronize to an external clock, move the Jump JP1 to SYNC/FCM and apply the external clock to the SYNC terminal ON THE 3020A. In sync mode, the part runs in forced continuous mode. Without external clock applied, the SYNC/MODE pin is floating, and the part runs in forced continuous mode. This mode offers fast transient response and full frequency operation over a wide load range. Alternatively, move the Jump JP1 to the SPREAD-SPECTRUM, and the SYNC/MODE is tied to INTVCC, the part runs in forced continuous mode with spread spectrum function enabled.

The LT8637 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this demo manual for demo circuit 3020A. The layout recommendations for low EMI operation and best thermal performance are available in the data sheet section Low EMI PCB Layout and Thermal Considerations and Peak Output Current. Contact ADI applications engineer for support.

Design files for this circuit board are available.

PERFORMANCE SUMMARY

Specifications are at $T_A = 25°C$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN_EMI}	Input Supply Range with EMI Filter		5.8		42	V
V_{OUT}	Output Voltage		4.85	5	5.15	V
I_{OUT}	Maximum Output Current	Derating is Necessary for Certain V_{IN} and Thermal Conditions	5			A
f_{SW}	Switching Frequency		1.85	2	2.15	MHz
EFF	Efficiency	V_{IN} = 12V, I_{OUT} = 3A		94.4		%

QUICK START PROCEDURE

Demonstration circuit 3020A is easy to set up to evaluate the performance of the LT8637. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip directly across the output capacitor.

1. Make sure the Jump JP1 is on the BURST position. Refer to the schematic.
2. With power off, connect the DC power supply to VEMI and GND. Connect the load from VOUT to GND.
3. Connect the voltage meter across the VIN_SENSE and GND for V_{IN} measurement, and VOUT_SENSE and GND for V_{OUT} measurement.
4. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed 42V.
5. Check for the proper output voltage (V_{OUT} = 5V).

   NOTE: If there is no output, temporarily disconnect the load to make sure that the load is not set too high or is shorted.
6. Once the proper output voltage is established, adjust the load within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other parameters. For efficiency measurement, use the VIN_SENSE, GND, and VOUT_SENSE, GND accordingly.
7. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). When JP1 is in SYNC, and no external clock is connected to the SYNC terminal of the board, the SYNC/FCM pin is floating, and the LT8637 runs in forced continuous mode. JP1 can also set LT8637 in spread spectrum mode (JP1 on the SPREAD-SPECTRUM position).

