LTM8054
36V_{IN}, 5.4A Buck-Boost µModule Regulator

DESCRIPTION

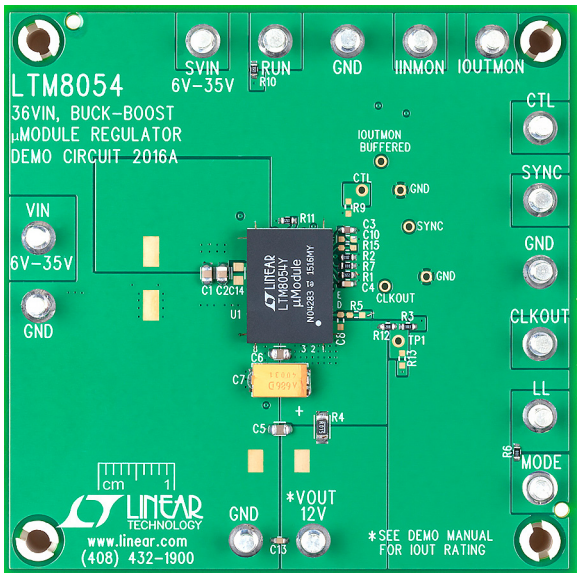
Demonstration circuit 2016A features the LTM8054, a synchronous buck-boost µModule regulator that accepts input voltages lower, higher or the same as the output, but is also highly efficient due to its four-switch architecture. The output for DC2016A is 12V and the input voltage range is 6V to 35V – see the LTM8054 data sheet for application circuits with input voltages up to 36V. The maximum output current of DC2016A is 3A and the switching frequency is 600kHz.

DC2016A supports the adjustable and controllable features of the LTM8054 including output voltage and current regulation, switching frequency, RUN threshold, soft-start period, synchronization and reverse inductor current inhibit. In most cases, adjustment is made by modifying the appropriate resistor or capacitor component(s). DC2016A provides output current monitoring and a clock output. Input current monitoring and regulation requires the installation of a current sense resistor. The SV_{IN} input for controller power can be made a diode-OR of power V_{IN} and the output voltage to extend the operating range of power V_{IN} to lower voltages. There are places to mount optional components that add an LC input filter and also a unity gain buffer to operate multiple DC2016As in parallel.

The LTM8054 data sheet must be read in conjunction with this demo manual to properly use or modify DC2016A.

Design files for this circuit board are available at http://www.linear.com/demo/DC2016A

BOARD PHOTO



PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Minimum Input Voltage, V_{IN}				6	V
Maximum Input Voltage, V_{IN}		35			V
Maximum Output Current, I_{OUT}	12V < V_{IN} < 35V, CTL = OPEN V_{IN} = 6V, CTL = OPEN	3	 1.8		A A
Input Turn-On Voltage, V_{IN}	R10 = 332k, R11 = 121k, V_{IN} Rising		5.5		V
Input Turn-Off Voltage, V_{IN}	R10 = 332k, R11 = 121k, V_{IN} Falling		4.5		V
Output Voltage, V_{OUT}	100mA < I_{OUT} < 3A (See Figure 2), R2 = 11k 1%, R3 = 100k 1%, R4 = 0.015Ω	11.7		12.5	V
Efficiency	V_{IN} = 24V, I_{OUT} = 3A		92		%
Switching Frequency	R1 = 36.5k		600		kHz
Output Current Limit	R4 = 0.015Ω		3.6		A

QUICK START PROCEDURE

To use DC2016A to evaluate the performance of the LTM8054, refer to Figure 1 for the proper measurement equipment setup, Figure 2 for the maximum output current versus input voltage and then follow the procedure below:

NOTE: Do not hot-plug the V_{IN} terminal at high input voltages. The absolute maximum voltage rating for V_{IN} of the LTM8054 is 40V and hot-plugging a power supply through wire leads to the demonstration circuit can cause the voltage on the extremely low ESR ceramic input capacitor to ring to twice its DC value. In order to protect the LTM8054, an aluminum electrolytic capacitor with higher ESR is placed at the input terminals. This may protect against some, but not all, input transients due to a hot-plugged power supply. See Application Note 88 for more details.

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 to terminals across the V_{IN} or V_{OUT} capacitors. See Figure 3 for proper scope probe technique. Solder terminals near the input or output capacitors, if necessary.

