LTC3892
60V, Low I_Q Dual Output High Voltage Step-Down Converter

DESCRIPTION

Demonstration circuit 1998A is a high input voltage, high efficiency synchronous dual output buck converter featuring the LTC®3892. The DC1998A has a wide input voltage range of 6V to 60V. The output voltages are set to 5V and 12V, however, the output voltage can be set almost as high as the input voltage (≤99% • V_{IN}), with certain modifications. This demo board is capable of delivering up to 8A from the 5V output and up to 5A from the 12V output.

The DC1998A supports three operation modes: forced continuous mode, pulse-skipping and Burst Mode® operation. Forced continuous mode, reduces output voltage ripple and yields a low noise switching spectrum. Burst Mode operation employs a variable frequency switching algorithm that minimizes the no-load input quiescent current and improves efficiency at light loads.

The DC1998A consumes less than 4µA of quiescent current during shutdown and below 0.15 mA no-load quiescent current when in Burst Mode operation with an input voltage above 14V. However, if Ch2 is in shutdown and Ch1 in sleep mode, the quiescent current can be as low as 29µA. The DC1998A has a fixed operating frequency of 200kHz and can be adjusted to frequencies between 50kHz and 900kHz.

The DC1998A is designed to support multiple footprints of input/output capacitors and inductors to accommodate a variety of applications.

The LTC3892 features an adjustable gate drive voltage. The DC1998A is preset to provide a 10V gate drive voltage (DRVCC) for the switching MOSFETs and has 7.5V/6.7V rising/falling undervoltage lockout (UVLO) thresholds. In addition, the LTC3892 features a continuously adjustable gate drive voltage (5V to 10V) and selectable UVLO thresholds that allow the use and optimization of both logic-level and standard threshold MOSFETs. See the LTC3892 data sheet for a more complete description of its functionality and applications. The LTC3892 data sheet must be read in conjunction with this demo board manual for demonstration circuit 1998A.

Design files for this circuit board are available at http://www.linear.com/demo/DC1998A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		6V
Maximum Input Voltage		60V
Output Voltage V_{OUT1} Regulation	V_{IN} = 8V – 55V	5V ± 2%
Output Voltage V_{OUT2} Regulation	V_{IN} = 16V – 55V	12V ± 2%
Maximum Continuous Output Current	V_{OUT1}	8A
Maximum Continuous Output Current	V_{OUT2}	5A
Preset Operating Frequency	R14 = 35.7k	200kHz
External Clock Sync Frequency Range		75kHz to 850kHz
Efficiency	V_{IN} = 16V, V_{OUT2} = 12V, I_{OUT} = 3A See Figure 3 Efficiency Curves for Complete Operating Range	97%
Typical Output Ripple V_{OUT}	V_{IN} = 36V, V_{OUT2} = 12V, I_{OUT} = 3A (20MHz BW)	<35mV_{P-P}
Quiescent Current at Shut-Down	V_{IN} = 16V – 55V	<5µA
Input Current at No-Load	V_{IN} = 16V – 55V	<1mA

QUICK START PROCEDURE

Demonstration circuit 1998A is easy to set up to evaluate the performance of the LTC3892. For proper measurement equipment configuration, set up the circuit according to the diagram in Figure 1. Before proceeding to test, insert shunts into JP2, JP3 (RUN1, 2) into OFF position, which connects the RUN pins to ground (GND), and thus shuts down the outputs. Set jumper JP1 (MODE) into FC (forced continuous mode) position.

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 input or output voltage ripple by touching the probe tip directly across the V_{IN} or V_{OUT} and GND terminals. See Figure 2 for proper scope probe technique.

