

LTM8073 60V, 3A Silent Switcher μModule Regulator

DESCRIPTION

Demonstration circuit 2389A is a 60V, 3A step-down μModule® regulator featuring the LTM8073. The demo board is designed for 5V output from a 7V to 60V input. The wide input range allows a variety of input sources, such as automotive batteries and industrial supplies. The user adjustable features of the LTM8073 such as output voltage, switching frequency, soft-start and power good can be changed on DC2389A simply by modifying the appropriate resistors and/or capacitors. Two or more LTM8073s can be paralleled to share load current equally.

The LTM8073 can be programmed to different operation modes. The SYNC pin on the demo board is grounded by default for low ripple Burst Mode® operation. Moving JP1 to PULSE SKIPPING position can change the operation mode to pulse-skipping operation. To synchronize to an external clock, move JP1 to SYNC and apply the external clock to the SYNC turret. Once JP1 is on SPREAD SPECTRUM position, an external DC bias can be applied to the SYNC pin to enable low EMI spread spectrum operation. This DC bias can also be generated from V_{OUT} with

appropriate voltage divider if V_{OUT} is 2.9V or higher. See Quick Start Procedure section for more details.

Figure 1 shows the efficiency of the circuit under different input voltages in Burst Mode operation. The rated maximum load current is 3A, while derating is necessary for certain input voltage and thermal conditions. Figure 2 shows the LTM8073 thermal performance on DC2389A demo board.

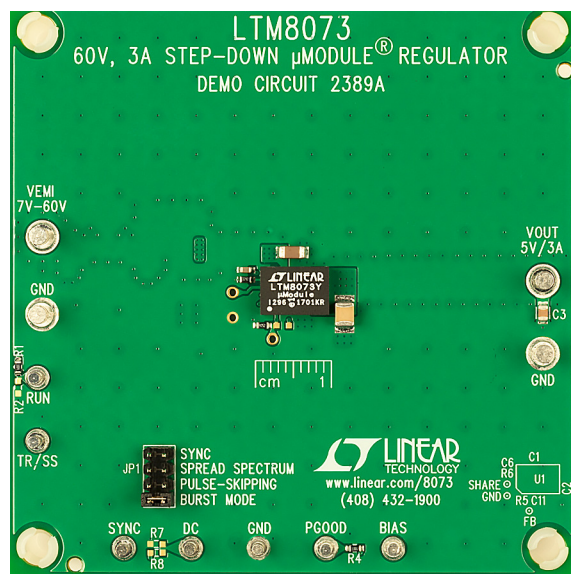
The demo board has an EMI filter installed. An inductor L1, which is shorted on the board by default, can be added in the EMI filter to further reduce the conducted emission.

The LTM8073 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 2389A.

Design files for this circuit board are available at
<http://www.linear.com/demo/DC2389A>

LT, LT, LTC, LTM, Linear Technology, Burst Mode, μModule and the Linear logo are registered trademarks of Analog Devices, Inc. All other trademarks are the property of their respective owners.

BOARD PHOTO



DEMO MANUAL DC2389A

PERFORMANCE SUMMARY Specifications are at $T_A = 25^{\circ}\text{C}$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Voltage Range		7		60	V
V_{OUT}	Output Voltage		4.85	5	5.15	V
I_{OUT}	Maximum Output Current		3			A
f_{SW}	Switching Frequency			1.2		MHz
EFF	Efficiency at DC	$V_{IN} = 12\text{V}, I_{OUT} = 1\text{A}$		93.9		%