1. Connect the RUN terminal to ground with a clip-on lead. Connect the power supply (with power off), load, and meters as shown in Figure 1.
2. After all connections are made, turn on the input power and verify that the input voltage is between 6V and 35V
3. Remove the clip-on lead from RUN. Verify that V_{OUT} is 12V.

NOTE: If V_{OUT} is too low, temporarily disconnect the load to make sure that the load is not set too high.

Once the proper output voltage is established, adjust the input voltage and load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

QUICK START PROCEDURE

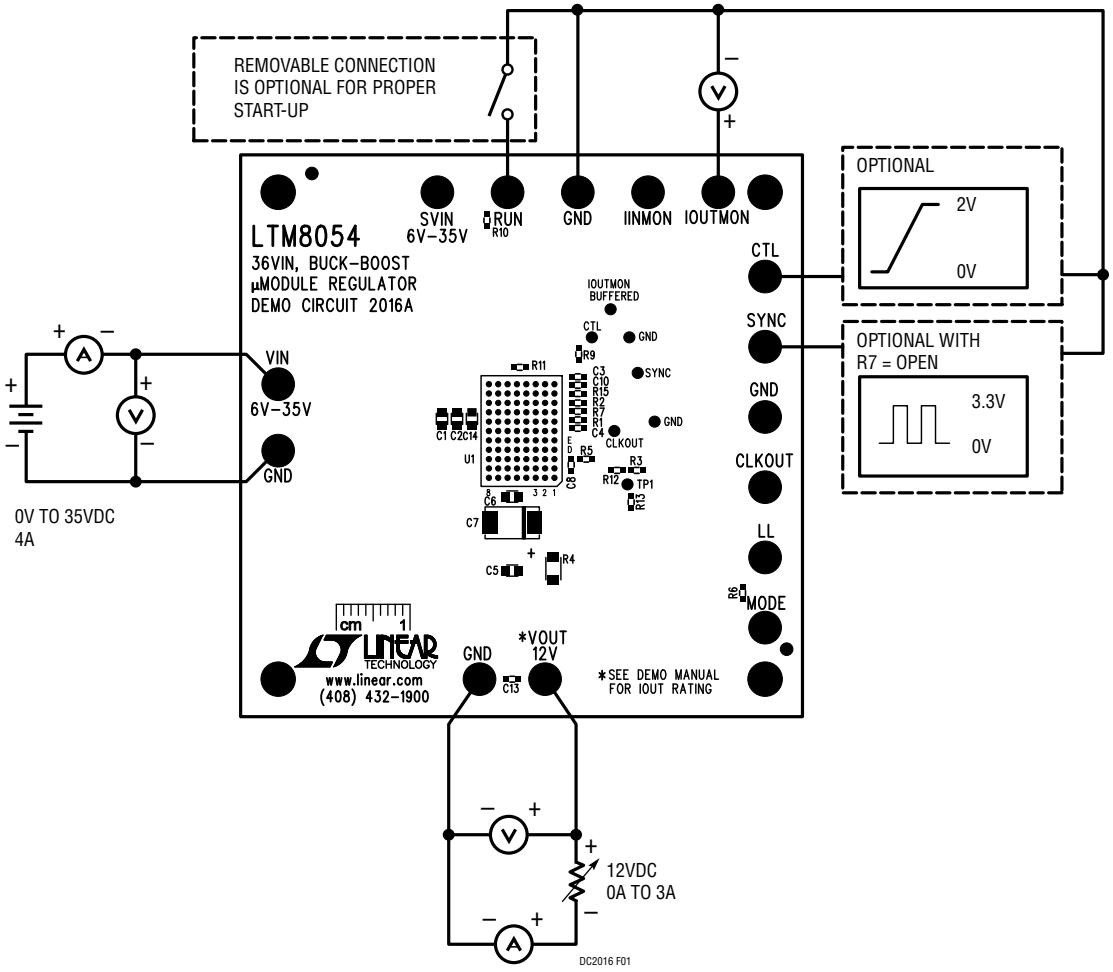


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

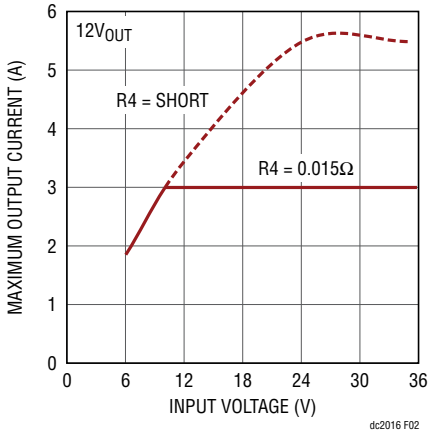


Figure 2. Maximum Output Current vs Input Voltage for V_{OUT} = 12V

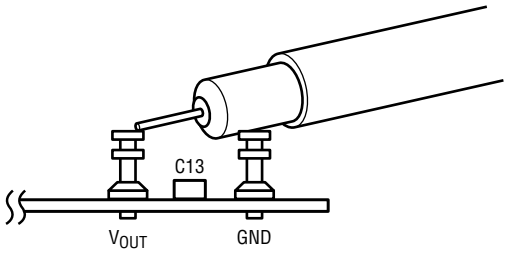


Figure 3. Proper Scope Probe Technique

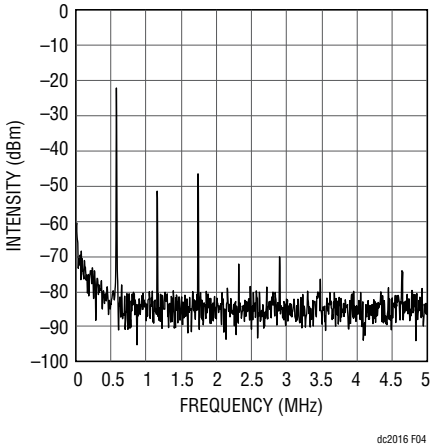
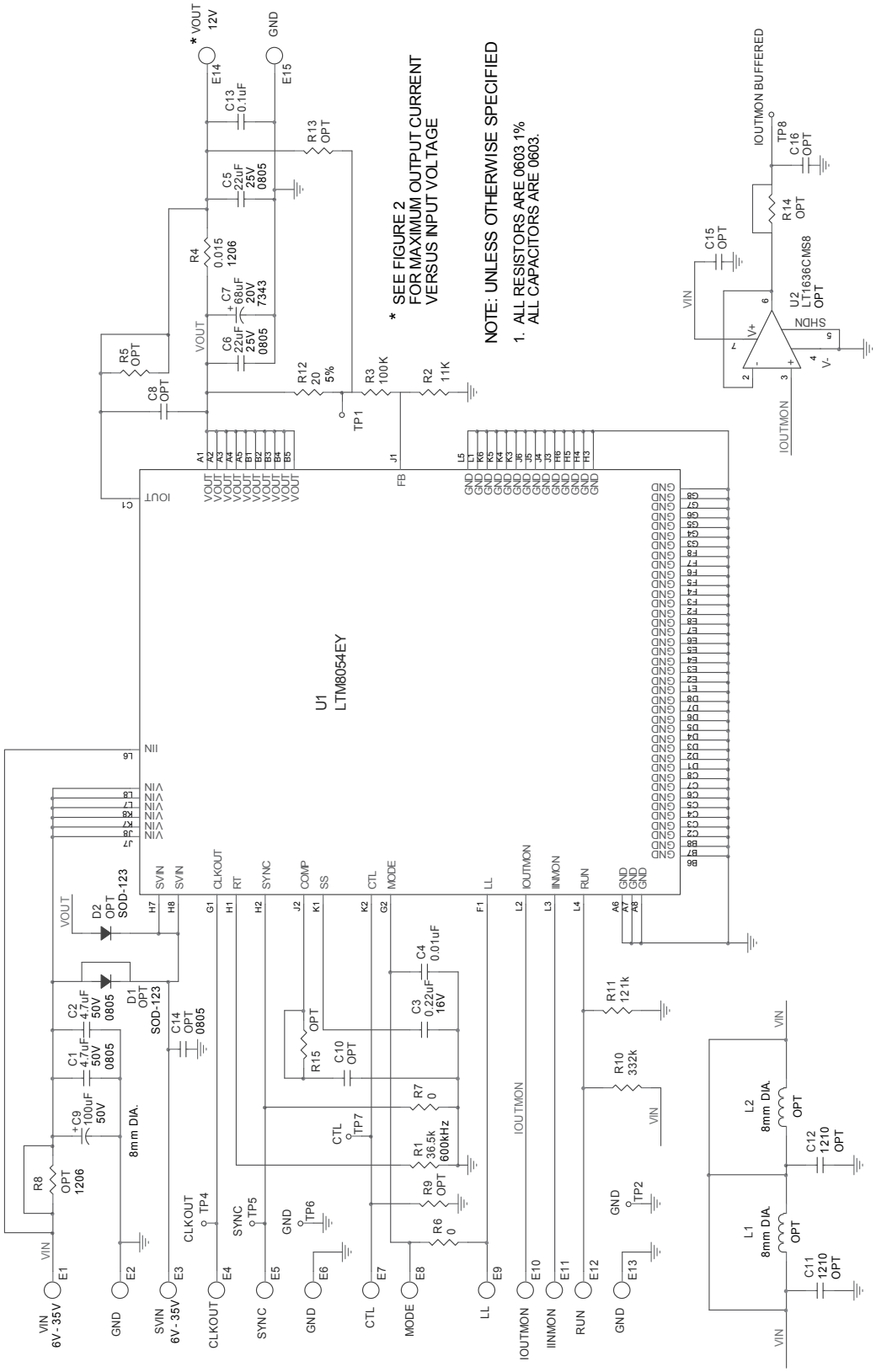


