LT8652S
Dual Channel 8.5A, 18V, Synchronous Step-Down Silent Switcher with 16μA Quiescent Current

DESCRIPTION

Demonstration circuit 2523A is an 18V, 8.5A (continuous)/12A (peak) synchronous step-down Silent Switcher® with 16μA quiescent current featuring the LT®8652S. The LT8652S is a compact, high efficiency, high speed synchronous monolithic step-down switching with the second generation Silent Switcher structure that minimizes EMI and reduces PCB layout sensitivity. Top and bottom power switches, compensation components and other necessary circuits are inside of the LT8652S to minimize external components and simplify design. The demo board has two outputs: 3.3V and 1.2V from a 3.6V to 18V input. The wide input range allows a variety of input sources, such as automotive batteries and industrial supplies.

The SYNC pin on the demo board is grounded by default for low ripple Burst Mode® operation. Move JP2 to FCM without SSM position can change the operation mode to forced continuous mode operation. Once JP2 is on FCM with SSM position, VCC is applied to the SYNC pin for low EMI spread spectrum operation. To synchronous to an external clock, move JP2 to SYNC and apply the external clock to the SYNC turret. Figure 1 shows the efficiency of the circuit.

The demonstration circuit 2523A runs at 2MHz to minimize solution size. The peak efficiency is 90%. The IC temperature rise is less than 70°C when both channels run at full load, 8.5A each, at 2MHz.

The demo board has EMI filters installed for both channels. The radiated EMI performances of the board (with EMI filters) are shown in Figure 2 and Figure 3. The red lines in Figure 2 and Figure 3 are CISPR32/CISPR25 CLASS 5 limit. To use the EMI filter, the input should be tied to VEMI1/VEMI2, not VIN1/VIN2.

The LT8652S 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 DC2523A.

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}	Input Voltage Range		3.6		18	V
V_{OUT1}	Output1 Voltage		3.168	3.3	3.432	V
I_{OUT1}	Maximum Output1 Current		12			A
V_{OUT2}	Output2 Voltage		1.152	1.2	1.248	V
I_{OUT1}	Maximum Output2 Current		12			A
f_{SW}	Switching Frequency		1.85	2	2.15	MHz
EFE	Efficiency at DC	V_{IN} = 12V, I_{OUT1} = 4A, I_{OUT2} = 4A		90		%

QUICK START PROCEDURE

DC2523A is easy to set up to evaluate the performance of the LT8652S. Refer to Figure 4 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. See Figure 5 for the proper scope technique.

1. Set an input power supply that is capable of 18V/20A. Then turn off the supply.
2. With power off, connect the supply to the input terminals V_{EMI1} and GND.
3. Turn on the power at the input.

NOTE: Make sure that the input voltage never exceeds 18V.

4. Check for the proper output voltages of 3.3V and 1.2V. Turn off the power at the input.
5. Once the proper output voltage is established, connect variable loads capable of sinking 8.5A at 3.3V and 1.2V to the output terminals V_{OUT1}/V_{OUT2} and GND. Set the current for 0A.
   a. If efficiency measurements are desired, ammeters can be put in series with the output loads to measure the DC2523A's output currents.
   b. Voltmeters can be placed across the output terminals to get accurate output voltage measurements.
6. Turn on the power at the input.

NOTE: If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

7. Once the proper output voltages are established again, adjust the load and/or input within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other desired parameters.
8. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). Please ensure that the chosen RT sets the LT8652S switching frequency to equal or below the lowest SYNC frequency. See the data sheet section, "Synchronization."

