

## LTM4625 5A Small Footprint Step-Down μModule Regulator

### DESCRIPTION

Demonstration circuit 2171A-B features the **LTM<sup>®</sup>4625** μModule<sup>®</sup> regulator, a tiny low profile high performance step-down regulator. The LTM4625 has an operating input voltage range of 4V to 20V and is able to provide an output current of up to 5A. The output voltage is programmable from 0.6V to 5V. The LTM4625 is a complete DC/DC point-of-load regulator in a 6.25mm × 6.25mm × 5.01mm BGA package requiring only a few input and output capacitors. Output voltage tracking is available through the TRACK/

SS pin for supply rail sequencing. CLKIN, CLKOUT and PHMODE pins are available for clock synchronization and interleaving. The LTM4625 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit 2171A-B.

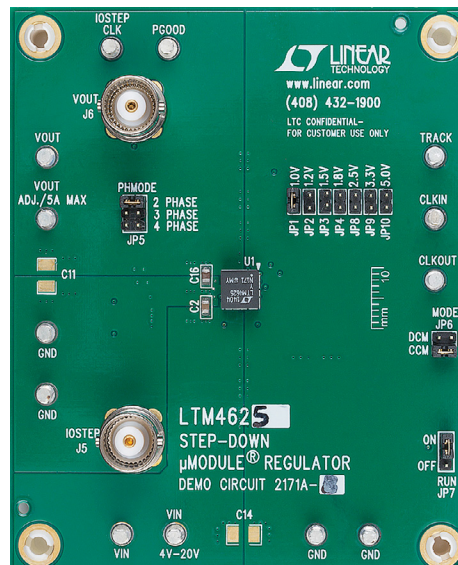
**Design files for this circuit board are available at <http://www.linear.com/demo/DC2171A-B>**

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### PERFORMANCE SUMMARY Specifications are at T<sub>A</sub> = 25°C

| PARAMETER                         | CONDITIONS / NOTES                                                                 | VALUE                                                |
|-----------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------|
| Input Voltage Range               |                                                                                    | 4V to 20V                                            |
| Output Voltage V <sub>OUT</sub>   | Jumper Selectable                                                                  | 1.0VDC, 1.2VDC, 1.5VDC, 1.8VDC, 2.5VDC, 3.3VDC, 5VDC |
| Maximum Continuous Output Current | Derating Is Necessary for Certain Operating Conditions. See Data Sheet for Details | 5ADC                                                 |
| Default Operating Frequency       |                                                                                    | 1MHz                                                 |
| Efficiency                        | V <sub>IN</sub> = 12V, V <sub>OUT</sub> = 1.8V, I <sub>OUT</sub> = 5A              | 83.4% See Figure 2                                   |

### BOARD PHOTO



# DEMO MANUAL DC2171A-B

## QUICK START PROCEDURE

Demonstration circuit 2171A-B is an easy way to evaluate the performance of the LTM4625EY. Please refer to Figure 1 for test setup connections and follow the procedure below.

1. With power off, place the jumpers in the following positions for a typical 1.8V<sub>OUT</sub> application:

| JP7 | JP6  | JP4         |
|-----|------|-------------|
| RUN | MODE | VOUT SELECT |
| ON  | CCM  | 1.8V        |

2. Before connecting input supply, load and meters, pre-set the input voltage supply to be between 4V to 20V. Pre-set the load current to 0A.
3. With power off, connect the load, input voltage supply and meters as shown in Figure 1.
4. Turn on input power supply. The output voltage meter should display the selected output voltage  $\pm 1.5\%$ .

5. Once the proper output voltage is established, adjust the load current within the 0A to 5A range and observe the load regulation, efficiency, and other parameters. Output voltage ripple should be measured at J6 with a BNC cable terminated into 50 $\Omega$  and an oscilloscope.
6. To observe increased light load efficiency place the MODE pin jumper (JP6) in the DCM position.
7. For optional load transient testing apply an adjustable positive pulse signal between IOSTEP CLK and GND pins. The pulse amplitude sets the load step current amplitude. The pulse width should be short ( $<1\text{ms}$ ) and pulse duty cycle should be low ( $<15\%$ ) to limit the thermal stress on the load transient circuit. The load step current can be monitored with a BNC connected to J5 (50mV/A).

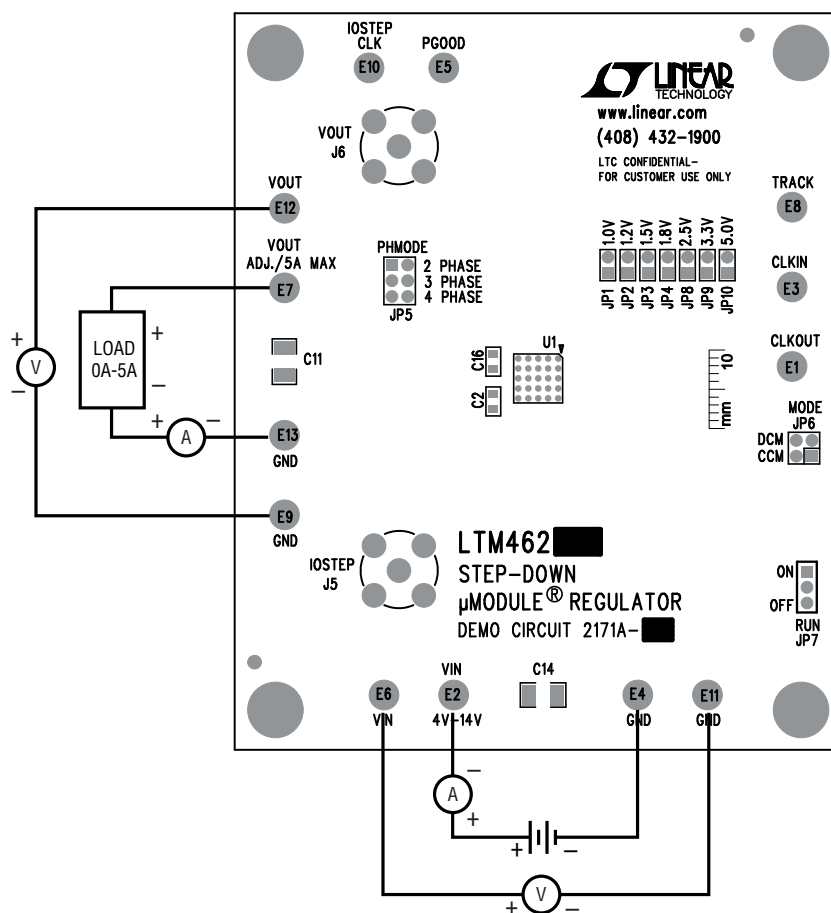


Figure 1. Test Setup

dc2171a-bf

## QUICK START PROCEDURE

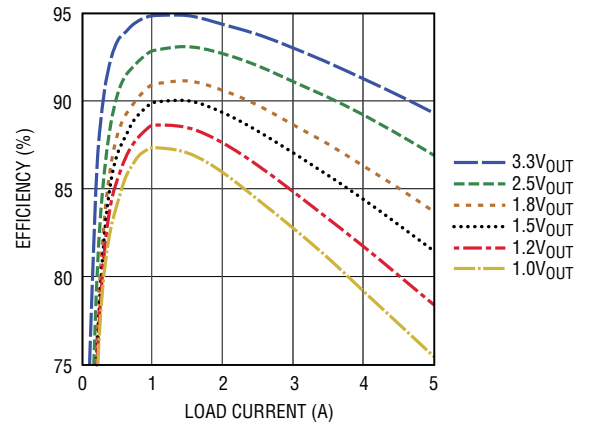
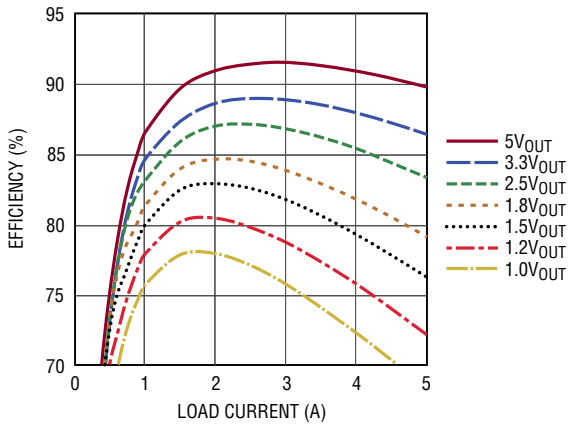
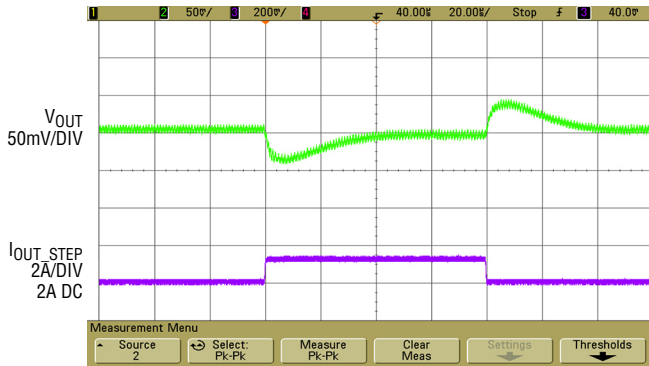
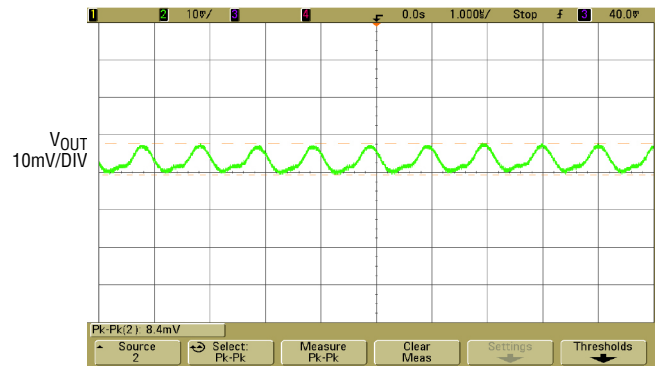


Figure 2. Measured Supply Efficiency at 12V<sub>IN</sub> and 5V<sub>IN</sub>



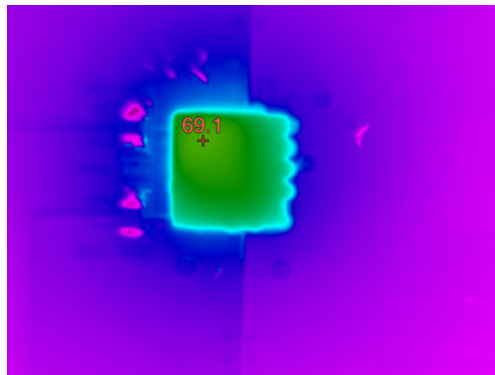
| V <sub>IN</sub> (V) | V <sub>OUT</sub> (V) | C <sub>OUT</sub>                                     |
|---------------------|----------------------|------------------------------------------------------|
| 12                  | 1.8                  | 1 × 100μF/6.3V +<br>1 × 22μF/6.3V +<br>1 × 47μF/6.3V |

Figure 3. Measured Load Transient Response (2A-4A Load Step)



| V <sub>IN</sub> (V) | V <sub>OUT</sub> (V) | I <sub>OUT</sub> (A) | C <sub>OUT</sub>                                     |
|---------------------|----------------------|----------------------|------------------------------------------------------|
| 12                  | 1.8                  | 5                    | 1 × 100μF/6.3V +<br>1 × 22μF/6.3V +<br>1 × 47μF/6.3V |

Figure 4. Measured V<sub>OUT</sub> Ripple



| V <sub>IN</sub> (V) | V <sub>OUT</sub> (V) | I <sub>LOAD</sub> (A) | f <sub>SW</sub> (MHz) | T <sub>AMBIENT</sub> (°C) | FORCED AIRFLOW (LFM) |
|---------------------|----------------------|-----------------------|-----------------------|---------------------------|----------------------|
| 12                  | 1                    | 5                     | 1                     | 25                        | 0                    |

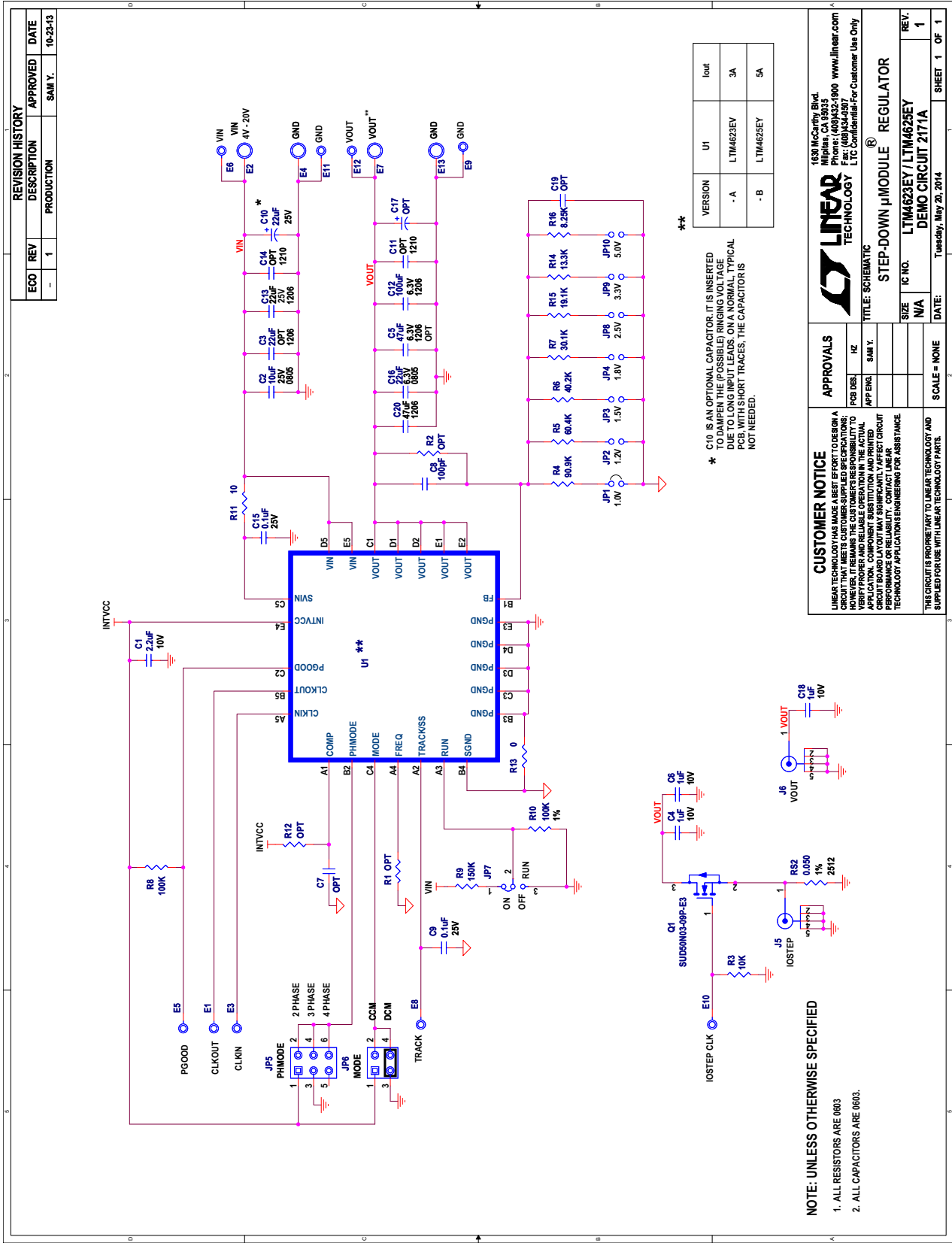
Figure 5

# DEMO MANUAL DC2171A-B

## PARTS LIST

| ITEM                                            | QTY | REFERENCE                 | PART DESCRIPTION                             | MANUFACTURER/PART NUMBER          |
|-------------------------------------------------|-----|---------------------------|----------------------------------------------|-----------------------------------|
| <b>Required Circuit Components</b>              |     |                           |                                              |                                   |
| 1                                               | 1   | C1                        | CAP., X5R, 2.2 $\mu$ F, 10V, 10%, 0603       | TAIYO YUDEN, LMK107BJ225KA-T      |
| 2                                               | 2   | C3, C13                   | CAP., X5R, 22 $\mu$ F, 16V, 20%, 1206        | TAIYO YUDEN, EMK316BJ226ML-T      |
| 3                                               | 1   | C20                       | CAP., X5R, 47 $\mu$ F, 6.3V, 20%, 1206       | TAIYO YUDEN, JMK316BJ476ML        |
| 4                                               | 1   | C12                       | CAP., X5R, 100 $\mu$ F, 6.3V, 20%, 1206      | TAIYO YUDEN, JMK316BJ107ML-T      |
| 5                                               | 2   | C9, C15                   | CAP., X5R, 0.1 $\mu$ F, 25V, 10%, 0603       | AVX, 06033D104KAT                 |
| 6                                               | 1   | R4                        | RES., CHIP, 90.9k, 1/16W, 1%, 0603           | VISHAY, CRCW060390K9FKEA          |
| 7                                               | 1   | R11                       | RES., CHIP, 10 $\Omega$ , 1/16W, 1%, 0603    | VISHAY, CRCW060310R0FKEA          |
| 8                                               | 1   | U1                        | I.C., LTM4625EY                              | LINEAR TECH., LTM4625EY#PBF       |
| <b>Additional Demo Board Circuit Components</b> |     |                           |                                              |                                   |
| 1                                               | 1   | C10                       | CAP., X5R, 22 $\mu$ F, 25V, 10%, 7343        | SANYO, 25TQC22MV                  |
| 2                                               | 0   | C11, C14                  | CAP., 1210, OPTION                           | OPTION                            |
| 3                                               | 0   | C5                        | CAP., 1206, OPTION                           | OPTION                            |
| 4                                               | 3   | C4, C6, C18               | CAP., X5R, 1 $\mu$ F, 10V, 10%, 0603, OPTION | TAIYO YUDEN, LMK107BJ105KA-T      |
| 5                                               | 0   | C7, C19                   | CAP., 0603, OPTION                           | OPTION                            |
| 6                                               | 0   | C17                       | CAP., 7343, OPTION                           | OPTION                            |
| 7                                               | 1   | C2                        | CAP., X5R, 10 $\mu$ F, 16V, 20%, 0805        | TAIYO YUDEN, EMK212ABJ106KG-T     |
| 8                                               | 1   | C16                       | CAP., X5R, 22 $\mu$ F, 6.3V, 20%, 0805       | TAIYO YUDEN, JMK212ABJ226MD-T     |
| 9                                               | 1   | C8                        | CAP., X7R, 100pF, 50V, 10%, 0603             | AVX, 06033C101KAT2A               |
| 10                                              | 1   | Q1                        | N-CHANNEL 30V MOSFET, TO-252                 | VISHAY, SUD50N03-09P-E3           |
| 11                                              | 1   | RS2                       | RES., CHIP, 0.05 $\Omega$ , 1W, 1%, 2512     | VISHAY, WSL2512R0500FEB           |
| 12                                              | 1   | R3                        | RES., CHIP, 10k, 1/16W, 1%, 0603             | VISHAY, CRCW060310K0FKEA          |
| 13                                              | 7   | R5, R6, R7, R14, R15, R16 | RES., CHIP, OPTION, 1/16W, 1%, 0603          | OPTION                            |
| 14                                              | 0   | R1, R12, R2               | RES., CHIP, OPTION, 1/16W, 1%, 0603          | OPTION                            |
| 15                                              | 1   | R8, R10                   | RES., CHIP, 100k, 1/16W, 1%, 0603            | VISHAY, CRCW0603100KFKEA          |
| 16                                              | 1   | R9                        | RES., CHIP, 150k, 1/16W, 1%, 0603            | VISHAY, CRCW0603150KFKEA          |
| 17                                              | 1   | R13                       | RES., CHIP, 0 $\Omega$ , 1/16W, 1%, 0603     | VISHAY, CRCW06030000Z0EA          |
| <b>Hardware</b>                                 |     |                           |                                              |                                   |
| 1                                               | 11  | E1-E13                    | TESTPOINT, TURRET, .095"                     | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 2                                               | 7   | JP1-JP4, JP8-JP10         | 2mm SINGLE ROW HEADER, 2-PIN                 | SAMTEC, TMM102-02-L-S             |
| 3                                               | 1   | JP6                       | 2mm DOUBLE ROW HEADER, 2 x 2 PIN             | SAMTEC, TMM-102-02-L-D            |
| 4                                               | 1   | JP7                       | 2mm SINGLE ROW HEADER, 3-PIN                 | SAMTEC, TMM-103-02-L-S            |
| 5                                               | 2   | J5, J6                    | CONN, BNC, 5 PINS                            | CONNEX, 112404                    |
| 6                                               | 3   | JP1, JP6, JP7             | SHUNT                                        | SAMTEC, 2SN-BK-G                  |
| 7                                               | 4   | STAND OFF                 | STAND OFF, SNAP ON                           | KEYSTONE _8832                    |

SCHEMATIC DIAGRAM



# DEMO MANUAL DC2171A-B

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Mailing Address:

Linear Technology  
1630 McCarthy Blvd.  
Milpitas, CA 95035

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#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.