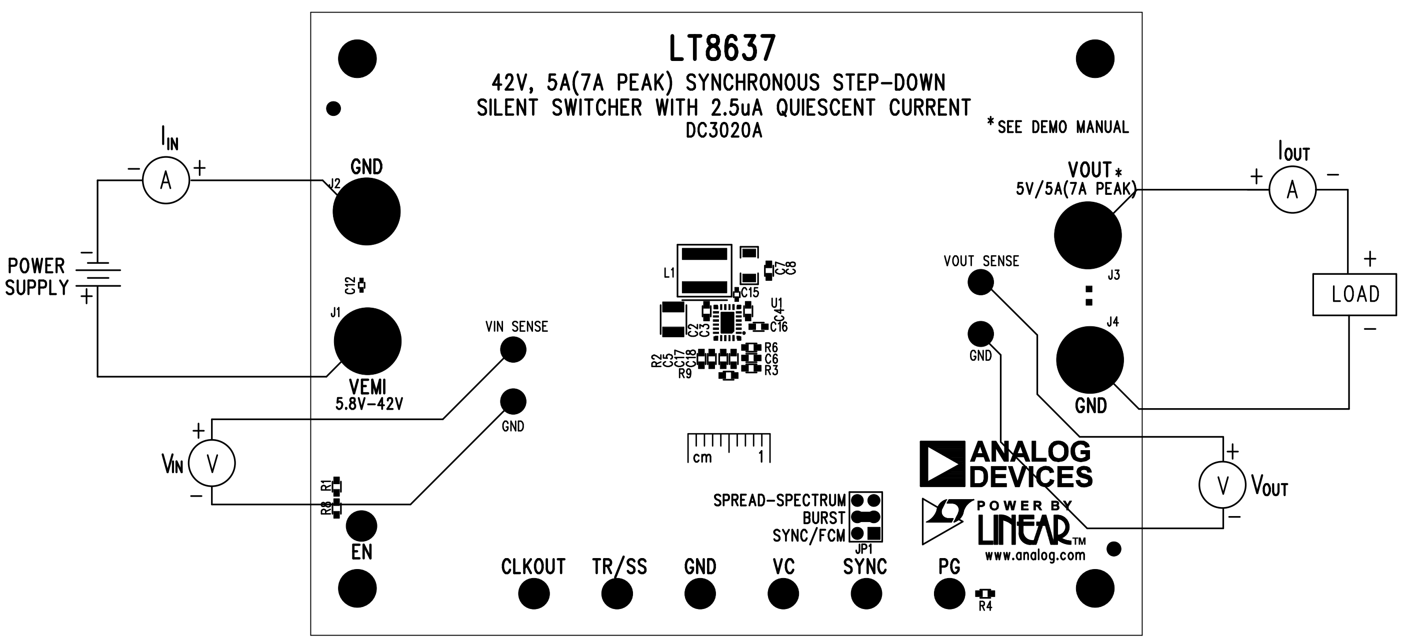


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

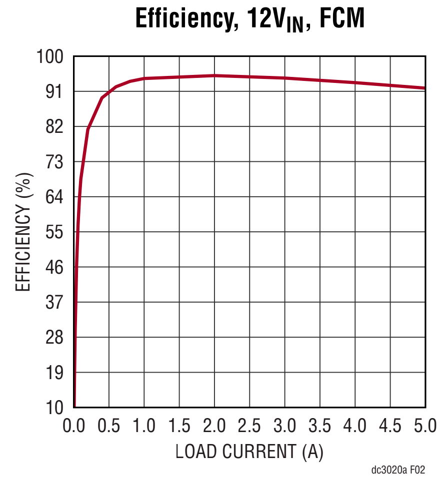


Figure 2. Efficiency vs Load Current, $12V_{IN}$, V_{OUT} = 5V

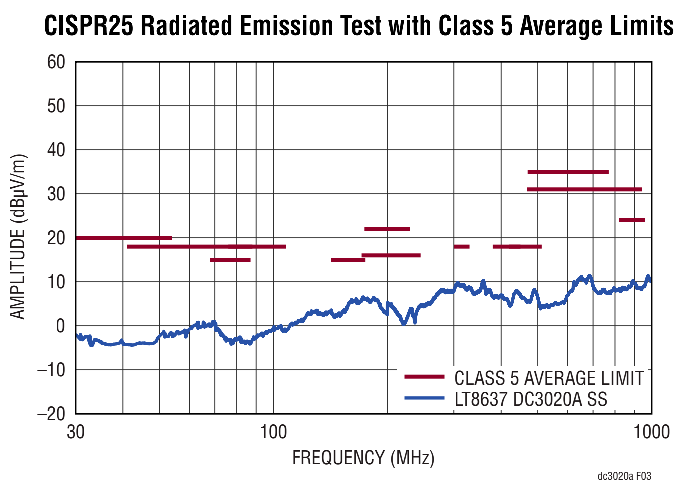
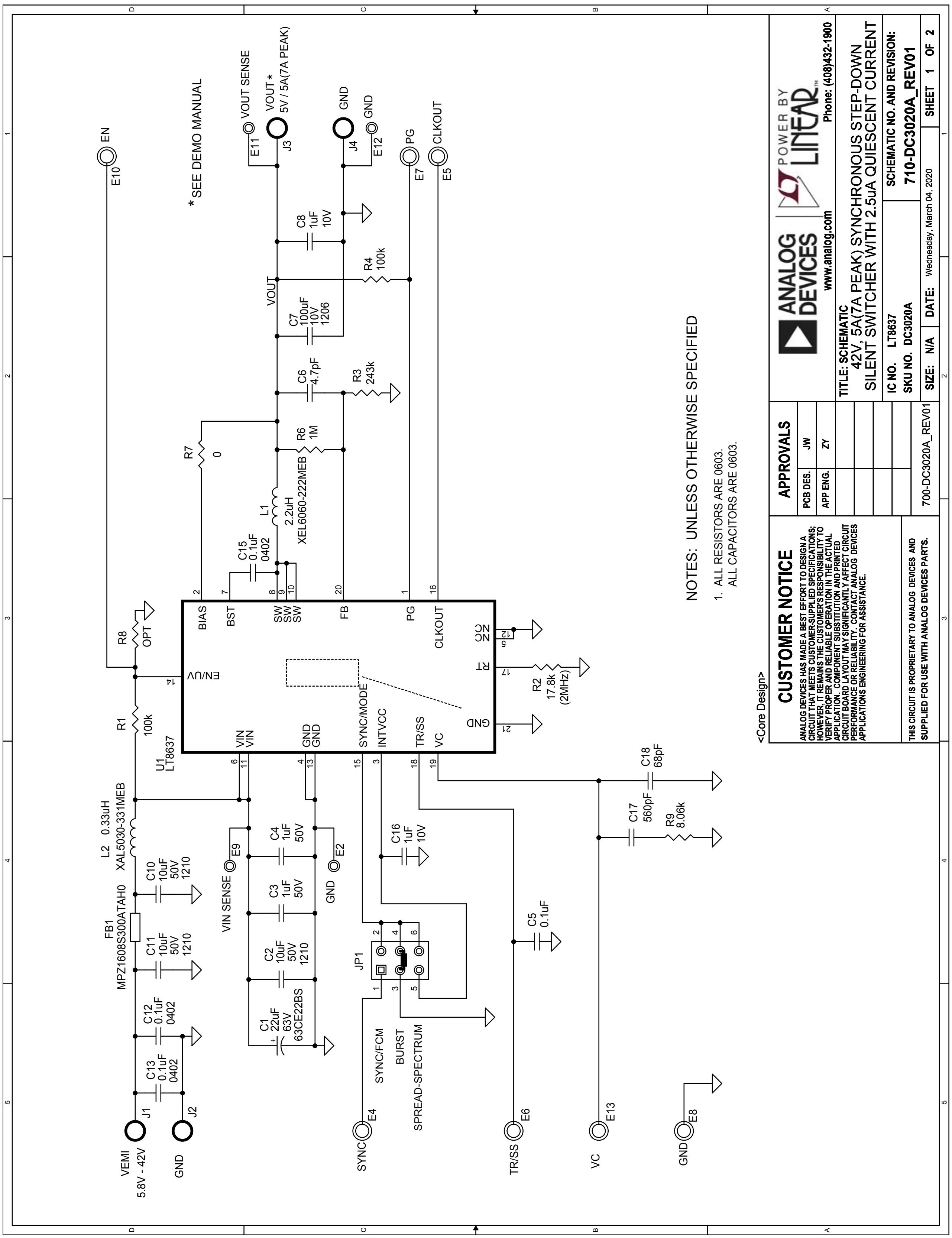


