

# ISL9230EVAL1Z Evaluation Board Application Manual

## Description

The ISL9230 is a fully integrated high input voltage single-cell Li-ion battery charger with power path management function. This charger performs the CC/CV charge function required by Li-ion batteries. The charger can withstand an input voltage up to 26V but is disabled when the input voltage exceeds 6.6V OVP threshold. The input current limit and charge current are programmable with external resistors. When the battery voltage is lower than 3.0V, the charger preconditions the battery with 10% of the programmed charge current. When the charge current reduces to the programmable end-of-charge (EOC) current level during the CV charge phase, the EOC indicator ( $\overline{\text{CHG}}$ ) will toggle to a logic High to indicate the end-of-charge condition.

The ISL9230 uses separate power paths to supply the system load and charge the battery. This feature allows the system to immediately operate with a completely discharged battery. This feature also allows the charge to terminate when the battery is full while continuing to supply the system power from the input source, thus minimizing unnecessary charge/discharge cycles and prolonging the battery life.

Two indication pins ( $\overline{\text{PG}}$  and  $\overline{\text{CHG}}$ ) allow simple interface to a microprocessor or LEDs.

## Ordering Information

| PART #        | DESCRIPTION                  |
|---------------|------------------------------|
| ISL9230EVAL1Z | Evaluation Board for ISL9230 |

## Features

- Complete Charger for Single-Cell Li-ion/Polymer Batteries
- Current Path Management Optimize for Charge and System Currents
- Intelligent Timeout Interval Based on Actual Charge Current
- 1% Charger Output Voltage Accuracy
- Programmable Input Current Limit
- Programmable Charge Current
- Charge Current Thermal Foldback for Thermal Protection
- Trickle Charge for Fully Discharged Batteries
- 26V Maximum Voltage at VIN Pin
- Power Presence and Charge Indications
- Ambient Temperature Range: -40 °C to +85 °C
- 16 Ld 3x3 TQFN Package
- Pb-Free (RoHS Compliant)

## What is Needed

The following instruments will be needed to perform testing:

- Power Supplies:
  - PS1: DC 30V/2A
  - PS2: DC 20V/2A
- DC Electronic Load: 20V/2A
- Multimeters
- Function Generator
- Oscilloscope
- Cables and Wires

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## Quick Setup Guide (Refer to Figure 1)

**DO NOT APPLY POWER UNTIL STEP 7**

- Step 1: Connect a 5V supply PS1 capable of delivering 1.5A current (see Figure 1)
- Step 2: Connect a 3.7V supply PS2 with current capability 1.5A (see Figure 1)
- Step 3: Connect voltmeters V1, V2 and V3 to monitor VIN, VBAT and VOUT (see Figure 1)
- Step 4: Connect a 2nd DC electronic load at CC mode, E-load 2 (see Figure 1)
- Step 5: Insert a thermistor of type 103AT between 2 and 3 of jumper header JP9, or place a jumper shunt between pin 1 and 2 to use the on board 10k resistor to skip the NTC evaluation

- Step 6: Configure jumper shunts on JP12, JP13, JP4 and JP5 to set maximum input current limit
- Step 7: Turn on Power Supplies and DC electronic load
- Step 8: LEDs D1 and D2 should be on, indicating normal charging operation
- Step 9: Turn off E-load 2 to check charge current only
- Step 10: Check charge currents as configured in Table 3
- Step 11: With a fixed charge current at CC mode, turn on E-load 2 at constant current mode and slowly increase the current, monitor the currents out of both J1 and J3, until the current at J1 starts to decrease. Further increase of the current at J3 will result in a current decrease at J1 at the same rate, indicating that the power DPPM function is working