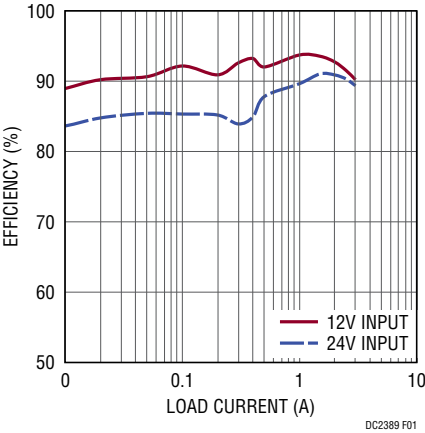


Figure 1. LTM8073 Demo Circuit DC2389A Efficiency vs Load Current

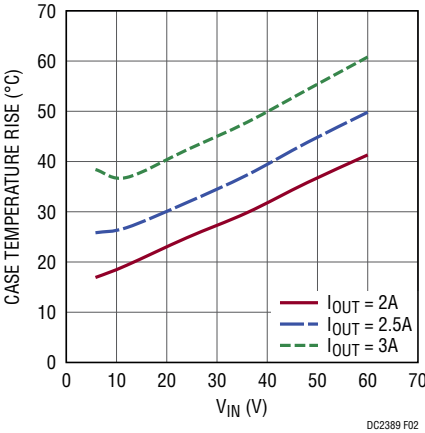


Figure 2. LTM8073 Demo Circuit DC2389A Case Temperature Rise vs Input Voltage

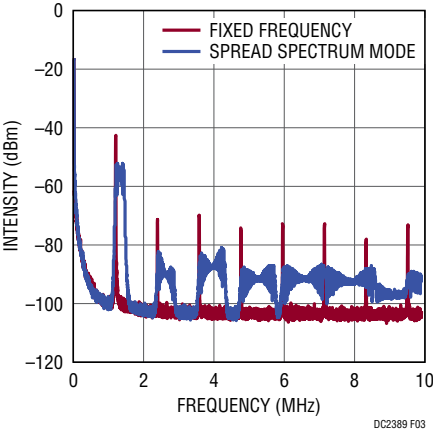


Figure 3. DC2389A Output Noise Spectrum, $V_{IN} = 12\text{V}, V_{OUT} = 5\text{V}, I_{OUT} = 3\text{A}$

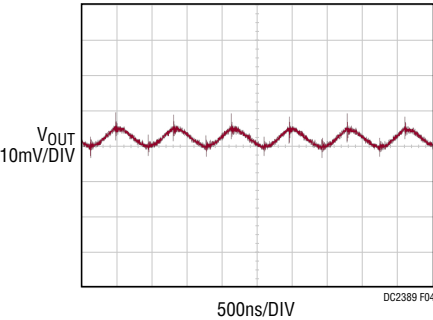


Figure 4. DC2389A Output Ripple, $V_{IN} = 12\text{V}, V_{OUT} = 5\text{V}, I_{OUT} = 3\text{A}$

QUICK START PROCEDURE

Demonstration circuit 2389A is easy to set up to evaluate the performance of the LTM8073. Refer to Figure 5 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. See Figure 6 for the proper scope technique.

1. Set an input power supply that is capable of 60V/3A. Then turn off the supply.
2. With power off, connect the supply to the input terminals V_{EMI} and GND.
3. Turn on the power at the input.

NOTE: Make sure that the input voltage never exceeds 60V.

4. Check for the proper output voltage of 5V. Turn off the power at the input.
5. Once the proper output voltage is established, connect a variable load capable of sinking 3A at 5V to the output terminals V_{OUT} and GND. Set the current for 0A.
 - a. If efficiency measurements are desired, an ammeter can be put in series with the output load in order to measure the DC2389A's output current.

- b. A voltmeter can be placed across the output terminals in order to get an accurate output voltage measurement.

6. Turn on the power at the input.

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

7. Once the proper output voltage is established again, adjust the load and/or input within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other desired parameters.
8. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). Please ensure that the chosen RT sets the LTM8073 switching frequency to equal or below the lowest SYNC frequency. An external 2.9V to 4.2V DC voltage can be applied to SYNC turret to enable low noise spread spectrum function (JP1 on the SPREAD SPECTRUM position). This DC voltage can be generated from V_{OUT} with a appropriate voltage divider. See the data sheet section, "Synchronization" for more information.

