

## LT8390A 60V 2MHz Synchronous Buck-Boost Controller

### DESCRIPTION

Demonstration circuit 2598A is a 60V 2MHz synchronous buck-boost controller featuring the [LT<sup>®</sup>8390A](#). It accepts an input voltage from 4V to 24V (with transient to 60V) and regulates 12V output at up to 4A. DC2598A features high efficiency and 2MHz switching frequency, a high speed for a 4-switch buck-boost controller. It has a PGOOD flag, short-circuit fault protection, ISMON current-monitoring output signal, and spread spectrum frequency modulation (SSFM) or frequency synchronization.

The LT8390A has a wide input voltage range from 4V to 60V. It can regulate an output as a boost, a buck, or a 4-switch boost-buck controller. It has adjustable switching frequency between 600kHz and 2MHz. It has an option for external frequency synchronization or spread spectrum frequency modulation. Its high switching frequency is unique to buck-boost controller ICs. Because of this, it can be used for high power when the input may be above, below, or equal to the output.

DC2598A features an option to turn on spread spectrum by simply changing the position of a jumper from “NO SSFM/SYNC” to “SSFM” (or to “SYNC”).

Small ceramic input and output capacitors are used to save space and cost. There is a protection diode from LED+ to GND to prevent negative ringing during a short-circuit with long wires. Optional EMI input, output, and gate resistor component placeholders exist when a low EMI application is needed.

Under voltage lockout can be adjusted with a few resistors and output voltage can be changed from 12V with FB resistors changes. Please note that higher voltage outputs may require higher voltage MOSFETs and output capacitors.

The LT8390A data sheet gives a complete description of the part, operation and applications information. The data sheet must be read in conjunction with this demo manual for demonstration circuit 2598A. The LT8390AEUFD is assembled in a 28-lead 4mm × 5mm plastic QFN package with a thermally enhanced ground pad. LT8390A is also available in a 28-Lead plastic TSSOP (FE) package. Proper board layout is essential for maximum thermal performance. See the data sheet section “Layout Considerations”.

**Design files for this circuit board are available at <http://www.analog.com/DC2598A>**

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### PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

PARAMETER	CONDITION	MIN	TYP	MAX
Input Voltage Range	Operating	4V		60V
Full Load (4A) Input Voltage Range	Component Temp Rise <60°C with No Airflow	7V		23V
Typical Efficiency	12V Input, 12V 4A Output, 2MHz		90%	
Switching Frequency	R3 = 59.0k		2MHz	
Peak Switch Current Limit	R1 = 0.005Ω		10A	
(AC) Output Ripple	12V Input, 12V 4A Output		70mV <sub>p-p</sub>	
Input Under Voltage Lockout (Falling Turn-Off)	R7 = 383k, R8 = 165k		4.0V	
Input Under Voltage Lockout (Rising Turn-On)	R7 = 383k, R8 = 165k		5.0V	
V <sub>ISMON</sub>	12V 4A Output		1.0V	
Maximum Load Current	12V Input, 12V Output	4	4.5A	

## QUICK START PROCEDURE

Demonstration circuit 2598A is easy to set up to evaluate the performance of the LT8390A. Follow the procedure below:

1. With the input power supply off, connect the input power supply and output load as shown in the test setup drawing in Figure 1.
2. Connect the EN/UVLO terminal to GND.
3. Make sure that the SSFM jumper is in the correct position – either with SSFM turned ON or OFF. Only place

the jumper in the SYNC position if an external SYNC frequency source is connected to the SYNC pin.

4. Turn the input power supply on and make sure the voltage is between 4V and 24V for proper steady state operation.
5. Release the EN/UVLO-to-GND connection.
6. Observe the 12V output voltage, the load current measurement via the ISMON pin voltage and the high efficiency of this small converter.