1. With the DC1998A set up according to the proper measurement and equipment in Figure 1, apply 20V at V_{IN}. Measure V_{OUT}; it should read 0V. If desired, one can measure the shutdown supply current at this point. The supply current will be approximately 5µA, or less, in shutdown.
2. Turn on V_{OUT1} of the circuit by inserting the shunt in header JP2 (RUN1) into the ON position. The output voltage should be regulating. Measure V_{OUT1}, it should measure 5V ±2% **(do not apply more than the rated maximum voltage of 60V to the board or the part may be damaged)**. Vary the V_{OUT1} load, which should not exceed 8A. Vary the input voltage from 6V to 55V. V_{OUT1} should measure 5V ±2%.
3. Turn on V_{OUT2} of the circuit by inserting the shunt in header JP3 (RUN2) into the ON position. The output voltage should be regulating. Measure V_{OUT2}, it should measure 12V ±2% **(do not apply more than the rated maximum voltage of 60V to the board or the part may be damaged)**. Vary the V_{OUT2} load, which should not exceed 5A. Vary the input voltage from 16V to 55V. V_{OUT2} should measure 12V ±2%.
4. Set output current to zero and move jumper JP1 (MODE) into BURST MODE position and measure V_{OUT1} and V_{OUT2}.
5. Set output current to zero and move jumper JP1 (MODE) into PLS SKIP position and measure V_{OUT1} and V_{OUT2}.