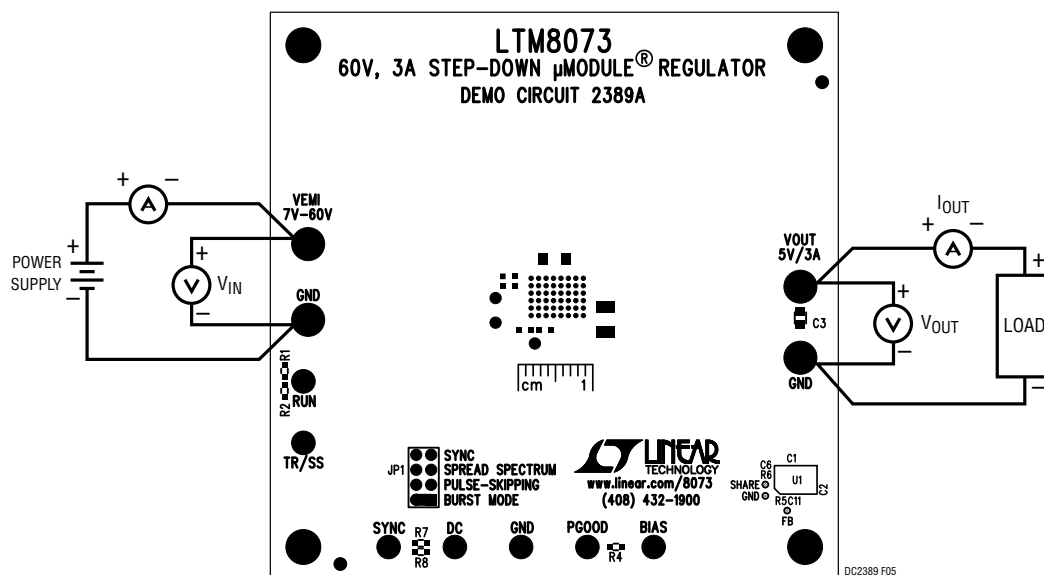


Figure 5. Proper Measurement Equipment Setup

QUICK START PROCEDURE

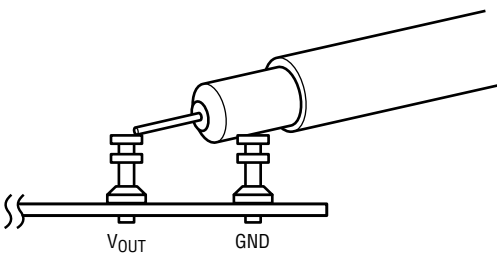
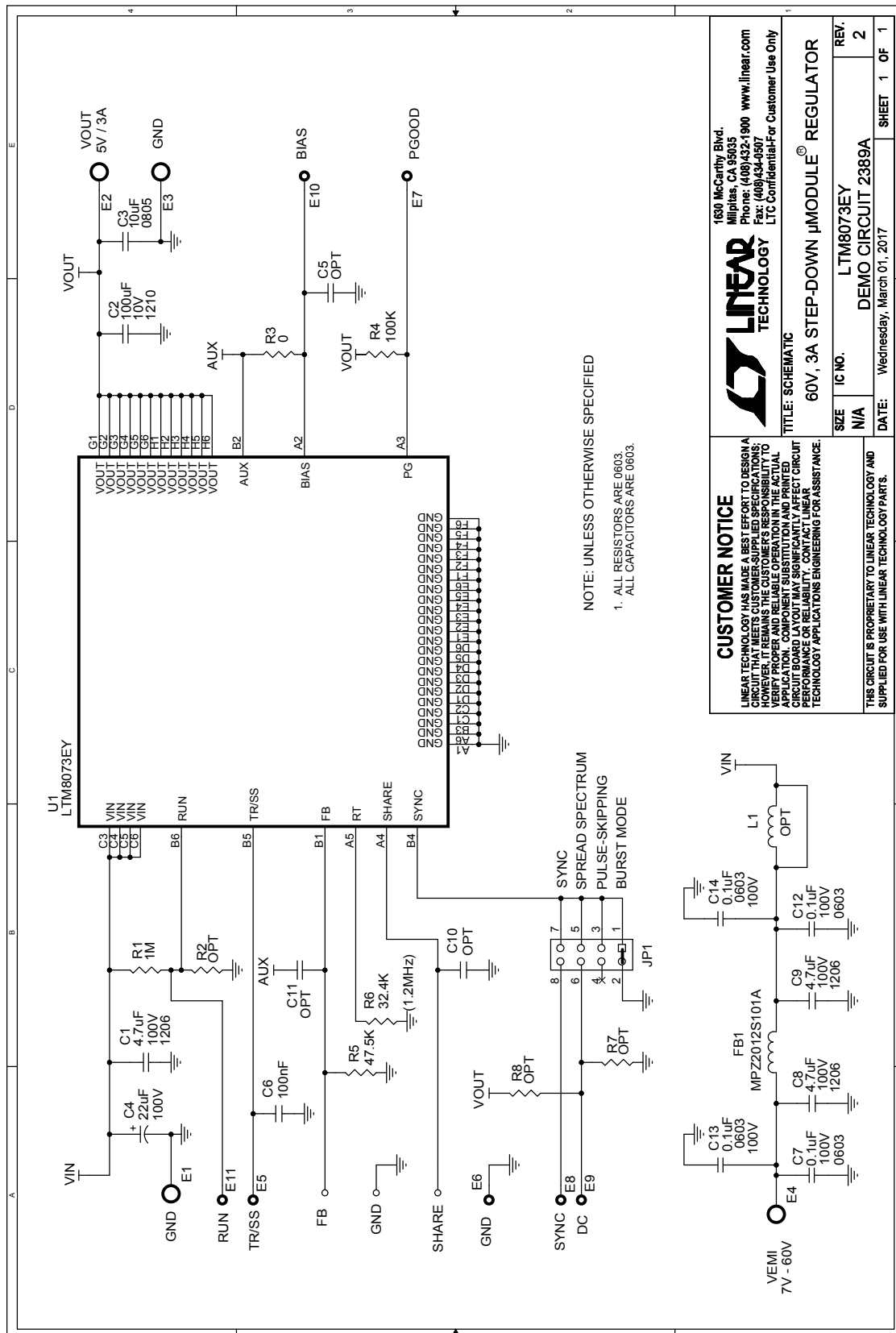