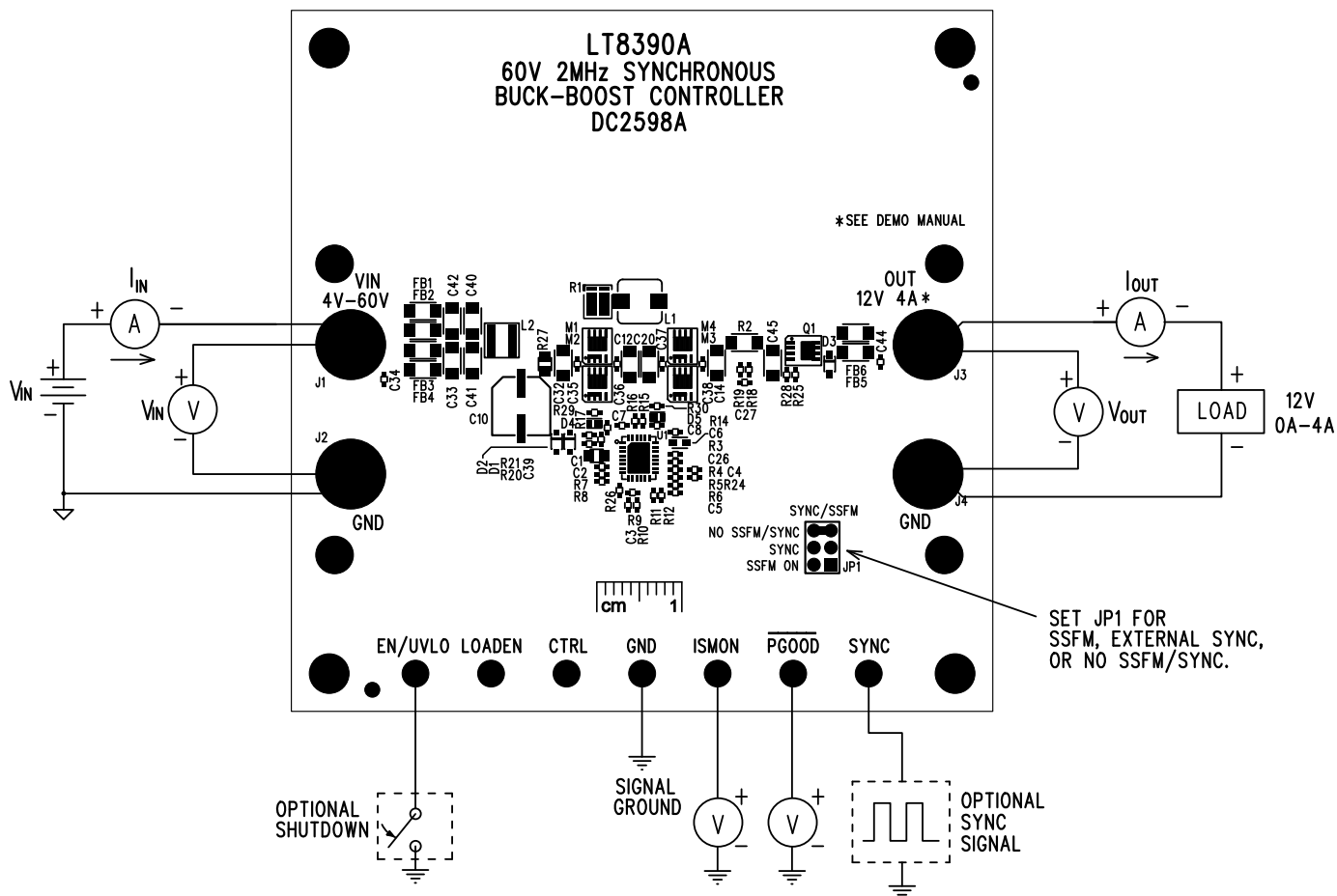


Figure 1. Test Procedure Setup Drawing For DC2598A

## QUICK START PROCEDURE

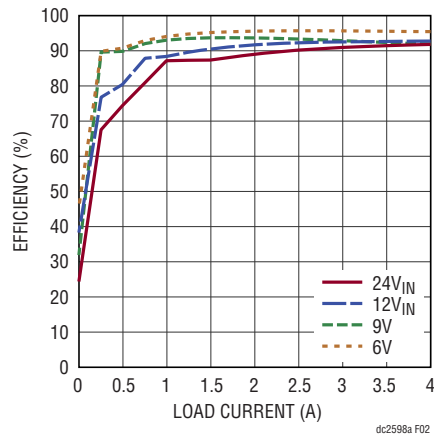


Figure 2. DC2598A, LT8390A 2MHz Buck-Boost Efficiency 12V<sub>OUT</sub>

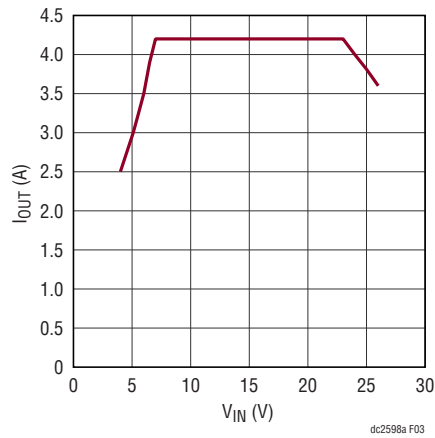


Figure 3. Recommended Maximum DC Current with No Airflow (for DC2598A)

## QUICK START PROCEDURE



Figure 4. DC2598A, LT8390A Output Ripple Measured at C45

**QUICK START PROCEDURE**

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**Figure 5. DC2598A, LT8390A Bode Plot 12V Input, 12V 4A Output**



## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	C1	CAP., 1 $\mu$ F, X7S, 100V, 10%, 0805	
2	1	C2	CAP., 4.7 $\mu$ F, X5R, 10V, 10%, 0402	TDK, C1005X5R1A475K050BC
3	1	C3	CAP., 0.47 $\mu$ F, X5R, 16V, 10%, 0402	TAIYO YUDEN, EMK105ABJ474KV-F
4	1	C4	CAP., 2200pF, X7R, 25V, 10%, 0402	MURATA, GRM155R71E222KA01D
6	1	C5	CAP., 0.022 $\mu$ F, X7R, 25V, 10%, 0402	MURATA, GRM155R71E223KA61D
7	1	C6	CAP., 1 $\mu$ F, X7R, 25V, 10%, 0603	KEMET, C0603C105K3RACTU
5	2	C7, C8	CAP., 0.1 $\mu$ F, X7R, 25V, 10%, 0402	AVX, 04023C104KAT2A
8	1	C10	CAP., 22 $\mu$ F, ALUM, 63V, 20%, SMD 6.3mm $\times$ 7.7mm	SUN ELECTRONIC INDUSTRIES CORP, 63CE22FS
9	2	C12, C32	CAP., 4.7 $\mu$ F, X7S, 100V, 20%, 1206	AVX, 12061Z475MAT2A
10	3	C14, C20, C45	CAP., 22 $\mu$ F, X5R, 25V, 10%, 1206	MURATA, GRM31CR61E226KE15L
16	2	D1, D2	DIODE, SCHOTTKY, 100V, 250mA, SOD-323F, AEC-Q101	NXP SEMICONDUCTORS, BAT46WJ
25	1	L1	IND., 1 $\mu$ H, Power Shielded, 20%, 7.3A, 6mm $\times$ 5.5mm	WURTH ELEKTRONIK, 74437336010
27	2	M1, M2	XSTR., POWER MOSFET, 60V, 40A, TSDSON-8	INFINEON, BSZ065N06LS5ATMA1
29	2	M3, M4	XSTR., POWER MOSFET, 25V, 40A, TSDSON-8	INFINEON, BSZ031NE2LS5ATMA1
31	1	R1	RES., 0.005 $\Omega$ , $\pm$ 1%, 1.5W, 3216, AEC-Q200	SUSUMU, KRL3216E-C-R005-F-T1
32	1	R2	RES., 0.01 $\Omega$ , 1%, 3/4W, 1206, SENSE	SUSUMU, KRL1632E-M-R010-F-T5
33	1	R3	RES., 59k, 1%, 1/16W, 0402, AEC-Q200	VISHAY, CRCW040259K0FKED
34	2	R4, R6	RES., 10k, 1%, 1/16W, 0402	VISHAY, CRCW040210K0FKED
35	1	R5	RES., 110k, 1%, 1/16W, 0402	VISHAY, CRCW0402110KFKED
36	1	R7	RES., 383k, 1%, 1/16W, 0402, AEC-Q200	VISHAY, CRCW0402383KFKED
37	1	R8	RES., 165k, 1%, 1/16W, 0402, AEC-Q200	VISHAY, CRCW0402165KFKED
40	1	R11	RES., 100k, 5%, 1/16W, 0402	VISHAY, CRCW0402100KFKED
45	1	U1	IC, 2MHz SYN. BUCK-BOOST CONTROLLER, 28-PIN QFN	LINEAR TECH., LT8390AEUFD#TRPBF
<b>Optional Electrical Components</b>				
5	3	C37, C38, C44	CAP., 0.1 $\mu$ F, X7R, 25V, 10%, 0402	AVX, 04023C104KAT2A
11	0	C26, C34, C39	CAP., OPTION, 0402	
12	1	C27	CAP., 1 $\mu$ F, X5R, 16V, 10%, 0402	AVX, 0402YD105KAT2A
13	0	C29, C30	CAP., 0805, OPTION	
14	0	C33, C40, C41, C42	CAP., OPTION, 1206	
15	2	C35, C36	CAP., 0.1 $\mu$ F, X5R, 100V, 10%, 0402	MURATA, GRM155R62A104KE14D
17	1	D3	DIODE, SCHOTTKY, 20V, 1A, SOD-323F	NXP SEMICONDUCTORS, PMEG2010EJ
18	0	D4, D5	DIODE, OPTION, SCHOTTKY, SMD	
22	0	FB1, FB2, FB3, FB4, FB5, FB6	IND., OPTION, BEAD, FERRITE, 1206	
26	0	L2	IND., OPTION, XAL4020 SERIES	
30	0	Q1	XSTR., OPTION, PPAK 1212-8	