QUICK START PROCEDURE

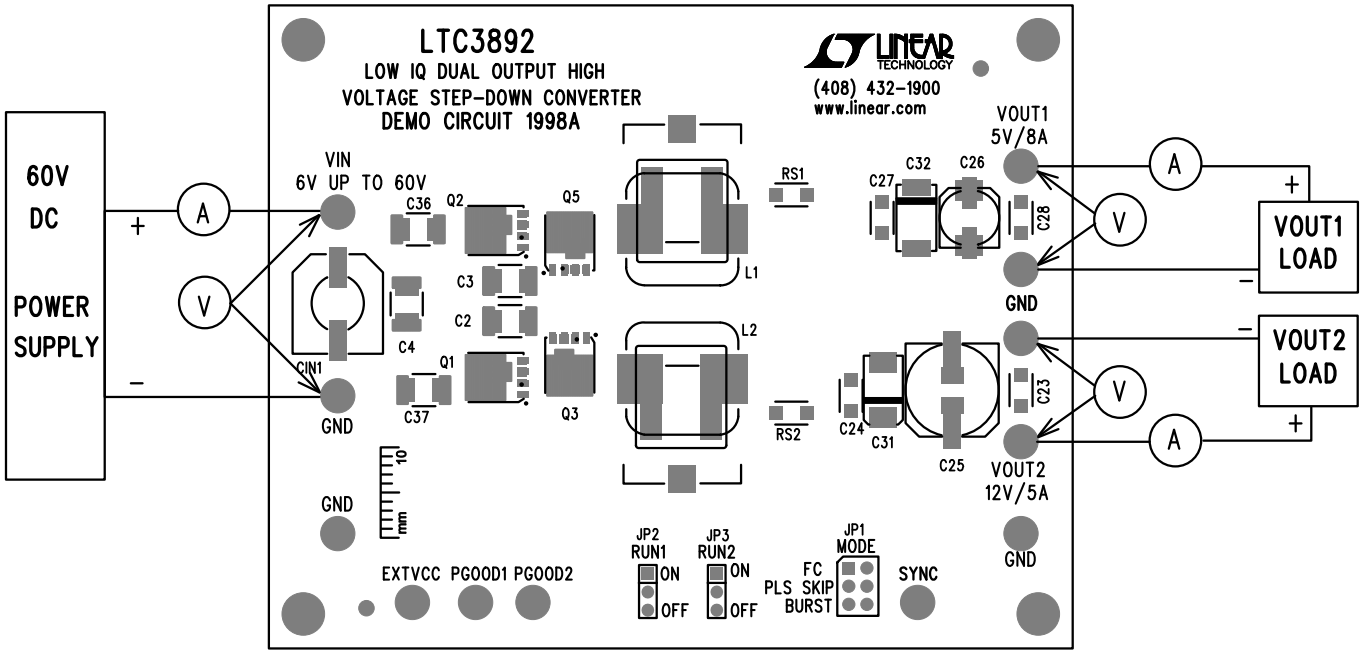


Figure 1. Proper Measurement Equipment Setup

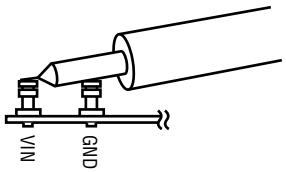


Figure 2. Measuring Input or Output Ripple

QUICK START PROCEDURE

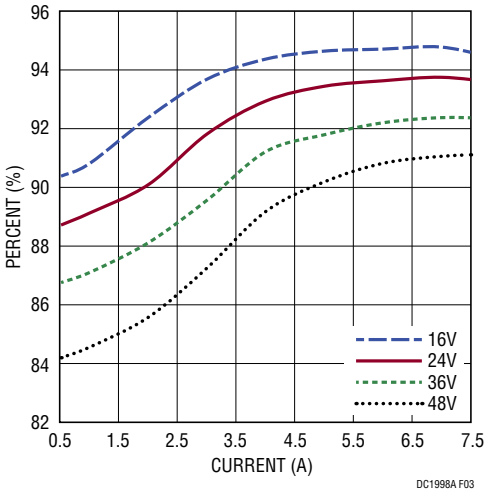


Figure 3. Efficiency vs Input Voltage, V_{OUT1}, Burst Mode Operation

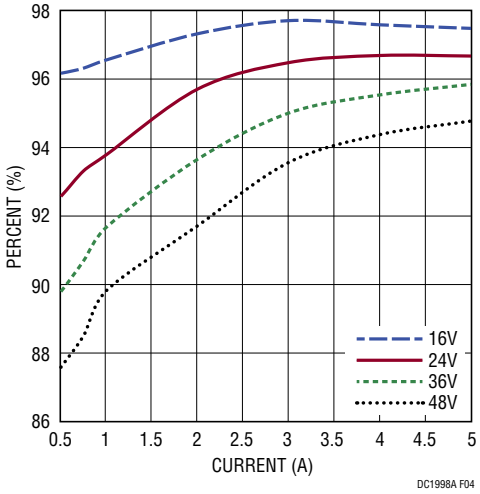


Figure 4. Efficiency vs Input Voltage, V_{OUT2}, Burst Mode Operation

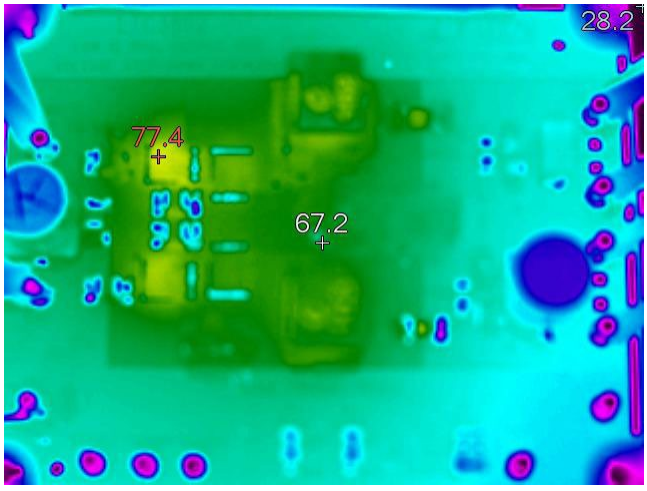


Figure 5. Thermal Map, V_{IN} 60V, I_{OUT1} 5V at 8A, I_{OUT2} 12V at 5A No Air Flow