QUICK START PROCEDURE

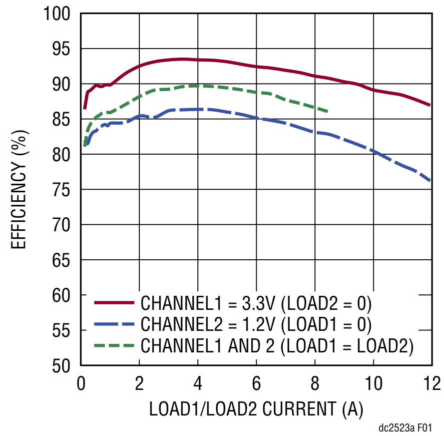


Figure 1. Efficiency vs Load Current at 2MHz Switching Frequency

QUICK START PROCEDURE

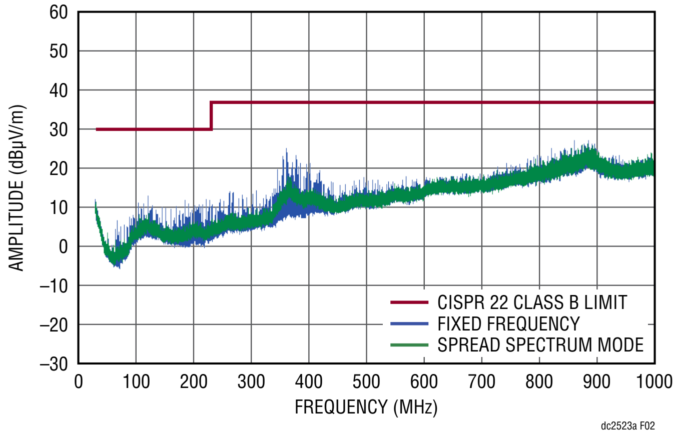


Figure 2. Demo Circuit 2523A EMI Performance in CISPR32 Radiated Emission Test (V_{IN} = 14V, V_{OUT1} = 3.3V, I_{OUT1} = 8.5A, V_{OUT2} = 1.2V, I_{OUT2} = 8.5A, 2MHz Switching Frequency)

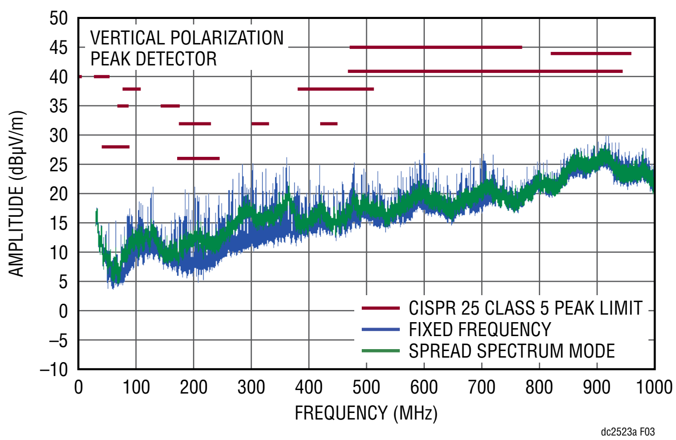


Figure 3. Demo Circuit 2523A EMI Performance in CISPR25 Radiated Emission Test (V_{IN} = 14V, V_{OUT1} = 3.3V, I_{OUT1} = 8.5A, V_{OUT2} = 1.2V, I_{OUT2} = 8.5A, 2MHz Switching Frequency)

QUICK START PROCEDURE

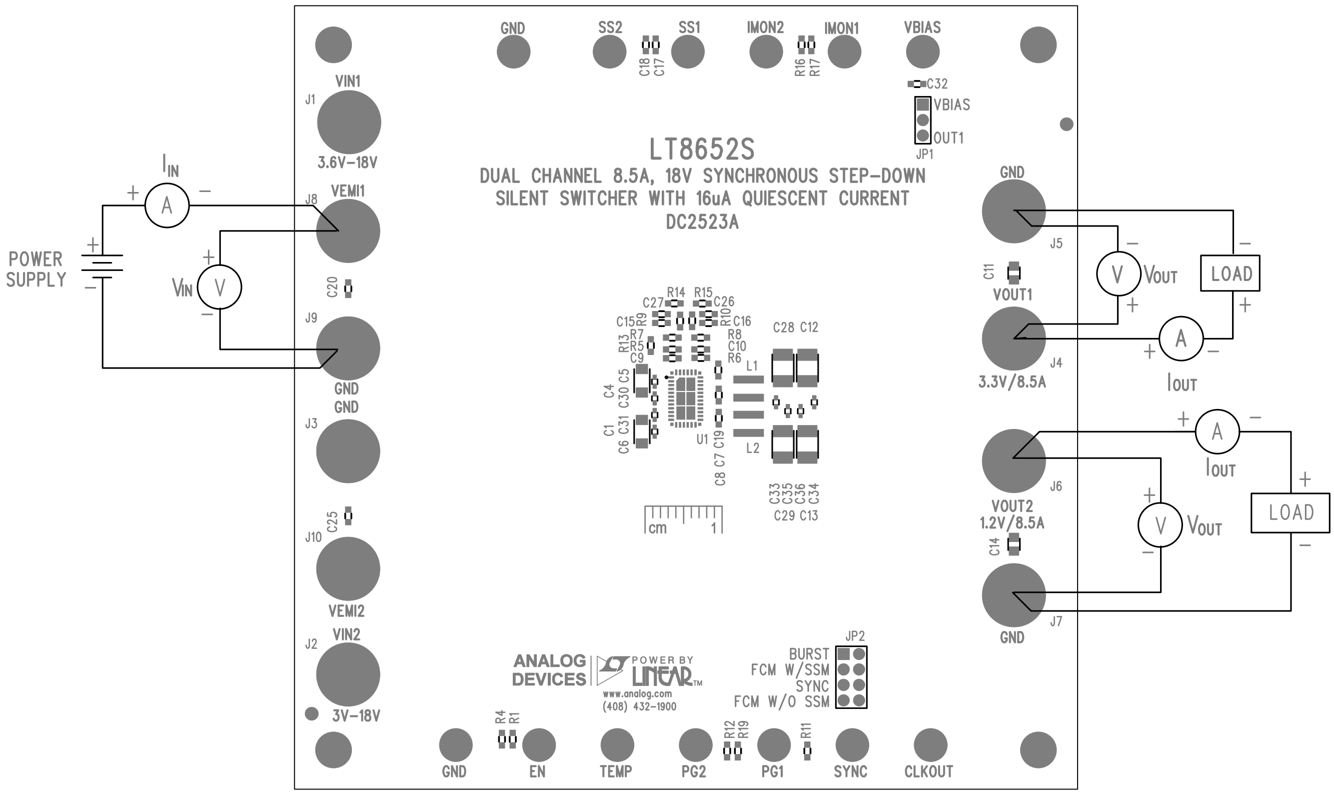
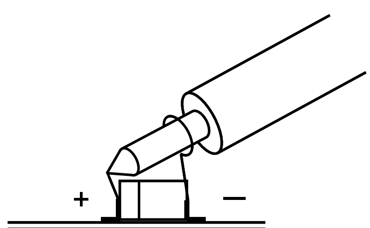