# DEMO MANUAL DC2598A

## PARTS LIST

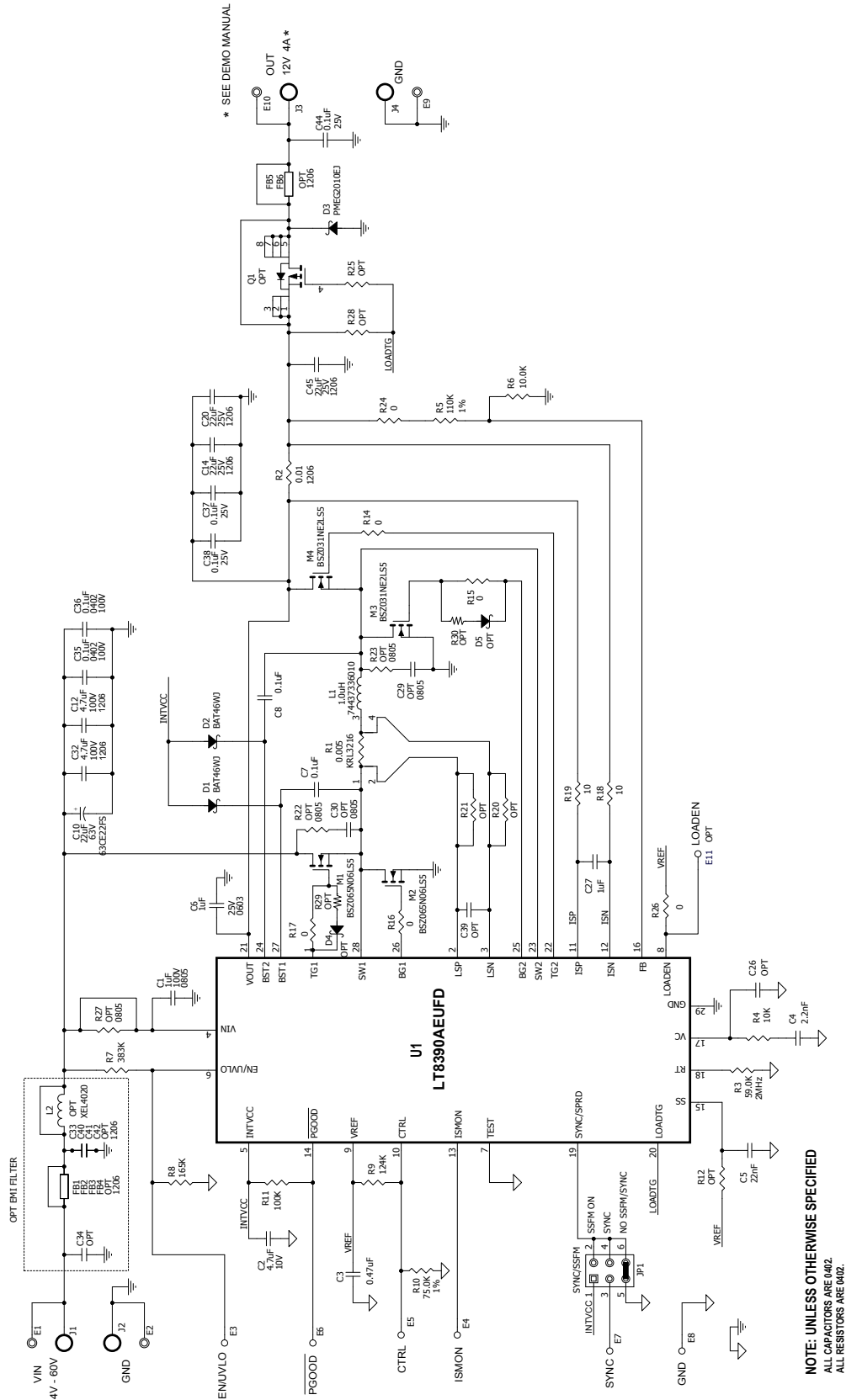
ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
38	1	R9	RES., 124k, 1%, 1/16W, 0402	VISHAY, CRCW0402124KFKED
39	1	R10	RES., 75k, 1%, 1/16W, 0402	VISHAY, CRCW040275K0FKED
41	0	R12, R20, R21, R25, R28, R29, R30	RES., OPTION, 0402	
42	6	R14, R15, R16, R17, R24, R26	RES., 0 $\Omega$ , 1/16W, 0402, AEC-Q200	VISHAY, CRCW04020000Z0ED
43	2	R18, R19	RES., 10 $\Omega$ , 5%, 1/16W, 0402	VISHAY, CRCW040210R0FKED
44	0	R22, R23, R27	RES., OPTION, 0805	

### Hardware

19	4	E1, E2, E9, E10	TEST POINT, TURRET, 0.094", MTG. HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
20	6	E3, E4, E5, E6, E7, E8	TEST POINT, TURRET, 0.064", MTG. HOLE	MILL-MAX, 2308-2-00-80-00-00-07-0
21	0	E11	TEST POINT, OPTION	
23	1	JP1	CONN., HDR, MALE, 2mm $\times$ 3,2mm, THT, STR	WURTH ELEKTRONIK, 62000621121
24	4	J1, J2, J3, J4	CONN., BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE	KEYSTONE, 575-4
28	4	MH1, MH2, MH3, MH4	STANDOFF, NYLON, SNAP-ON, 0.375"	WURTH ELEKTRONIK, 702933000
46	1	XJP1	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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