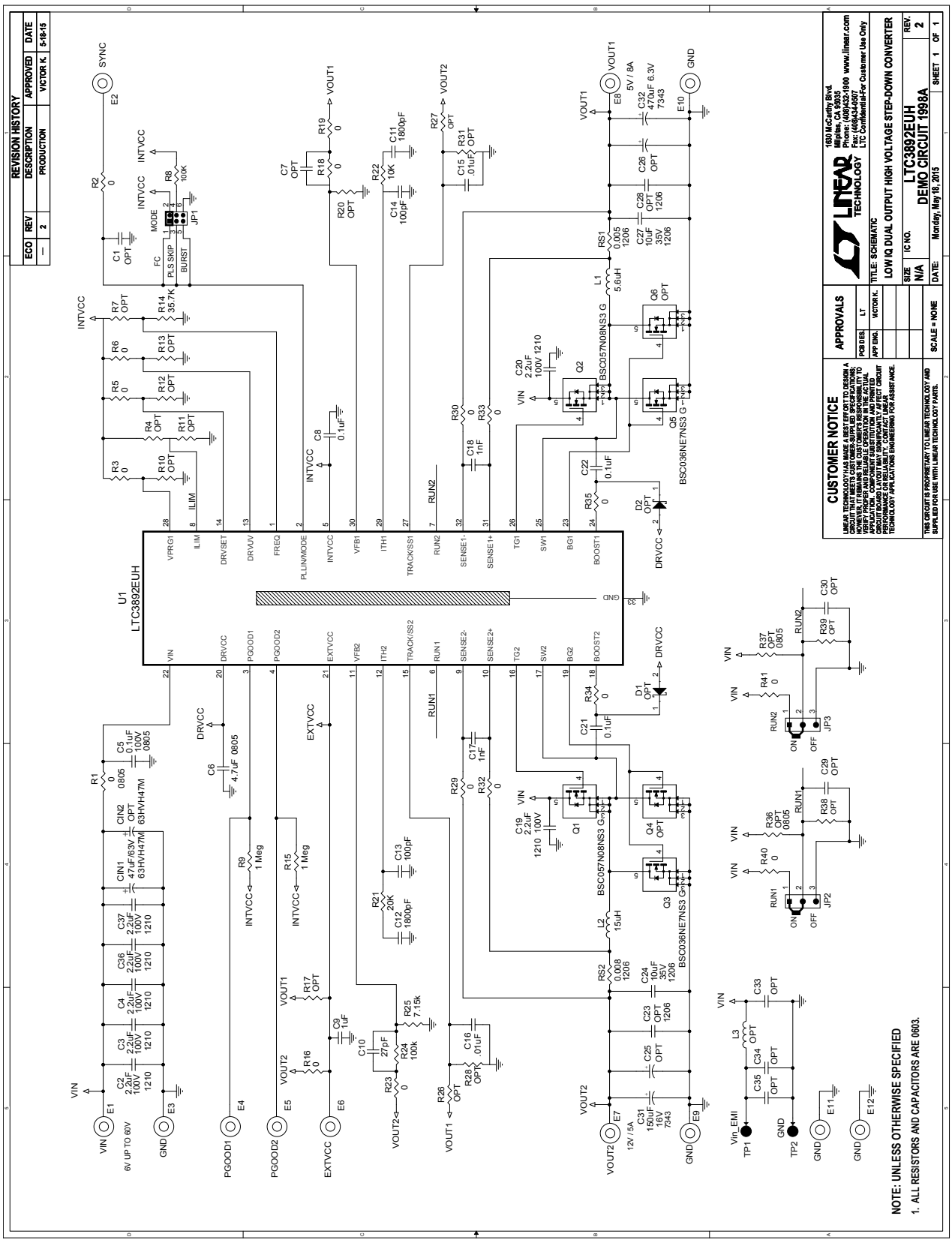
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP, ALUM, 47µF, 63V, 20%, 10 X 10.5	SUN ELECT, 63HVH47M
2	7	C2, C3, C4, C19, C20, C36, C37	CAP, 2.2µF, X7R, 100V, 10%, 1210	AVX, 12101C225KAT2A
3	1	C5	CAP, 0.1µF, X7R, 100V, 10%, 0805	AVX, 08051C104KAT2A
4	1	C6	CAP, 4.7µF, X5R, 50V, 10%, 0805	MURATA, GRM21BR61E475KA12L
5	3	C8, C21, C22	CAP, 0.1µF, X7R, 100V, 10%, 0603	MURATA, GRM188R72A104KA35D
6	1	C9	CAP, 1µF, X5R, 35V, 10%, 0603	TAIYO YUDEN, GMK107BJ105KA-T
7	1	C10	CAP, 27pF, NP0, 25V, 5%, 0603	AVX, 06033A270JAT2A
8	2	C11, C12	CAP, 1800pF, C0G, 50V, 5%, 0603	MURATA, GRM1885C1H182JA01D
9	2	C17, C18	CAP, 1000pF, NP0, 50V, 10%, 0603	AVX, 06035A102KAT2A
10	2	C13, C14	CAP, 100pF, NP0, 100V, 10%, 0603	AVX, 06031A101KAT2A
11	2	C15, C16	CAP, 0.01µF, X7R, 100V, 10%, 0603	AVX, 06031C103KAT2A
12	2	C24, C27	CAP, 10µF, X5R, 35V, 10%, 1206	TAIYO YUDEN, GMK316BJ106KL-T
13	1	C31	CAP, POSCAP, 150µF, 16V, 7343	PANASONIC, 16TQC150MYF
14	1	C32	CAP, POSCAP, 470µF, 6.3V 7343	PANASONIC, 6TPE470MI
15	1	L1	IND, PWR, 5.6µH, 20%, XAL1010 SERIES	COILCRAFT, XAL1010-562MED
16	1	L2	IND, PWR, 15µH, 20%, XAL1010 SERIES	COILCRAFT, XAL1010-153MED
17	2	Q1, Q2	XSTR, MOSFET, N-CH, 80V, 100A, TDSON-8	INFINEON, BSC057N08NS3 G
18	2	Q3, Q5	XSTR, MOSFET, N-CH, 75V, 100A, TDSON-8	INFINEON, BSC036NE7NS3 G
19	1	RS1	RES, SENSE, 0.005Ω 1% 1/4W,1206	VISHAY, WSL12065L000FEA
20	1	RS2	RES, SENSE, 0.008Ω 1% 1/4W,1206	VISHAY, WSL12068L000FEA
21	2	R8, R24	RES, 100k, 1%, 1/10W, 0603	VISHAY, CRCW0603100KFKEA
22	2	R9, R15	RES, 1M, 1%, 1/10W, 0603	VISHAY, CRCW06031M00FKEA
23	1	R14	RES, 35.7k, 1%, 1/10W, 0603	VISHAY, CRCW060335K7FKEA
24	1	R21	RES, 20k, 1/10W, 1%, 0603	VISHAY, CRCW060320K0FKEA
25	1	R22	RES, 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
26	1	R25	RES, 7.15k, 1/10W, 1%, 0603	VISHAY, CRCW06037K15FKEA
27	1	U1	IC, LTC3892EUH#PBF, QFN32UH-5X5	LINEAR TECHNOLOGY, LTC3892EUH#PBF