Figure 3. Radiated Emission Test with CISPR 25, Average Limit, SS Mode. V_{IN} = 14V, I_{OUT} = 5A, V_{OUT} = 5V

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., 22µF, ALUM. ELECT., 63V, 20%, 6.3mm × 7.7mm, CE-BS	SUN ELECTRONIC INDUSTRIES CORP, 63CE22BS
2	3	C2, C10, C11	CAP., 10µF, X7R, 50V, 10%, 1210, NO SUBS. ALLOWED	MURATA, GRM32ER71H106KA12L
3	2	C3, C4	CAP., 1µF, X5R, 50V, 10%, 0603	AVX, 06035D105KAT2A
4	1	C5	CAP., 0.1µF, X7R, 16V, 10%, 0603	WURTH ELEKTRONIK, 885012206046
5	1	C6	CAP., 10pF, X7R, 50V, 10%, 0603	AVX, 06035C100KAT2A
6	1	C7	CAP., 100µF, X5R, 6.3V, 10%, 1206	MURATA, GRM31CR60J107KE39L
7	2	C8, C16	CAP., 1µF, X7R, 10V, 10%, 0603	AVX, 0603ZC105KAT2A
8	3	C12, C13, C15	CAP., 0.1µF, X7R, 50V, 10%, 0402	AVX, 04025C104KAT2A
9	1	C17	CAP., 560pF, C0G, 50V, 5%, 0603	AVX, 06035A561JAT2A
10	1	C18	CAP., 68pF, C0G, 50V, 5%, 0603	AVX, 06035A680JAT2A
11	1	FB1	IND., 30Ω AT 100MHz, FERRITE BEAD, 25%, 5A, 10mΩ, 0603	TDK, MPZ1608S300ATAH0
12	1	L1	IND., 2.2µH, 20%, 18.1A, 6.70mΩ, 6.56mm × 6.36mm, XEL6060, AEC-Q200	COILCRAFT, XEL6060-222MEB
13	1	L2	IND., 0.33µH, 20%, 19.2A, 3.52mΩ	COILCRAFT, XAL5030-331MEB
14	2	R1, R4	RES., 100k, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW0603100KFKEA
15	1	R2	RES., 17.8k, 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F1782TRF
16	1	R3	RES., 243k, 1%, 1/10W, 0603	VISHAY, CRCW0603243KFKEA
17	1	R6	RES., 1M, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06031M00FKEA
18	1	R7	RES., 0Ω, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06030000Z0EA
19	1	R9	RES., 8.06k, 1%, 1/10W, 0603	YAGEO, RC0603FR-078K06L
20	1	U1	IC, SYN. STEP-DOWN Silent Switcher, LQFN-20, 42V, 5A/7A	ANALOG DEVICES, LT8637EV#PBF
Additional Demo Board Circuit Components				
1	0	R8	RES., OPTION, 0603	
Hardware: For Demo Board Only				
1	4	E2, E9, E11, E12	TEST POINT, TURRET, 0.064" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2308-2-00-80-00-00-07-0
2	6	E4-E8, E10	TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2501-2-00-80-00-00-07-0
3	4	J1-J4	CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE, 0.218"	KEYSTONE, 575-4
4	1	JP1	CONN., HDR., MALE, 2 × 3, 2mm, VERT, STR, THT	WURTH ELEKTRONIK, 62000621121
5	4	MH1-MH4	STANDOFF, NYLON, SNAP-ON, 0.50"	WURTH ELEKTRONIK, 702935000
6	1	XJP1	CONN., SHUNT, FEMALE, 2-POS, 2mm	SAMTEC, 2SN-BK-G

SCHEMATIC DIAGRAM



Rev. 0

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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