LTM8003
$40V_{IN}$, 3.5A Step-Down µModule Regulator

DESCRIPTION

Demonstration circuit 2416A features the LTM®8003, a 40V, 3.5A step-down µModule® Regulator. This demo circuit is configured to deliver a 5.0V output from an input voltage between 6.0V to 40V at a switching frequency of 2MHz. The wide input range of the LTM8003 allows a variety of input sources such as automotive batteries and industrial supplies. Under light load conditions, the available Burst Mode® operation supports high efficiency with low output ripple.

The demo board has an EMI filter installed. The EMI performance of the board is shown in Figure 3.

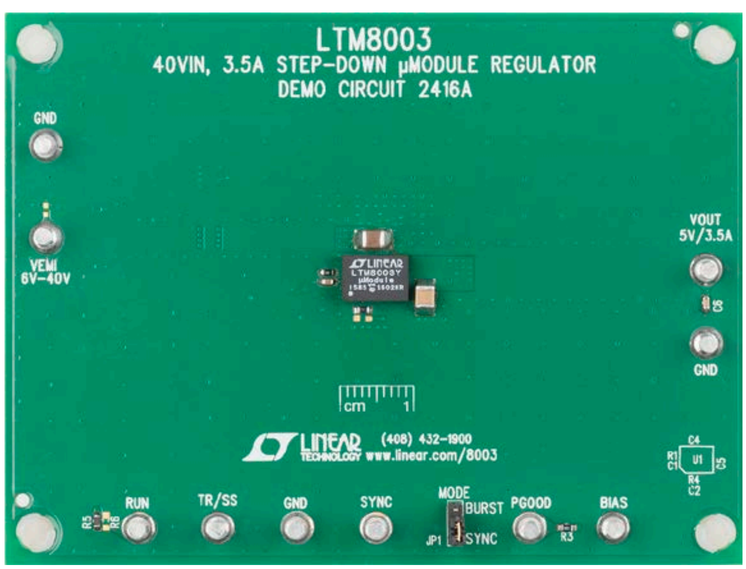
The LTM8003 data sheet gives complete description of the device, operation and application information. The data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit 2416A.

Design files for this circuit board are available at http://www.linear.com/demo/DC2416A

PERFORMANCE SUMMARY Specifications are at $T_A = 25°C$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		6		40	V
V_{OUT}	Output Voltage		4.75	5	5.25	V
I_{OUT}	Output Current	V_{IN} = 12V	3.5			A
f_{SW}	Switching Frequency	V_{IN} = 12V, I_{OUT} = 3.5A		2		MHz
$V_{OUT(AC)}$	Output Ripple	V_{IN} = 12V, I_{OUT} = 3.5A		20		mV
η	Efficiency	V_{IN} = 12V, I_{OUT} = 3.5A		91.6		%

BOARD PHOTO



QUICK START PROCEDURE

DC2416A is an easy way to evaluate the performance of the LTM8003. Refer to Figure 1 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. 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. Place JP1 in Burst position.
2. With power off, connect the input power supply to VEMI and GND.
3. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed 40V.

4. Check for the proper output voltage between V_{OUT} and GND (V_{OUT} = 5V).

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

5. Once the proper output voltage is established, adjust the load within the operating range and measure the output voltage regulation, ripple voltage, efficiency and other parameters.
6. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). Make sure that R1 be chosen to set the switching frequency equal to or below the lowest SYNC frequency. JP1 can also set the regulator in pulse-skipping mode (Floating JP1) or spread spectrum mode (JP1 on SYNC, and set it high between 3.2V and 4.2V).