Figure 4. Proper Measurement Equipment Setup



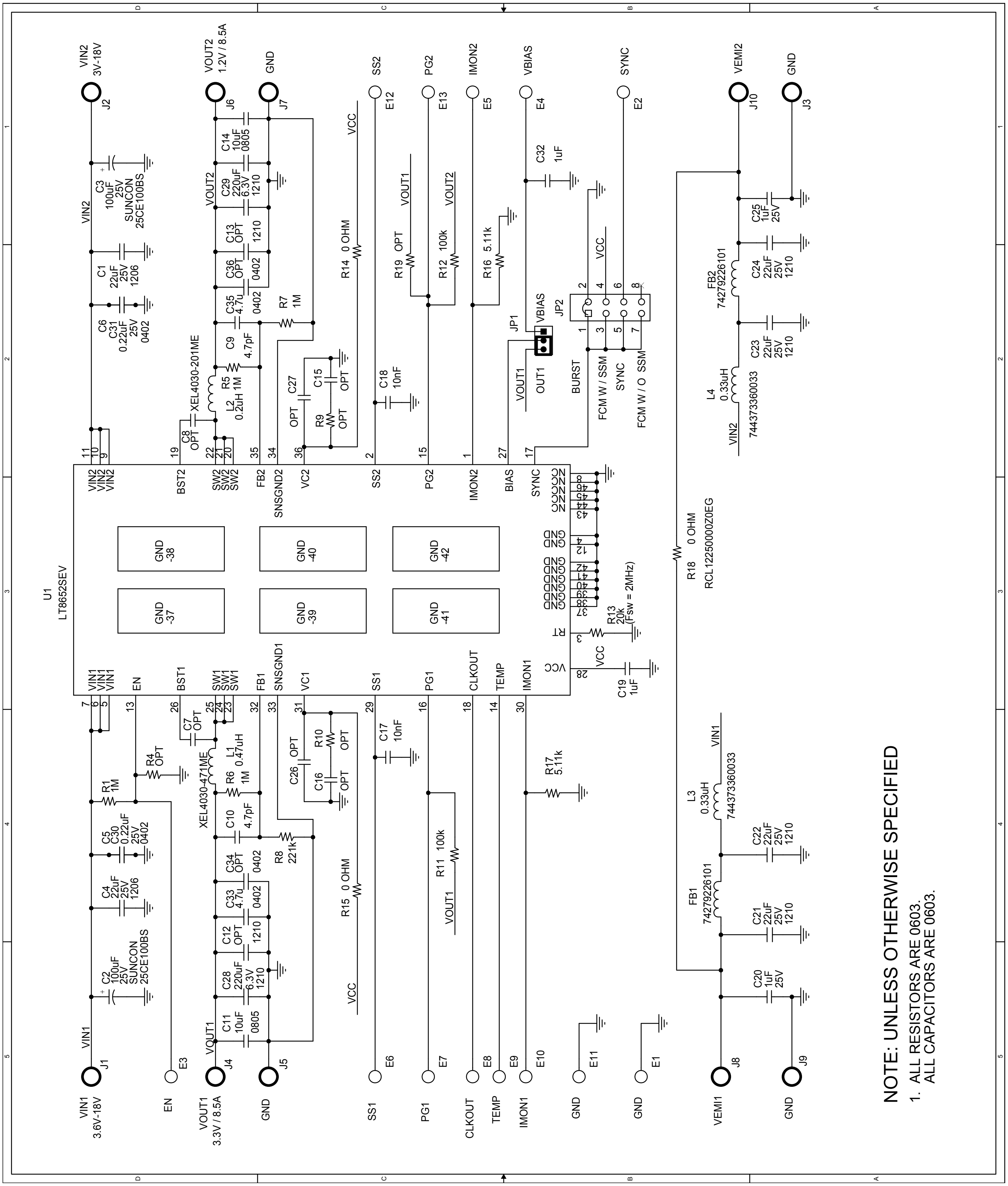
INPUT OR OUTPUT CAPACITOR

Figure 5. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C4	CAP., 22µF, X5R, 25V, 10% 1206	MURATA, GRM31CR61E226KA15L
2	4	C5, C6, C30, C31	CAP., 0.22µF, X5R, 25V, 10%, 0402	MURATA, GRM155R61E224KE01D
3	2	C9, C10	CAP., 4.7pF, C0G, 50V, ±0.25pF 0603	MURATA, GRM1885C1H4R7CA01D
4	2	C17, C18	CAP., 10nF, X7R, 25V, 10% 0603	MURATA, GRM188R71E103KA01D
5	2	C19, C32	CAP., 1µF, X7R, 25V, 10% 0603	MURATA, GRM188R71E105KA12D
6	2	C28, C29	CAP., 220µF, X5R, 6.3V, 20%, 1210	TAIYO YUDEN , JMK325ABJ227MM-T
7	1	L1	INDUCTOR, 0.47µH	COILCRAFT, XEL4030-471MEB
8	1	L2	INDUCTOR, 0.2µH	COILCRAFT, XEL4030-201MEB
9	4	R1, R5, R6, R7	RES., 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
10	1	R8	RES., 221k, 1/10W, 1% 0603	VISHAY, CRCW0603221KFKEA
11	1	R13	RES., 20k, 1/10W, 1%, 0603	VISHAY, CRCW060320K0FKEA
12	2	R16, R17	RES., 5.11k, 1/10W, 0.5%, 0603	VISHAY, CRCW06035K11FKEA
13	1	U1	IC, REGULATOR, LQFN-36	LINEAR TECH., LT8652SEV#PBF
Additional Demo Board Circuit Components				
1	2	C2, C3	CAP., 100µF, ALUM, 25V	SUNCON, 25CE100BS
2	0	C7, C8, C15, C16, C26, C27	CAP., OPT, 0603	