Figure 4. Conducted V_{OUT} Noise Spectrum Using HP 4395A Spectrum Analyzer and 41800A Active Probe. V_{IN} = 24V and V_{OUT} = 12V at 3A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C2	CAP., 4.7µF, X5R, 50V, 10%, 0805	SAMSUNG, CL21A475KBQNNNE
2	1	C3	CAP., 0.22µF, X7R, 16V, 10%, 0603	TDK, C1608X7R1C224K080AC
3	1	C4	CAP., 0.01µF, X7R, 16V, 10%, 0603	MURATA, GRM188R71C103KA01D
4	2	C5, C6	CAP., 22µF, X5R, 25V, 20%, 0805	SAMSUNG, CL21A226MAQNNNE
5	1	C7	CAP., TANT. POLYMER, 68µF, 20V, 20%, 7343	AVX, TCJD686M020R0055
6	1	R1	RES., 36.5k, 1%, 1/10W, 0603	VISHAY, CRCW060336K5FKEA
7	1	R2	RES., 11k, 1%, 1/10W, 0603	VISHAY, CRCW060311K0FKEA
8	1	R3	RES., 100k, 1%, 1/10W, 0603	VISHAY, CRCW0603100KFKEA
9	1	R4	RES., SENSE, 0.015Ω, 1%, 1/2W, 1206	VISHAY, WSL1206R0150FEA
10	1	U1	IC, 36V_{IN} Buck-Boost µModule Regulator	LINEAR TECH., LTM8054EY#PBF
Optional Demo Board Circuit Components				
1	0	C8, C10, C15, C16(OPT)	CAP., 0603	
2	1	C9	CAP., ALUM. ELECT., 100µF, 50V, 20%, 8mm x 10.2mm	SUN ELECT., 50CE100LX
3	0	C11, C12(OPT)	CAP., 1210	
4	1	C13	CAP., 0.1µF, X7R, 16V, 10%, 0603	MURATA, GRM188R71C104KA01D
5	0	C14(OPT)	CAP., 0805	
6	0	D1, D2(OPT)	DIODE, OPTION, SOD-123	
7	0	L1, L2(OPT)	INDUCTOR, 8mm DIA.	
8	0	R5, R9, R13, R14, R15(OPT)	RES., CHIP, 0603	
9	2	R6, R7	RES., 0Ω, 1/10W, 0603	VISHAY, CRCW0603000Z0EA
10	0	R8(OPT)	RES., OPTION, 1206	
11	1	R10	RES., 332k, 1%, 1/10W, 0603	VISHAY, CRCW0603332KFKEA
12	1	R11	RES., 121k, 1%, 1/10W, 0603	VISHAY, CRCW0603121KFKEA
13	1	R12	RES., 20Ω, 5%, 1/10W, 0603	VISHAY, CRCW060320R0JNEA
14	0	U2(OPT)	IC, R-R I/O OP AMP, MSOP-8	LINEAR TECH., LT1636CMS8#PBF
Hardware				
1	15	E1-E15	TESTPOINT, TURRET, .094" MTG. HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
2	4	MH1-MH4	STANDOFF, NYLON, SNAP-ON, 0.500"	KEYSTONE, 8833

SCHEMATIC DIAGRAM



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