# LTM4661
# 1.8V-5.5V Input, Synchronous Step-Up µModule Regulator

## DESCRIPTION

Demonstration circuit 2569A is ultrathin step-up µModule regulator featuring the LTM4661. The DC2569A operates over 1.8V to 5.5V input and it generates 12V, 1A output from 5V input. Also, the LTM4661 has precision voltage reference, which can generate output voltage with 3% tolerance over the full operating conditions. The 1MHz switching frequency operation results in small and efficient circuit. The converter operates with only one phase in burst mode and achieves over 90% efficiency with 100mA load. The demonstration circuit can be easily modified to generate different output voltages.

The DC2569 has small circuit footprint. It is a high performance and cost effective solution for generating output voltages up to 15V from inputs as low as 1.8V.

**Design files for this circuit board are available at http://www.linear.com/demo/DC2569A**

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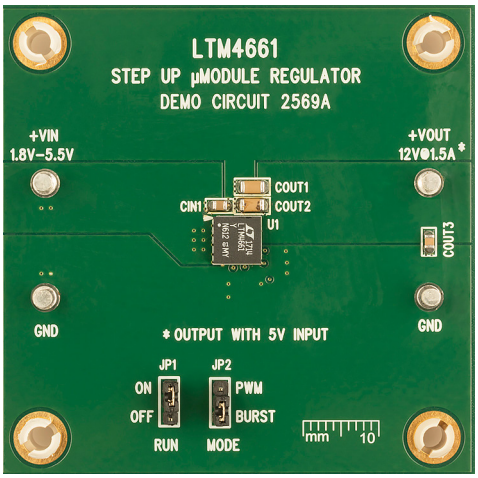
## PERFORMANCE SUMMARY

**Specifications are at $T_A$ = 25°C**

| PARAMETER | CONDITIONS | VALUE |
|---|---|---|
| Minimum Input Voltage | $I_{OUT}$ = 0A to 0.3A | 1.8V |
| Maximum Input Voltage | $I_{OUT}$ = 0A to 1A | 5.5V |
| $V_{OUT}$ | $V_{IN}$ = 1.8V to 5.5V, $I_{OUT}$ = 0A | 12V ±3% |
| Output Voltage Ripple | $V_{IN}$ = 5V, $I_{OUT}$ = 1A | 20m$V_{P-P}$ |
| Nominal Switching Frequency | | 1MHz |

## BOARD PHOTO



## QUICK START PROCEDURE

Demonstration circuit DC2569 is easy to set up to evaluate the performance of the LTM4661. For proper measurement equipment setup refer to Figure 1 and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, care must be taken to minimize the length of oscilloscope probe ground lead. Measure the input or output voltage ripple by connecting the probe tip directly across the $V_{IN}$ or $V_{OUT}$ and GND terminals as shown in Figure 2.

1. With power off, connect the input power supply to $V_{IN}$ and GND.
2. Keep the load set to 0A or disconnected.
3. Turn the input power source on and slowly increase the input voltage. Be careful not to exceed 5.5V.

   NOTE: Make sure that the input voltage $V_{IN}$ does not exceed 5.5V.
4. Set the input voltage to 5V and check for the proper output voltage of 12V. 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 and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