Figure 6. Measuring Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., 4.7μF, X7S, 100V, 10% 1206	AVX, 12061Z475KAT2A
2	1	C2	CAP., 100μF, X5R, 10V, 20% 1210	MURATA, GRM32ER61A107ME20L
3	1	C6	CAP., 100nF, X7R, 25V, 10% 0603	MURATA, GRM188R71E104KA01D
4	1	R1	RES., CHIP, 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
5	1	R3	RES., 0Ω, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
6	1	R4	RES., 100k, 1/10W, 1% 0603	VISHAY, CRCW0603100KFKEA
7	1	R5	RES., 47.5k, 1/10W, 1% 0603	VISHAY, CRCW060347K5FKEA
8	1	R6	RES., 32.4k, 1/10W, 1% 0603	VISHAY, CRCW060332K4FKEA
9	1	U1	IC, REGULATOR, 48BGA	LINEAR TECH., LTM8073EY#PBF
Additional Demo Board Circuit Components				
1	1	C3	CAP., 10μF, X7R, 10V, 10% 0805	MURATA, GRM21BR71A106KE51L
2	1	C4	CAP., ALUM. 22μF, 100V	SUN ELECT., 100CE22BS
3	0	C5, C10, C11 (OPT)	CAP., OPTION, 0603	
4	4	C7, C12, C13, C14	CAP., 0.1μF, X7R, 100V, 10% 0603	MURATA, GRM188R72A104KA35D
5	2	C8, C9	CAP., 4.7μF, X7S, 100V, 10% 1206	AVX, 12061Z475KAT2A
6	1	FB1	FERRITE BEAD 0805	TDK, MPZ2012S101AT000
7	0	L1 (OPT.)	IND., OPTION	
8	0	R2, R7, R8 (OPT)	RES., 0603	
Hardware: For Demo Board Only				
1	4	E1-E4	TESTPOINT, TURRET, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	7	E5-E11	TESTPOINT, TURRET, 0.064"	MILL-MAX, 2308-2-00-80-00-00-07-0
3	1	JP1	DOUBLE ROW HEADER 2 x 4 0.079"	WURTH ELEKTRONIK, 62000821121
4	1	XJP1	SHUNT, 0.079" CENTER	WURTH ELEKTRONIK, 60800213421
5	4	MH1-MH4	STAND-OFF, NYLON 0.5"	WURTH ELEKTRONIK, 702935000

SCHEMATIC DIAGRAM



DEMO MANUAL DC2389A

DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation