# PI33xx-xx-EVAL1 Cool-Power® ZVS Buck Regulator Evaluation Board

Contents Page


*Introduction* 1

*Evaluation Board Supply & Load Connections* 2

*Bill of Materials* 3

*Evaluation Board Notes* 4

*Optional Test Points & Component Locations* 4

*Board Dimensions* 4

*PCB Metal Layers* 4


## Introduction

The PI33xx-xx-EVAL1 evaluation board demonstrates the features and benefits of the Picor Cool-Power® ZVS Buck Regulator PI33XX family. The board features the ZVS Buck Regulator SIP (U1), along with inductor (L1), ceramic input (C1-C8), and output capacitors (C10-C16).

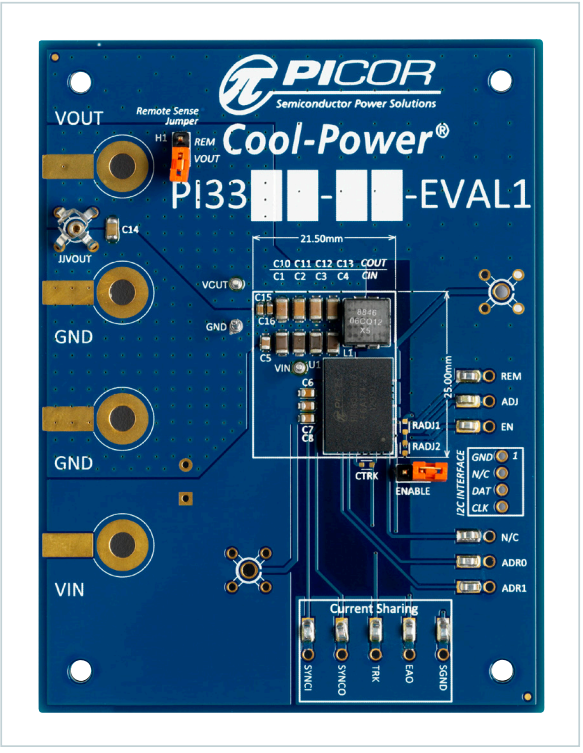
The evaluation board provides several options for making input power (Vin and GND) and output load (Vout and GND) connections. The user can solder tab style banana jacks or wire, use threaded binding posts secured by a retaining nut, or to simply use a #6 nut and bolt connection.

All the I/O pins are labeled and routed to the board edge for easy access. Each I/O pin is accompanied with an adjacent 50 mil through-hole for adding a test point or to facilitate wiring to external circuitry.

The board has a scope tip jack for measuring output voltage (Vout), and has locations for two optional jacks for measuring Vin and the switching node of the regulator (See Figure 4). There are two headers installed: an ENABLE jumper which can be used to enable or disable the converter and the remote sense jumper (H1) that will connect the buck's remote sense pin to the output at the Vout terminal.

Figure 1.

PI33xx-xx-EVAL1 Evaluation Board*




** RSYNCI resistor not shown*

## Introduction (Cont.)

For PI33XX-20 regulators only, there is a location for a 4-pin I²C header that allows users to set certain device parameters and to read the fault registers of the regulator. Each regulator can be assigned an address from 0 to 7 using the two tri-state address pins (ADR0 and ADR1).

Connections required for parallel regulator operation are grouped together (labeled Current Sharing) to allow for easy connection between evaluation boards. There is a zero ohm jumper between SYNCI and SGND to ensure that SYNCI is grounded when not used for paralleling PI33XX regulators. This resistor must be removed for parallel operation.

There are two unpopulated resistor footprints (RADJ1 and RADJ2) used in trimming the output voltage and a capacitor footprint (CTRK) to add additional capacitance to the output tracking pin. Please refer to the product datasheet for more detailed information on these topics.

The evaluation board is constructed using 4 layers of 2 oz copper and is routed to optimize the regulation path between input and output voltage, which reduces the parasitic losses and yields the best efficiency.

## Evaluation Board Supply & Load Connections

Figure 2 displays the recommended connections for input supply and output loading, and the best test points for measuring input and output voltages. All the I/O pins are brought out to the edge to allow for easy measurement and/or connection to the user's external circuitry.

Figure 2.
Evaluation Board Measurement Connection

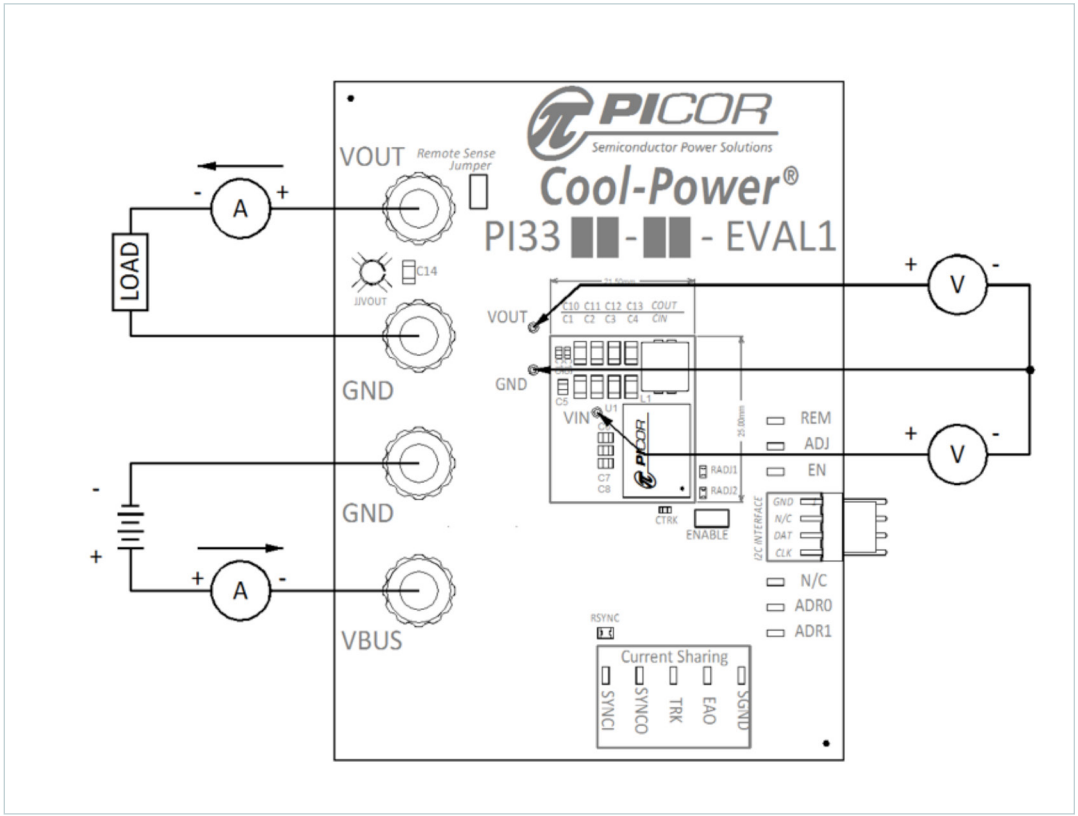
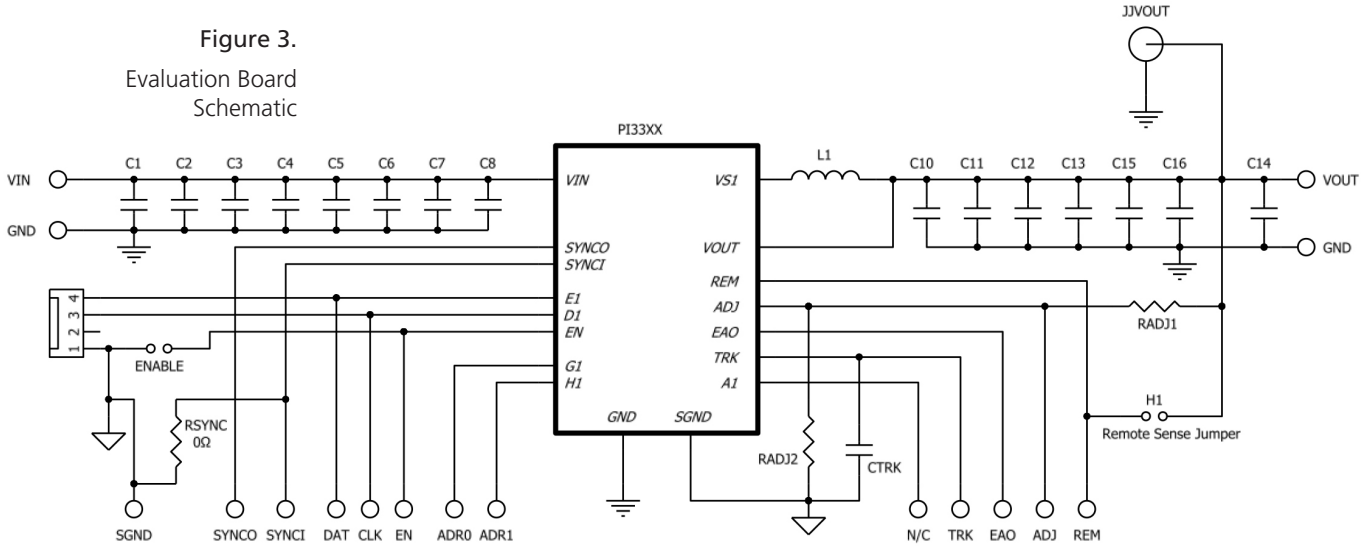


Figure 3.
Evaluation Board Schematic




## Bill of Materials

Table 1.
Bill of Material
Picor Cool-Power®
ZVS Buck Regulator
Evaluation Board

| Device | Qty | Designators | Value | Description | Manufacturer | Part Number |
|---|---|---|---|---|---|---|
| **PI3312** | 1 | U1 | 2.5 V ZVS Regulator | ZVS Regulator | PICOR | PI3312-00-LGIZ |
| | 4 | C10, C11 C12, C13 | 100 µF 6 V | Ceramic Output Capacitor | Murata | GRM31CR60J107ME39L |
| | 1 | L1 | 200 nH | Buck Inductor | Cooper | FPT705-200-R |
| **PI3301** | 1 | U1 | 3.3 V ZVS Regulator | ZVS Regulator | PICOR | PI3301-00-LGIZ |
| | 4 | C10, C11 C12, C13 | 100 µF 6V | Ceramic Output Capacitor | Murata | GRM31CR60J107ME39L |
| | 1 | L1 | 200 nH | Buck Inductor | Cooper | FPT705-200-R |
| **PI3302** | 1 | U1 | 5 V ZVS Regulator | ZVS Regulator | PICOR | PI3302-00-LGIZ |
| | 4 | C10, C11 C12, C13 | 47 µF 16 V | Ceramic Output Capacitor | Murata | GRM31CR61A476ME15 |
| | 1 | L1 | 200 nH | Buck Inductor | Cooper | FPT705-200-R |
| **PI3303** | 1 | U1 | 12 V ZVS Regulator | ZVS Regulator | PICOR | PI3303-00-LGIZ |
| | 4 | C10, C11 C12, C13 | 22 µF 25 V | Ceramic Output Capacitor | Murata | GRM31CR61E226KE15L |
| | 1 | L1 | 230 nH | Buck Inductor | Cooper | FPT705-230-R |
| **PI3305** | 1 | U1 | 15 V ZVS Regulator | ZVS Regulator | PICOR | PI3305-00-LGIZ |
| | 4 | C10, C11 C12, C13 | 22 µF 25 V | Ceramic Output Capacitor | Murata | GRM31CR61E226KE15L |
| | 1 | L1 | 230 nH | Buck Inductor | Cooper | FPT705-230-R |

## Bill of Materials (Cont.)

Table 1. (Continued)

| Device | Qty | Designators | Value | Description | Manufacturer | Part Number |
|---|---|---|---|---|---|---|
| Common | 10 | ADJ, ADR0 ADR1, EAO EN, REM SGND, SYNCI SYNCO, TRK | | SM Testpoint | Keystone | 5015 |
| | 4 | C1, C2 C3, C4 | 4.7 µF 50 V | Ceramic Capacitor 50 V, X7R | Murata | GRM31CR71H475KA12L |
| | 4 | C5, C6 C7, C8 | 0.1 µF 50 V | Ceramic Capacitor | TDK | C2012X7R1H104K |
| | 1 | C14 | 0.1 µF 50 V | Ceramic Capacitor | Murata | RM319R71H104KA01D |
| | 2 | C15, C16 | 1 µF 50 V | Ceramic Capacitor | Murata | GRM188R71C105KA12J |
| | 1 | CTRK | 47 nF | Ceramic Capacitor | Murata | GRM188F51H473ZA01D |
| | 2 | ENABLE H1 | | Header Jumper | Samtec | TSW-148-07-F-S |
| | 3 | GND, VIN VOUT | | TH Testpoint | Vector | K24 |
| | 1 | JJVOUT | | Johnson Jack | Tektronix | 131503100 |
| | 1 | PCB | | PI33XX-xx-EVAL1 PCB | PICOR | PCB0108 |
| | 1 | RSYNCI | 0 Ω | 0603 Resistor | Rohm | MCR03EZPJ000 |
| User Optional | 2 | RADJ1 RADJ2 | User Defined | 0603 Trim resistors | TBD | TBD |
| | 2 | JJVIN JJVSW | Optional | Scope Tip Jack | Tektronix | 131503100 |

## Evaluation Board Notes

The evaluation board has solder mask openings on the bottom side of the board to allow for the option of additional output capacitance (4 x 1206 or 2 x 1812).

There are two additional, unmarked, scope tip test points (circled in red in figure 4) that allow the user to measure VIN and the switching node (VS1). These are labeled as JJVIN and JJVSW in Figure 4.

There are two thru-hole pads (blue circle) for the addition of an electrolytic bulk storage capacitor. This capacitor is required when the evaluation board is connected to the input voltage source through long leads. A 100 µF, 50 V Electrolytic is recommended with an ESR between 20 and 50 mΩ.

The two pins labeled as "N/C" (highlighted in green box in figure 4) are not electrically connected to each other.

There is an internal connection within the PI33xx between grounds SGND and PGND. It is not required to tie these two grounds together externally and these two grounds are not connected together on the evaluation board.

Figure 4.

Optional Test Points & Component Locations

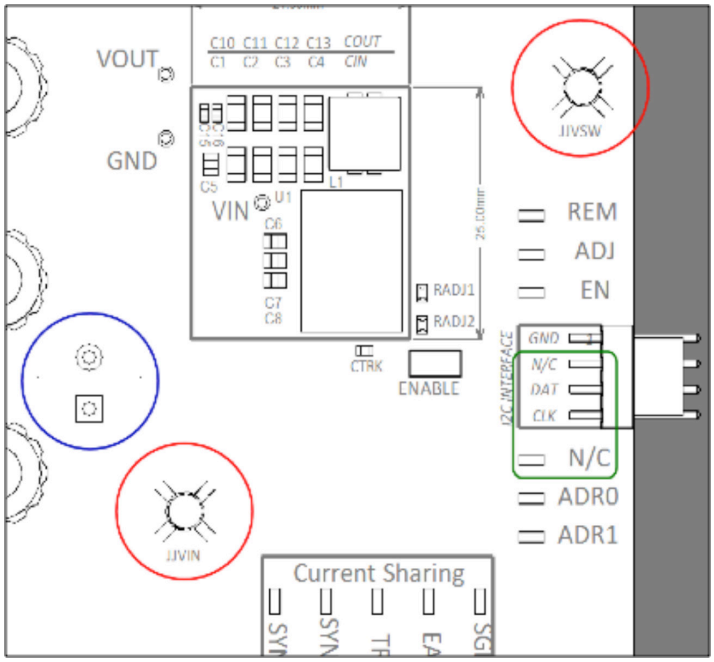



Figure 5.

PI33xx-xx-Eval1 Board Dimensions

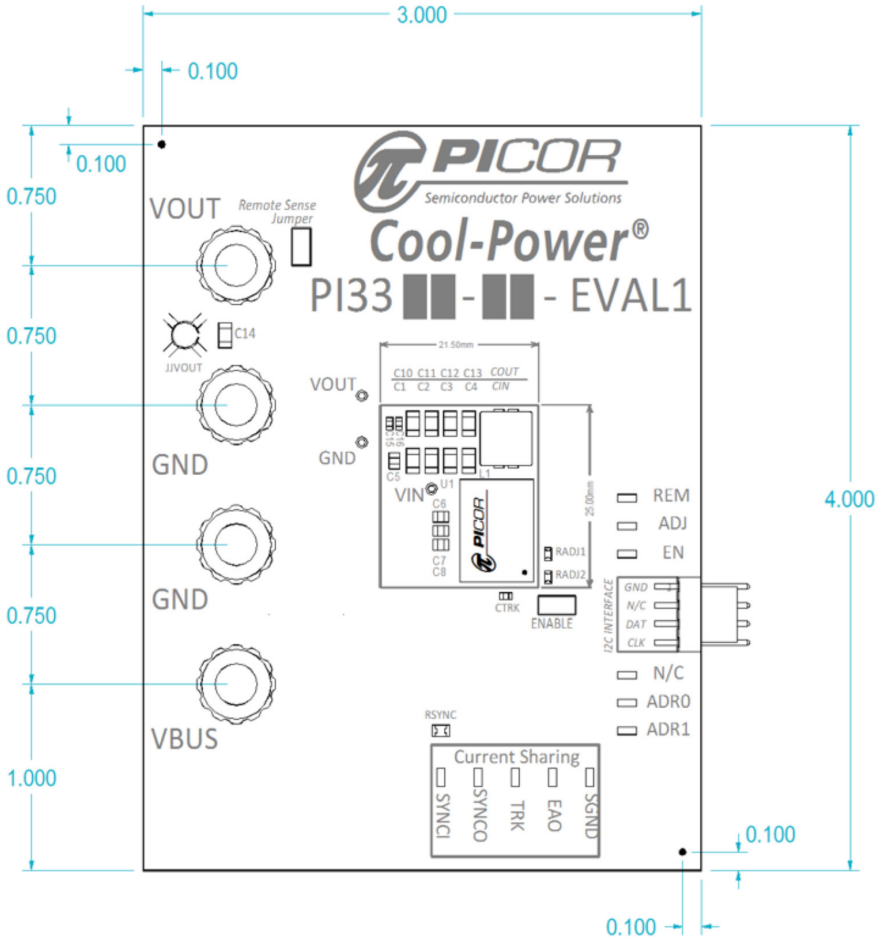
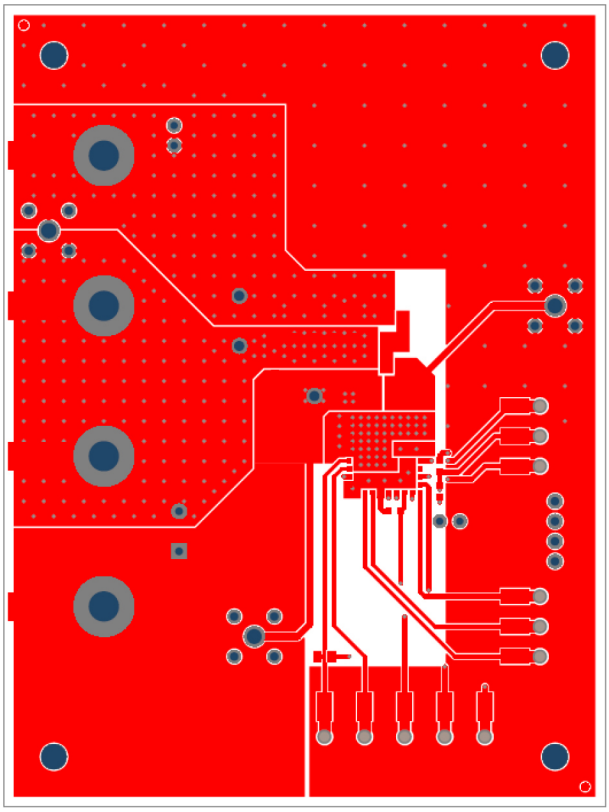
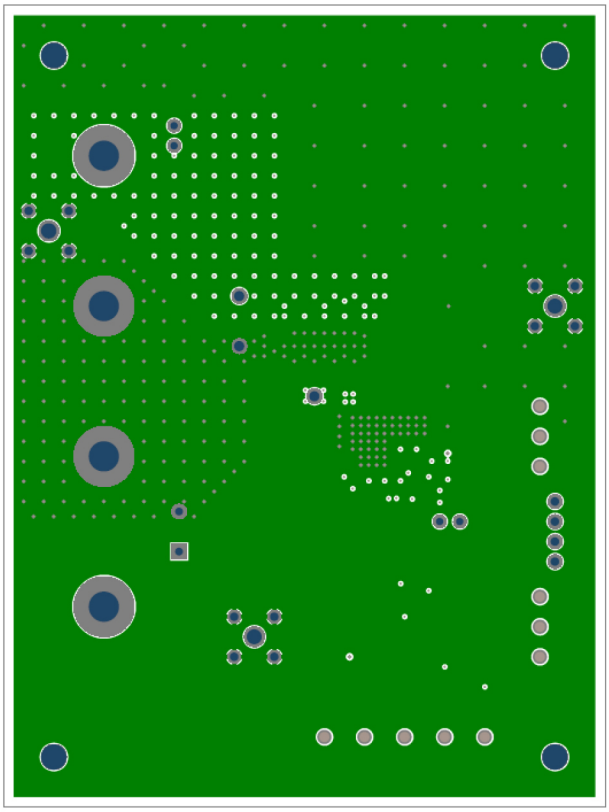