3	2	C11, C14	CAP., 10µF, X7R, 10V, 10% 0805	MURATA, GRM21BR71A106KE51L
4	0	C12, C13 (OPT)	CAP., OPT, 1210	
5	2	C20, C25	CAP., 1µF, X7R, 25V, 10% 0603	MURATA, GRM188R71E105KA12D
6	4	C21, C22, C23, C24	CAP., 22µF, X7R, 25V, 10% 1210	MURATA, GRM32ER71E226KE15L
7	2	C33, C35	CAP., 4.7µF, X7R, 6.3V, 10% 0402	AVX, 04026D475KAT2A
8	0	C34, C36	CAP., OPT, 0402	
9	2	FB1, FB2	FERRITE BEAD 100Ω 1812 ILN	WURTH ELECTRONIK, 74279226101
10	2	L3, L4	FIXED IND., 330nH 16.5A 5mΩ	WURTH ELECTRONIK, 744373360033
11	0	R4, R9, R10 (OPT)	RES., OPT, 0603	
12	2	R11, R12	RES., 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
13	2	R14, R15	RES., 0Ω, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
14	1	R18	RES., 0Ω, 2W, 2512	VISHAY, RCL12250000Z0EG
Hardware: For Demo Board Only				
1	13	E1-E13	TESTPOINT, TURRET, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	JP1	HEADER 3 PIN 0.079" SINGLE ROW	WURTH ELECTRONIK, 62000311121
3	1	JP2	HEADER, 2X4, 0.079" DOUBLE ROW	WURTH ELECTRONIK, 62000821121
4	2	xJP1, xJP2	SHUNT, 0.079" CENTER	WURTH ELECTRONIK, 608 002 134 21
5	10	J1-J10	BANANA JACK	KEYSTONE, 575-4
6	4	MH1-MH4	STAND-OFF, NYLON 11.1mm	WURTH ELECTRONIK, 702934000

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.