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Additional Demo Board Circuit Components				
1	0	CIN2	CAP, OPTION, 10 X 10.5	OPT
2	0	C1, C7, C29, C30	CAP, OPTION, 0603	OPT
3	0	C23, C28, C34, C35	CAP, OPTION, 1206	OPT
4	0	C25	CAP, OPT, OSCON-SVP-F8	OPT
5	0	C26	CAP, OPT, OSCON-SVP-C6	OPT
6	0	C33	CAP, OPTION, 0805	OPT
7	0	D1, D2	DIODE, OPT, DI-123	OPT
8	0	L3	IND, OPT	OPT
9	0	Q4, Q6	XSTR, OPT, WPACKV	OPT
10	1	R1	RES, 0Ω, JUMPER 1/18W, 0805	VISHAY, CRCW08050000Z0EA
11	16	R2, R3, R5, R6, R16, R18, R19, R23, R29, R30, R32, R33, R34, R35, R40, R41	RES, 0Ω, JUMPER 1/18W, 0603	VISHAY, CRCW06030000Z0EA
12	0	R4, R7, R10, R11, R12, R13, R17, R20, R26, R27, R28, R31, R38, R39	RES, OPTION, 0603	OPT
13	0	R36, R37	RES, OPTION, 0805	OPT
14	0	TP1, TP2	TEST PAD SMD	OPT
Hardware/Components (For Demo Board Only)				
1	12	E1 TO E12	TESTPOINT, TURRET, 0.094" MTG. HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	JP1	CONN, HEADER, 2 x 3, 2mm	SULLINS, NRPN032PAEN-RC
3	2	JP2, JP3	CONN, HEADER, 1 x 3, 2mm	SULLINS, NRPN031PAEN-RC
4	3	XJP1, XJP2, XJP3	SHUNT, 2mm	SAMTEC, 2SN-BK-G
5	4	MTGS AT 4 CORNERS	STANDOFF, NYLON, SNAP-ON, 0.500" TALL	KEYSTONE, 8833

SCHEMATIC DIAGRAM



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Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

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