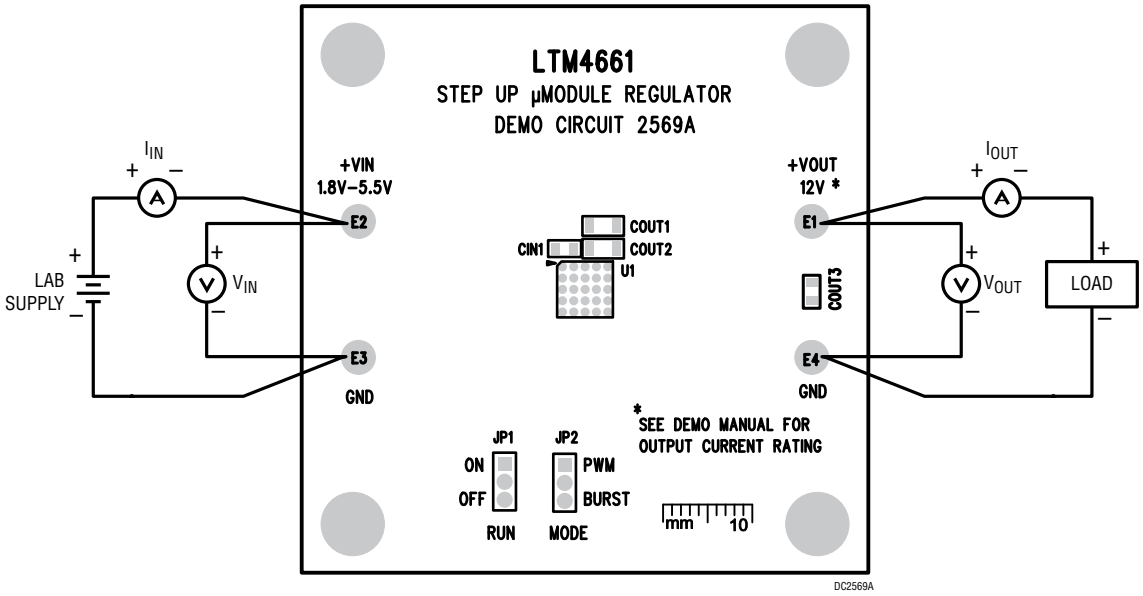



**Figure 1. Proper Measurement Equipment Setup**

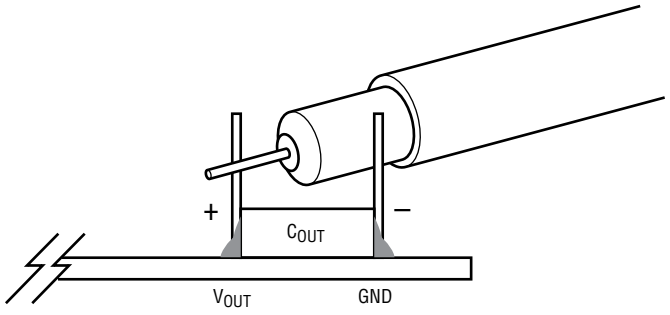



**Figure 2. Measuring Input or Output Ripple**

# QUICK START PROCEDURE

## CHANGING THE OUTPUT VOLTAGE

To change the output voltage from the programmed 12V, change the voltage setting resistors connected to LTM4661 FB pin (see the schematic on page 5).

## CONVERTER OUTPUT CURRENT

The DC2569 output current capability depends on the input voltage and programmed input current limit. Typical performance of DC2569A is shown in Figure 3. As can be seen from Figure 3, the maximum output current is 1A with 5V input. Switching the mode of operation to BURST mode can increase the efficiency at light loads.