Figure 6.
PCB Metal Layers

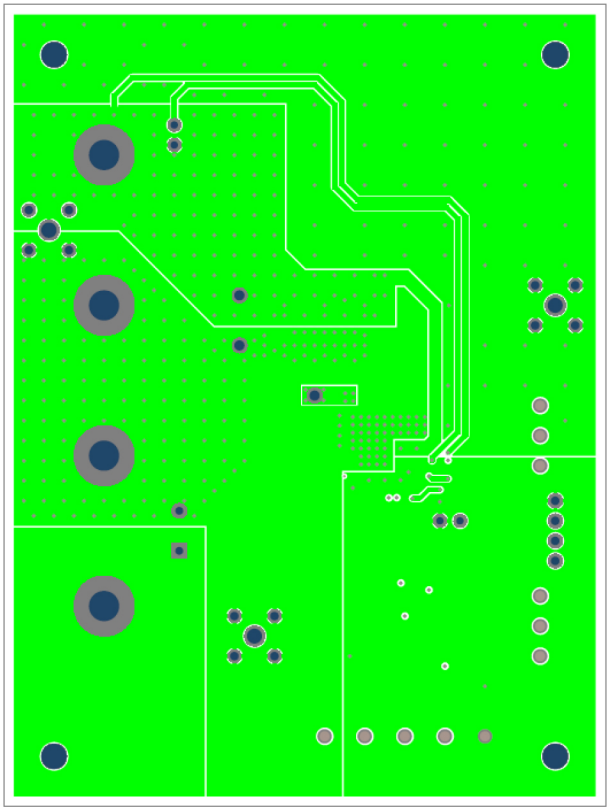
Top - Copper



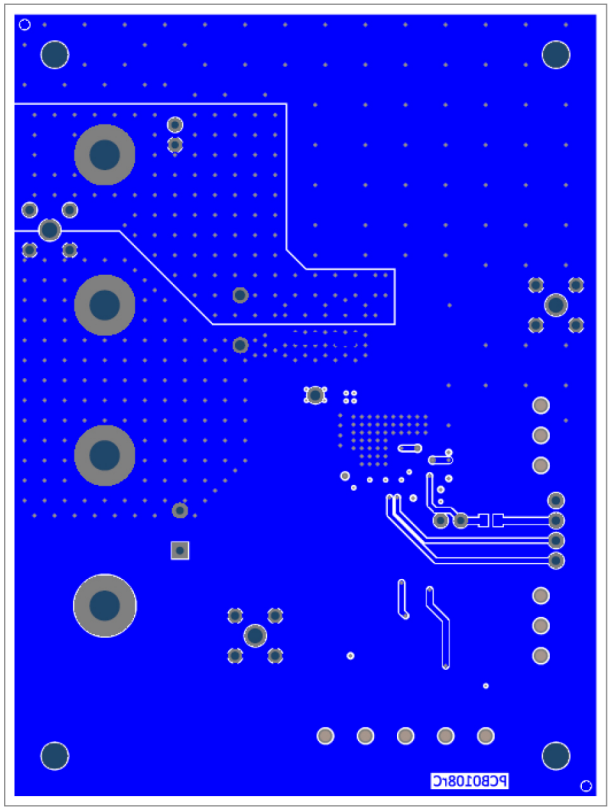
Mid Layer 1 - Copper



Mid Layer 2 - Copper



Bottom - Copper



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**Телефон:** +7 812 627 14 35

**Электронная почта:** sales@st-electron.ru

**Адрес:** 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331