LT3995
60V, 3A, 2MHz Step-Down Switching Regulator with 2.7µA Quiescent Current

DESCRIPTION

Demonstration circuit 1832A is a monolithic step-down DC/DC switching regulator featuring the LT3995. The LT3995 is a compact, high efficiency monolithic step-down switching regulator that consumes only 2.7µA of quiescent current. The demo circuit is designed for 3.3V, 3A output from a 4.3V to 60V input. The switching frequency can be programmed either via oscillator resistor or external clock up to 2MHz. To synchronize to an external clock, move JP2 to SYNC and apply the external clock to the SYNC turret. The RT resistor (R5) should be chosen to set the LT3995 internal switching frequency at least 20% below the lowest synchronization input frequency.

Low ripple Burst Mode® operation increases the efficiency at the light load while keeping the output ripple below 15mV. The SYNC pin on the demo board is grounded by default by setting JP2 at RT FREQ for low ripple Burst Mode operation. Figure 1 shows the demo board efficiency at 12V input voltage.

The LT3995 is in shutdown when the EN pin is low and active when the pin is high. The threshold of the EN pin is accurate at 1.02V with 60mV of hysteresis. Users can populate R7 and R8 to provide a programmable under voltage lockout. A low dropout voltage of 500mV is maintained when the input voltage drops below the programmed output voltage. During a short-circuit fault, the LT3995 has current limit foldback to limit the power dissipation.

The demo board has an EMI filter installed. The EMI performance of the demo board at 12V input voltage is shown on Figure 2. The limit in Figure 2 is EN55022 Class B. The figure shows the circuit passes the test with a wide margin. To use the EMI filter, the input should be tied to VEMI not V_{IN}.

The LT3995 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 1832A. The LT3995 is assembled in a 16-lead plastic MSOP package with an exposed pad for low thermal resistance. Proper board layout is essential for both proper operation and maximum thermal performance. See the data sheet sections for details.

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

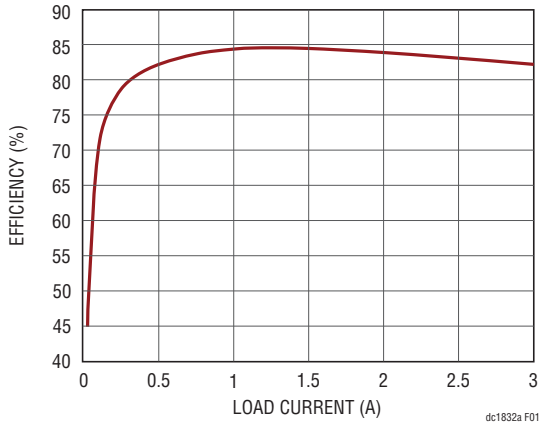


Figure 1. LT3995 Efficiency vs Load Current, $12V_{IN}$ to $3.3V_{OUT}$ Efficiency

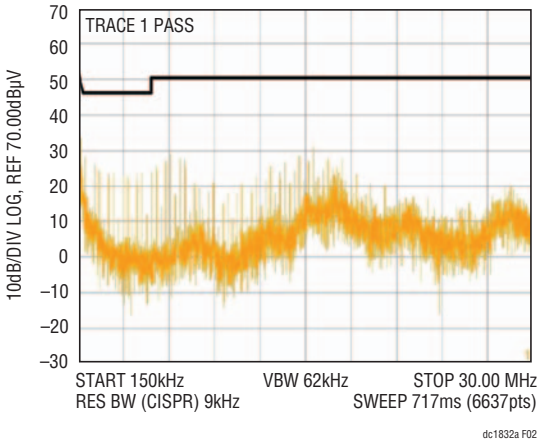


Figure 2. LT3995 Demo Board EMI Performance (Switching Frequency = 300kHz, V_{IN} = 12V)