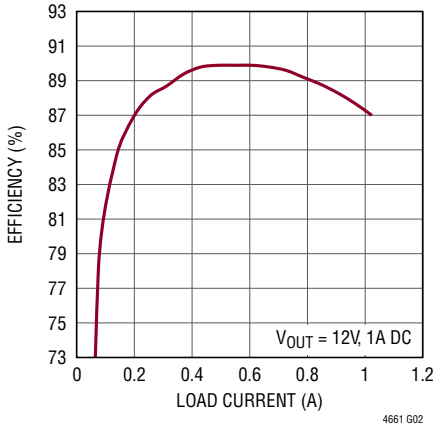



**Figure 3. The 5V Input Efficiency is 90% at 0.6A Load**

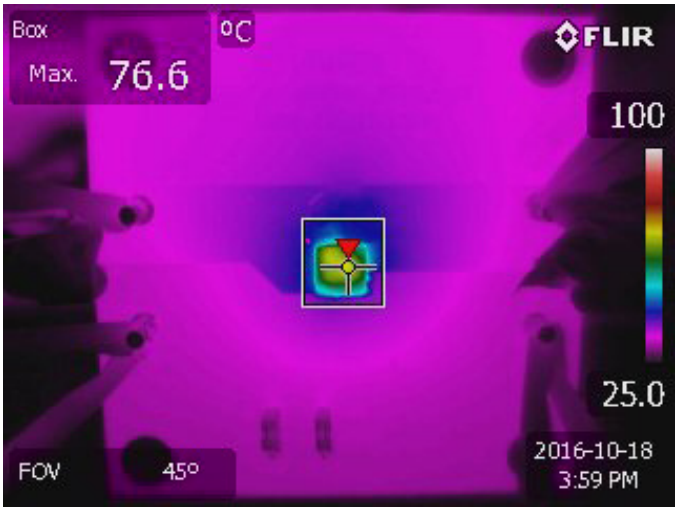



**Figure 4. Thermal Image, 3.3V Input to 12V Output at 0.8A, 200LFM Air Flow, No Heat Sink**

## OUTPUT LOAD STEP RESPONSE

The load step response of DC2569A is dependent on the amount and type of output caps used. If higher load steps need to be handled more output capacitance can be added in order to keep the voltage transients at the desired level. The 200mA to 400mA load step transients with 3.3V input are shown in Figure 5. Other types of low ESR and high value capacitors can be used if space is available to reduce load transients to desired level.

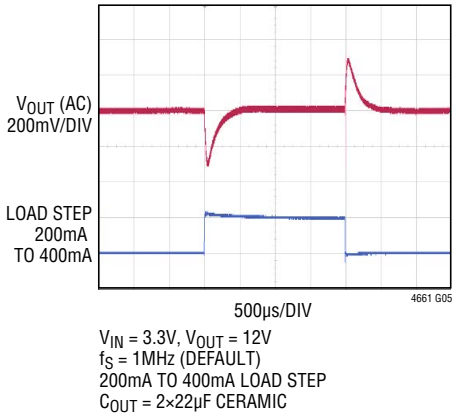



**Figure 5. The LTM4661 Has Good Load Step Response with Small Output Capacitors (2× 22µF)**

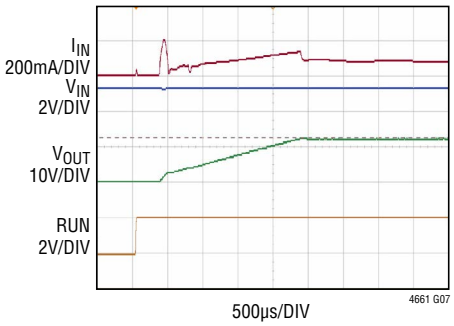
## START-UP AND SOFT-START FUNCTION

The DC2569 features internal soft-start circuit that ramps the output voltage up in monotonic fashion. The soft-start circuit also prevents output voltage overshoot when output voltage ramp reaches regulation.

# QUICK START PROCEDURE

### OUTPUT SHORT CIRCUIT PROTECTION

The LTM4661 features safe short-circuit and thermal protection. The part can operate continuously with output shorted while maintaining a maximum set current limit. The internal peak switch current is reduced during overload to about 2A and is restored to 3.5A once the output exceeds 1.5V.



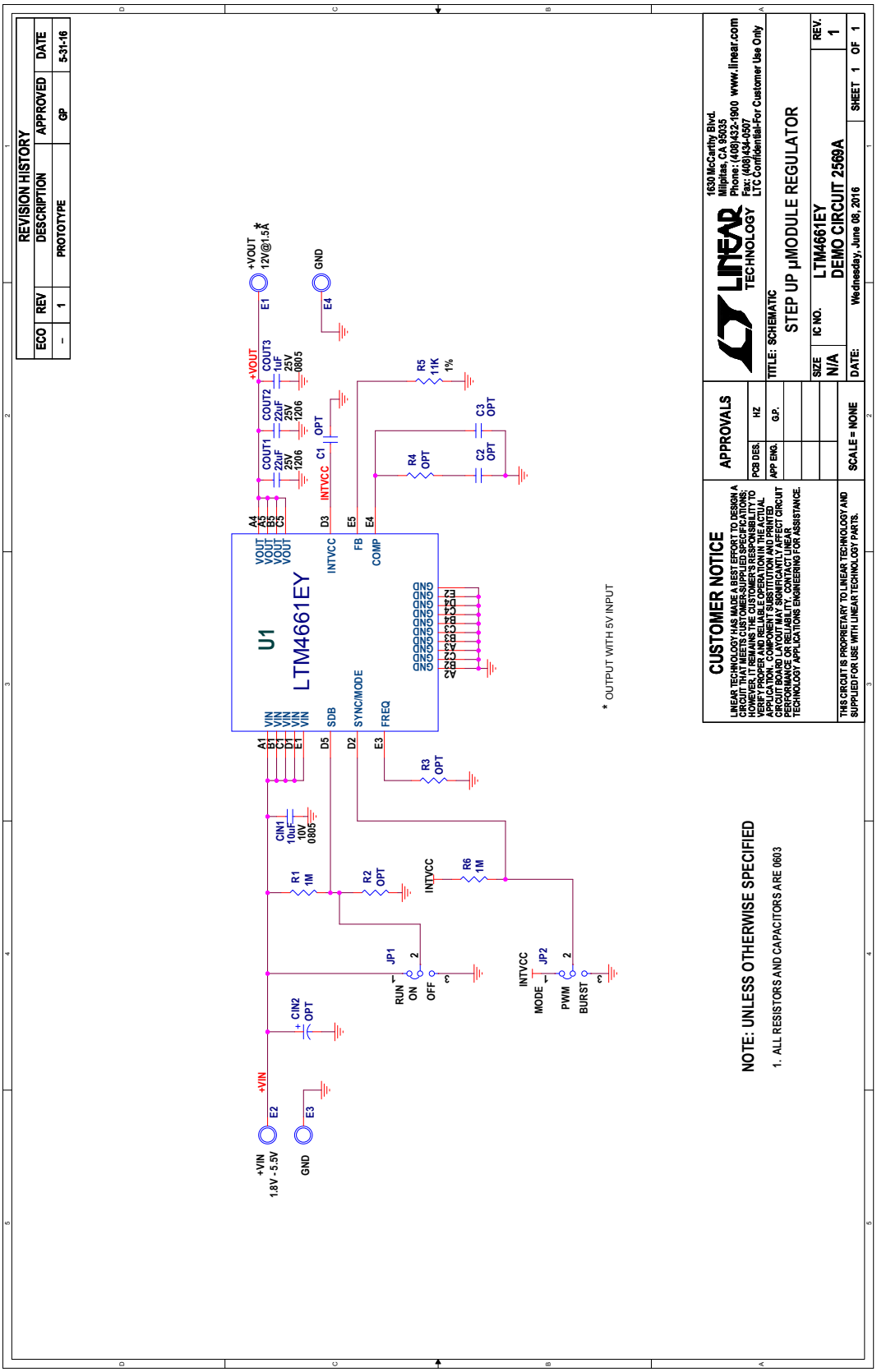

$V_{IN}$ = 3.3V,
$V_{OUT}$ = 12V
$f_S$ = 1MHz (DEFAULT)
$C_{OUT}$ = 2×22µF CERAMIC

**Figure 6. The DC2569 Ramps the Output Slowly at Start-Up without Output Voltage Overshoot**

# PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|---|---|---|---|
| **Required Circuit Components** | | | | |
| 1 | 1 | CIN1 | CAP.,10µF, X5R, 16V, 20%, 0805 | AVX, 0805YD106MAT2A<br>KEMET, C0805C106M4PAC7800<br>KEMET, C0805C106M4PACTU |
| 2 | 1 | COUT1, COUT2 | CAP., 22µF, X5R, 16V, 20%, 1206 | MURATA, GRM31CR61C226ME15L |
| 3 | 1 | COUT3 | CAP., 1µF, X5R, 25V, 10%, 0805 | AVX, 08053D105KAT2A |
| 4 | 2 | R1, R6 | RES., 1MΩ, 1%, 1/10W, 0603 | NIC, NRC06F1004TRF<br>PANASONIC, ERJ3EKF1004V<br>VISHAY, CRCW06031M00FKEA |
| 5 | 1 | R5 | RES., 11k, 1%, 1/10W, 0603 | VISHAY, CRCW060311K0FKEA |
| 6 | 1 | U1 | IC,Step-Up DC/DC Power Module, LGA-25 | LINEAR TECHNOLOGY, LTM4661EV#PBF |
| **Additional Demo Board Circuit Components** | | | | |
| 1 | 0 | C1, C2, C3 | CAP., 0603, OPTION | OPT |
| 2 | 0 | R2, R3, R4 | RES., OPTION, 0603 | OPT |

# SCHEMATIC DIAGRAM



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