QUICK START PROCEDURE

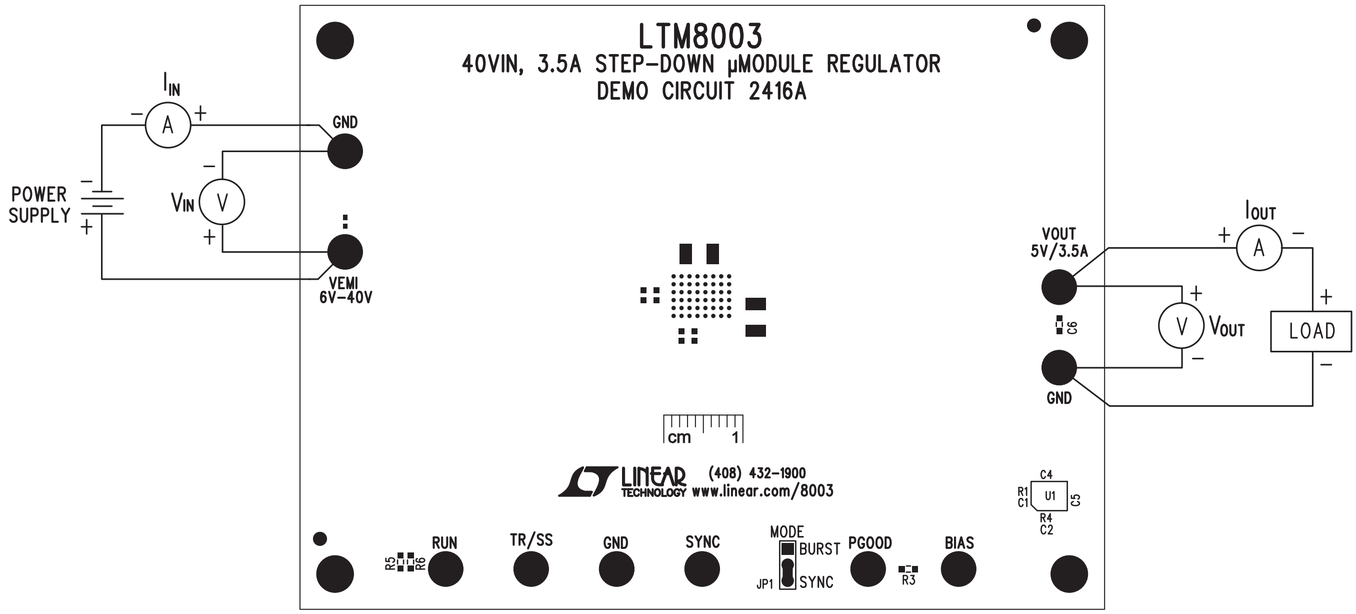


Figure 1. DC2416A Proper Equipment Setup

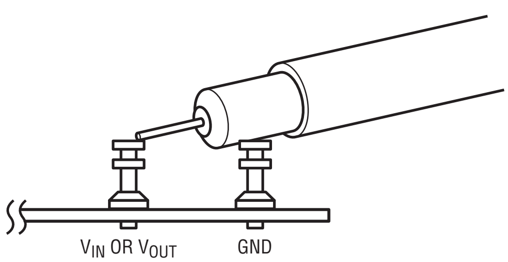
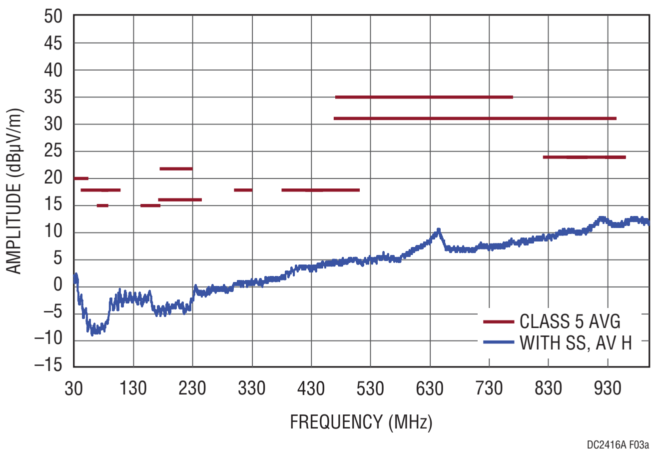
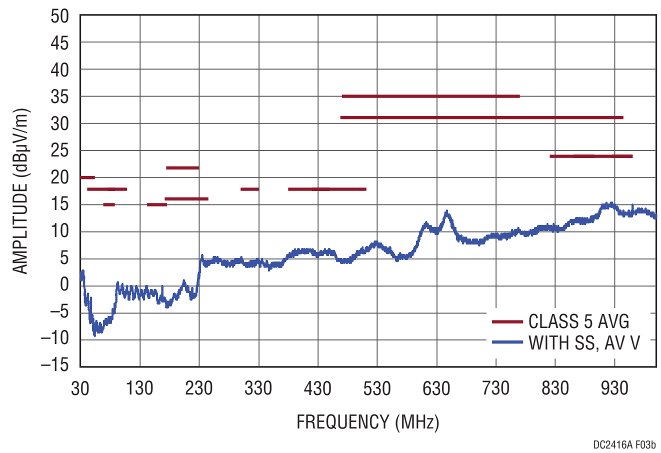


Figure 2. Measuring Input or Output Ripple

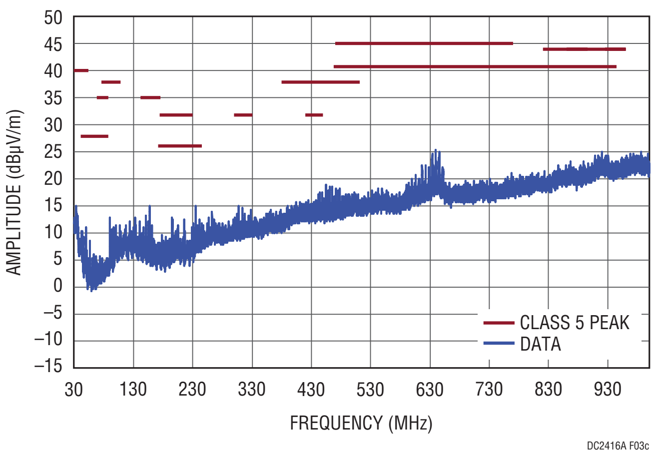
QUICK START PROCEDURE



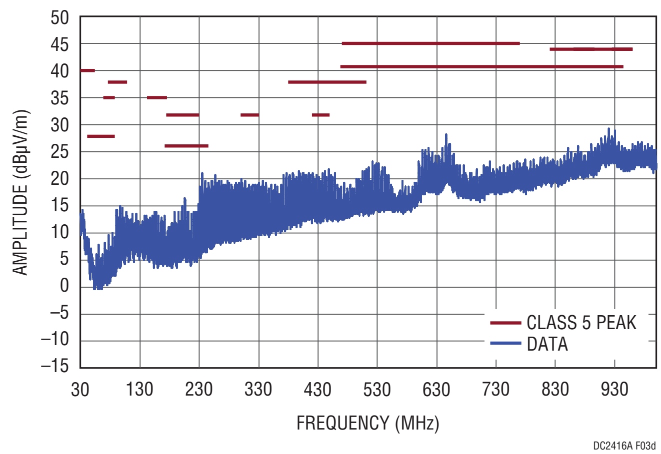
(3a) Horizontal Polarization, Average, with Spread Spectrum



(3b) Vertical Polarization, Average, with Spread Spectrum



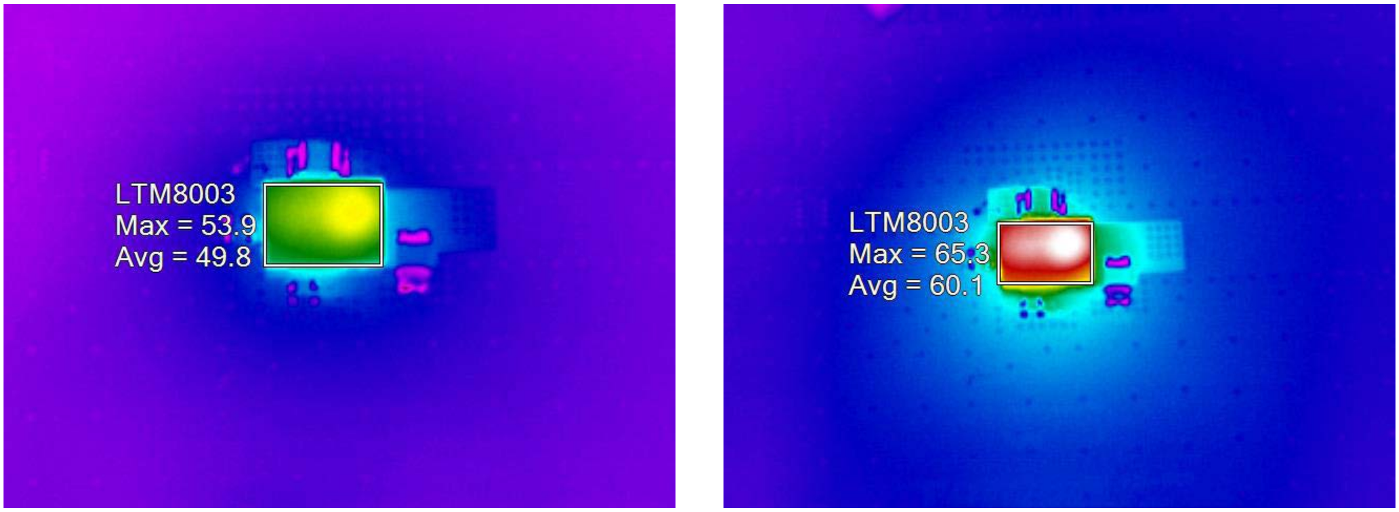
(3c) Horizontal Polarization, Peak, without Spread Spectrum