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Guaranteed Minimum Input Voltage		4.3V
Maximum Input Voltage		60V
Output Voltage V_{OUT}	V_{IN} = 4.3V ~ 60V	3.275V ± 3%
Switching Frequency	R_T = 182k	300kHz ± 20%
Guaranteed Maximum Output Current I_{OUT}	V_{IN} = 4.3V ~ 60V	3A
Typical Efficiency	V_{IN} = 12V, I_{OUT} = 3A	82.2%
Typical Output Voltage Ripple	V_{IN} = 12V, I_{OUT} = 3A	11mV

QUICK START PROCEDURE

Demonstration circuit 1832A is easy to set up to evaluate the performance of the LT3995. Refer to Figure 3 for proper measurement equipment setup and use the following procedure.

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 4 for the proper scope technique.

1. Place JP1 on the ON position.
2. Place JP2 on the RT FREQ position.
3. With power off, connect the input power supply to V_{IN} and GND. Make sure that the input voltage does not exceed 60V.
4. With power off, connect load from V_{OUT} to GND.
5. Turn on the power at the input.
6. Check for the proper output voltage (3.3V).

   NOTE. If there is no output, temporarily disconnect the load to make sure that the load is not set too high or is shorted.
7. 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.
8. An external clock can be added to the SYNC terminal when SYNC function is used (JP2 on the SYNC position). Please make sure that the SYNC frequency is at least 20% higher than the set switching frequency. See the data sheet Synchronization section.

QUICK START PROCEDURE

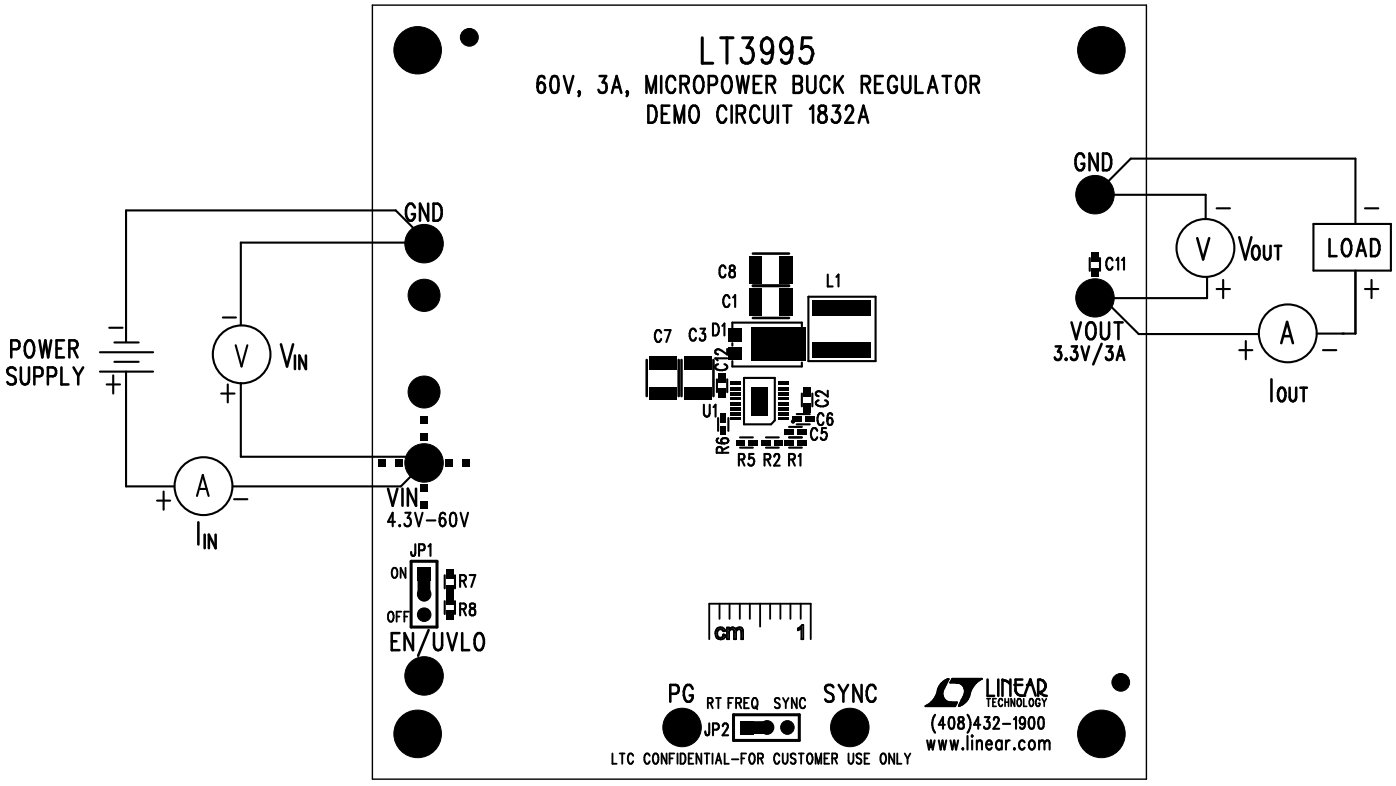


Figure 3. Proper Measurement Equipment Setup

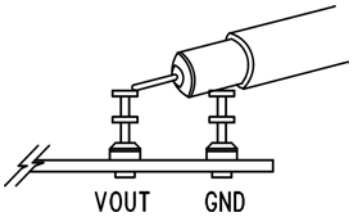
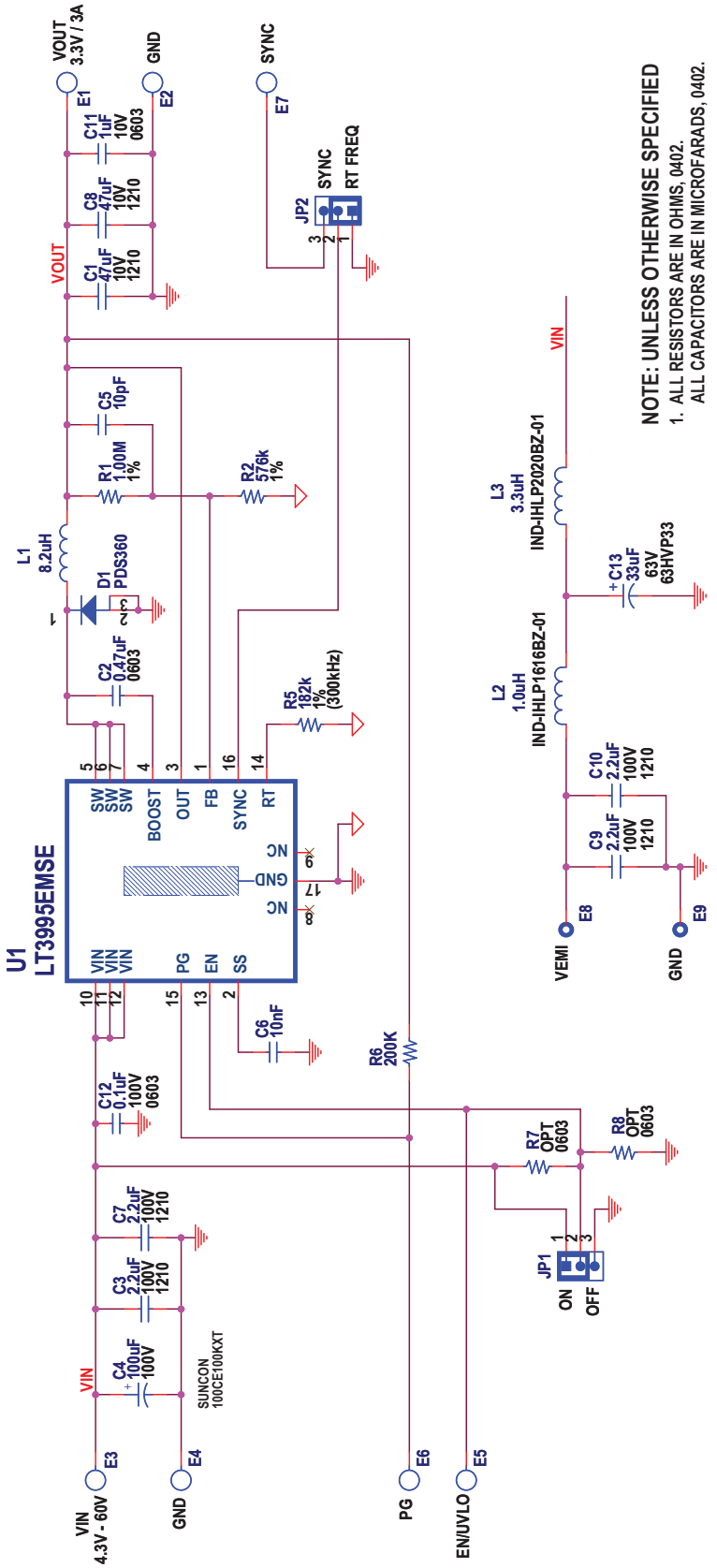


Figure 4. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C8	CAP., X5R, 47µF, 10V, 20%, 1210	TDK, C3225X5R1A476M
2	1	C2	CAP., X5R, 0.47µF, 25V, 10%, 0603	TDK, C1608X5R1E474M
3	2	C3, C7	CAP., X7R, 2.2µF, 100V, 10%,1210	TDK, C3225X7R2A225M
4	1	C5	CAP., C0G, 10pF, 50V, 10%, 0402	TDK, C1005C0G1H100D
5	1	C6	CAP., X7R, 10nF, 25V, 10%, 0402	TDK, C1005X7R1E103K
6	1	C11	CAP., X5R, 1µF, 10V, 10%, 0603	TDK, C1608X5R1A105K
7	1	C12	CAP., X7R, 0.1µF, 100V, 10%, 0603	MURATA, GRM188R72A104KA35D
8	1	D1	DIODE, PDS360 PowerDi5	DIODE INC., PDS360
9	1	L1	IND, 8.2µH	COILCRAFT, XAL6060-822ME
10	1	R1	RES., CHIP, 1.00M, 1/16W, 1%, 0402	NIC, NRC04F1004TRF
11	1	R2	RES., CHIP, 576k, 1/16W, 1%, 0402	NIC, NRC04F5763TRF
12	1	R5	RES., CHIP, 182k, 1/16W, 1%, 0402	NIC, NRC04F1823TRF
13	1	R6	RES., CHIP, 200k, 1/16W, 1%, 0402	NIC, NRC04F2003TRF
14	1	U1	I.C., LT3995EMSE, MSE16	LINEAR TECHNOLOGY, LT3995EMSE
Additional Demo Board Circuit Components				
1	1	C4	CAP., ALUM., 100µF, 100V, 10%	SUN ELECT, 100CE100KXT
2	2	C9, C10	CAP., X7R, 2.2µF, 100V, 10%, 1210	TDK, C3225X7R2A225M
3	1	C13	CAP., HVP SERIES, 33µF, 63V, 20%	SUNCON, 63HVP33M
4	1	L2	IND, 1.0µH	VISHAY, IHLP-1616BZER1R0M01
5	1	L3	IND, 3.3µH	VISHAY, IHLP-2020BZER3R3M01
6	0	R7,R8	RES., 0603	OPT
Hardware: For Demo Board Only				
1	7	E1, E2, E3, E4, E5, E6, E7	TURRET, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	2	E8, E9	TESTPOINT, TURRET, 0.061" PBF	MILL-MAX, 2308-2-00-80-00-00-07-0
3	2	JP1, JP2	JMP, 1X3-079	SAMTEC, TMM-103-02-L-S
4	2	XJP1, XJP2	SHUNT, 2mm CTRS.	SAMTEC, 2SN-BK-G

SCHEMATIC DIAGRAM



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