(3d) Vertical Polarization, Peak, without Spread Spectrum

Figure 3. DC2416A EMI Performance in CISPR25 Radiated Emission Test with and without Spread Spectrum ($14V_{IN}$, I_{OUT} = 3.5A)

QUICK START PROCEDURE



(4a) V_{IN} = 12V

(4b) V_{IN} = 24V

Figure 4. DC2416A Thermal Performance (12V_{IN}, I_{OUT} = 3.5A, T_A = 25°C)

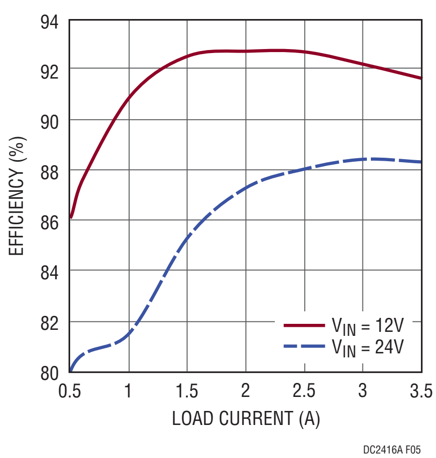


Figure 5. DC2416A Efficiency vs Load Current (T_A = 25°C)

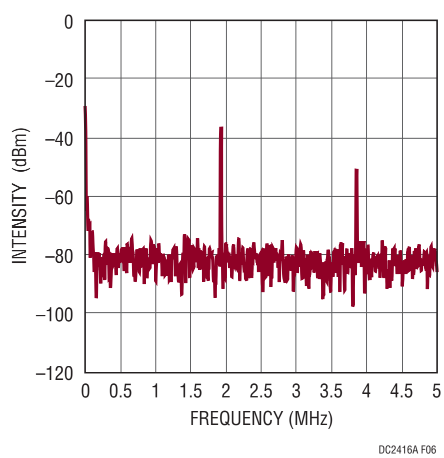
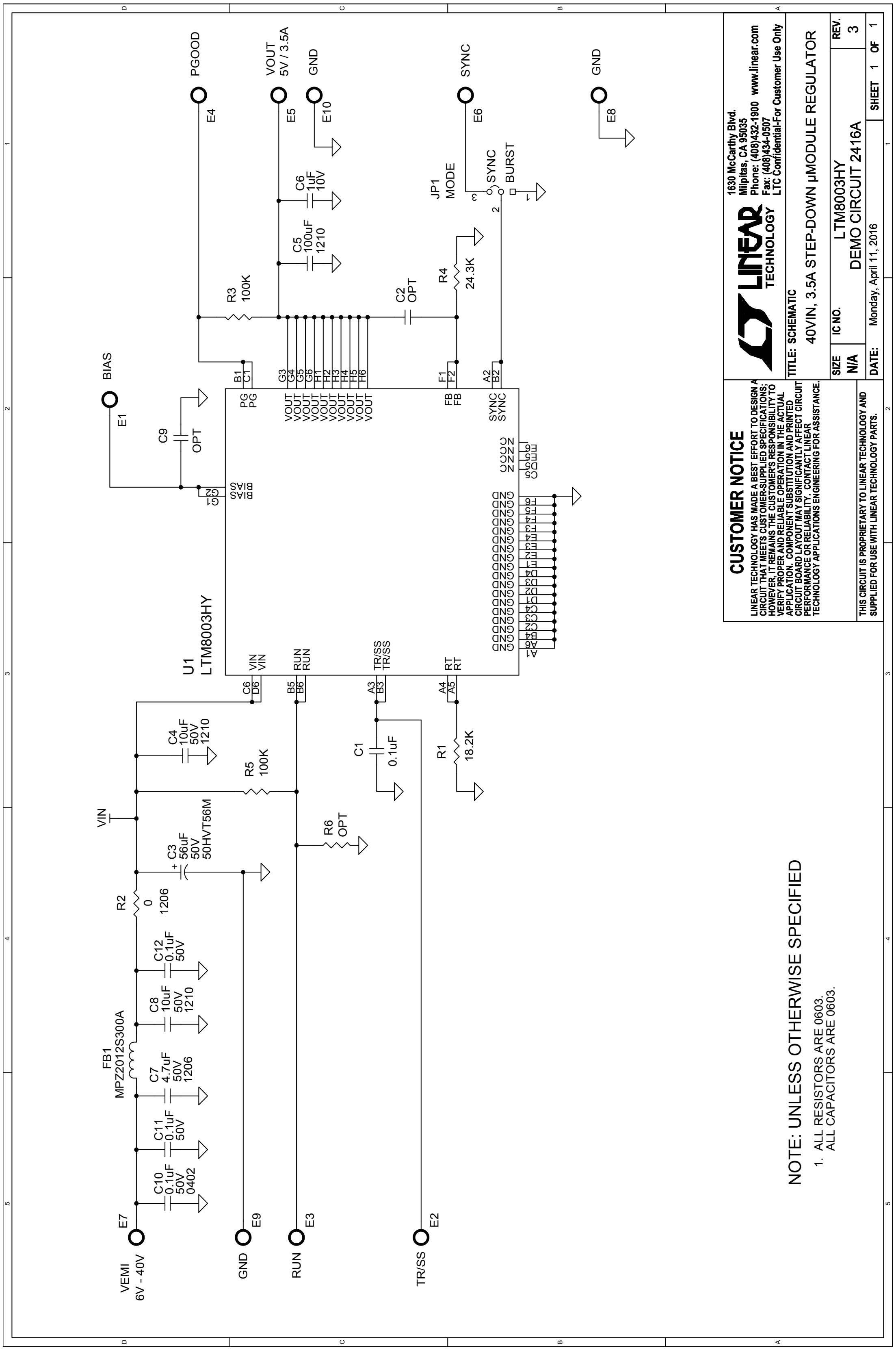


Figure 6. Output Noise Spectrum with 3.5A Load Current (V_{IN} = 12V)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., CER., X7R, 0.1µF, 25V, 10% 0603	MURATA, GRM188R71E104KA01D
2	1	C3	CAP., ALUM., 56µF, 50V	SUN ELECTRONIC INDUSTRIES CORP., 50HVT56M
3	2	C4, C8	CAP., CER., X7R, 10µF, 50V, 10% 1210	MURATA, GRM32ER71H106KA12L
4	1	C5	CAP., CER., X7S, 100µF, 6.3V, 20% 1210	MURATA, GRM32EC70J107ME15L
5	1	C6	CAP., CER., X7R, 1µF, 10V, 10%, 0603	MURATA, GRM188R71A105KA61D
6	1	C7	CAP., CER., X7R, 4.7µF, 50V, 20% 1206	MURATA, GRM31CR71H475KA12L
7	1	C10	CAP., CER., X7R, 0.1µF, 50V, 10% 0402	TDK, C1005X7R1H104K050BB
8	2	C11, C12	CAP., CER., X7R, 0.1µF, 50V, 10% 0603	AVX, 06035C104KAT2A
9	1	R1	RES., CHIP, 18.2k, 1/10W, 1% 0603	VISHAY, CRCW060318K2FKEA
10	1	R2	RES., CHIP, 0Ω, 1/10W, 1% 1206	VISHAY, CRCW12060000Z0EA
11	2	R3, R5	RES., CHIP, 100k, 1/10W, 1% 0603	VISHAY, CRCW0603100KFKEA
12	1	FB1	CHIP BEAD IND., 0805	TDK, MPZ2012S300AT000
13	1	R4	RES., CHIP, 24.3k, 1/10W, 1% 0603	VISHAY, CRCW060324K3FKEA
14	1	U1	IC., BGA, LTM8003, 48PIN	LINEAR TECH., LTM8003HY#PBF
Additional Demo Board Circuit Components				
1	0	C2, C9 (OPT)	CAP., 0603	
2	0	R6 (OPT)	RES., 0603	
Hardware: For Demo Board Only				
1	10	E1-E10	TESTPOINT, TURRET, .094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	JP1	HEADER 3 PIN 0.079 SINGLE ROW	WURTH ELEKTRONIK, 62000311121
3	1	XJP1	SHUNT, .079" CENTER	WURTH ELEKTRONIK, 60800213421
4	4	MH1-MH4	STAND-OFF, NYLON 0.50"	WURTH ELEKTRONIK, 702935000

SCHEMATIC DIAGRAM



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