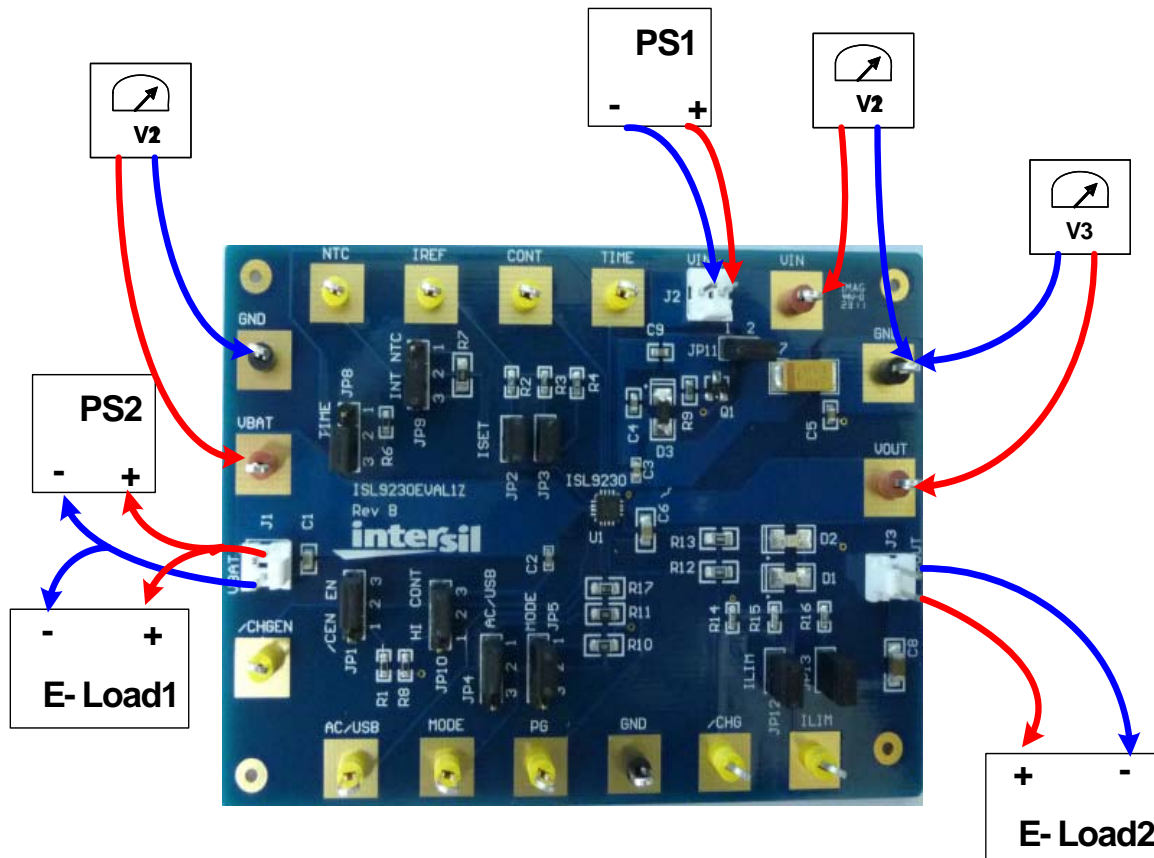


FIGURE 1. CONNECTION OF INSTRUMENTS

## Detailed Description

The ISL9230EVAL1Z is a complete evaluation platform addressing all datasheet specifications and functions. The jumpers on the board facilitate the necessary connections, such as current measurement.

### Jumper Settings

**JP1** - Insert a shunt installed between pin1 and pin2 to disable the charging function. Install a shunt between pin2 and pin3 to enable the charging function.

**JP2** - Install or remove a jumper shunt to set the fast charge current as shown in Table 3.

**JP3** - Install or remove a jumper shunt to set the fast charge current as shown in Table 3.

**JP4** - Selects the input current limit along with JP5, as shown on Table 2. A shunt installed between pin1 and pin2 pulls the AC/USB pin to high through the internal pull-up resistor. If a shunt is installed between 2 and 3, the AC/USB is pulled to low.

**JP5** - Selects the input current limit along with JP4, as shown in Table 2. A shunt installed between pin1 and pin2 pulls the Mode pin to high through the internal pull-up resistor. If a shunt is installed between 2 and 3, the Mode is pulled to low.

**JP8** - A shunt installed between pin1 and pin2 sets the TIME pin to use the on board resistor (49.9k) to set the timeout interval. If the shunt is installed between pin2 and pin3, the default timeout is used. Connect an external resistor on pin2 and pin3 to set other timeout intervals.

**JP9** - Thermistor input. Connect a thermistor of type 103AT with 10k @ RT, between pin2 and pin3. If temperature monitoring is not needed, simply install a jumper shunt on pin1 and pin2 to connect the on board 10k resistor to GND to skip the NTC function.

**JP10** - A shunt installed between pin1 and pin2 sets the continuous mode, i.e., the charger continues to deliver current to the battery after an EOC condition has been reached. If the shunt is installed between pin2 and pin3, the charge will be terminated when the EOC current is reached.

**JP11** - Install a jumper shunt to use VIN as the bias power for the LEDs and the internal pull-up source. If an external source is used for these housekeeping sources, connect a 5V supply between pin 1 and GND.

**JP12** - Install or remove a jumper shunt to set the input current limit as shown in Table 2.

**JP13** - Install or remove a jumper shunt to set the input current limit as shown in Table 2.

**TABLE 1. INPUT CURRENT LIMIT SETTINGS FOR AC/USB = 1 AND MODE = 0**

|                      | RESISTOR VALUE | ILIM   |
|----------------------|----------------|--------|
| JP12 and JP13 OFF    | 3.09k          | 493mA  |
| JP12 ON and JP13 OFF | 1.62k          | 993mA  |
| JP12 OFF and JP13 ON | 1.56k          | 1030mA |
| JP12 and JP13 ON     | 1.07k          | 1505mA |

**TABLE 2. INPUT CURRENT LIMIT SELECTION**

| JUMPER                               | AC/USB | MODE | DESCRIPTION                          |
|--------------------------------------|--------|------|--------------------------------------|
| Shunt on 2-3 JP4<br>Shunt on 2-3 JP5 | 0      | 0    | USB 100mA limit                      |
| Shunt on 2-3 JP4<br>Shunt on 1-2 JP5 | 0      | 1    | USB 500mA limit                      |
| Shunt on 1-2 JP4<br>Shunt on 2-3 JP5 | 1      | 0    | R <sub>LIM</sub> current programming |
| Shunt on 1-2 JP4<br>Shunt on 1-2 JP5 | 1      | 1    | Suspend mode                         |

**TABLE 3. FAST CHARGE CURRENT SETTINGS**

|                    | RESISTOR VALUE | ICHG   |
|--------------------|----------------|--------|
| JP2 and JP3 OFF    | 1.96k          | 454mA  |
| JP2 ON and JP3 OFF | 1.1k           | 809mA  |
| JP2 OFF and JP3 ON | 1.08k          | 820mA  |
| JP2 and JP3 ON     | 0.68k          | 1309mA |

# Board Layout Information

## Schematic of PCB Board

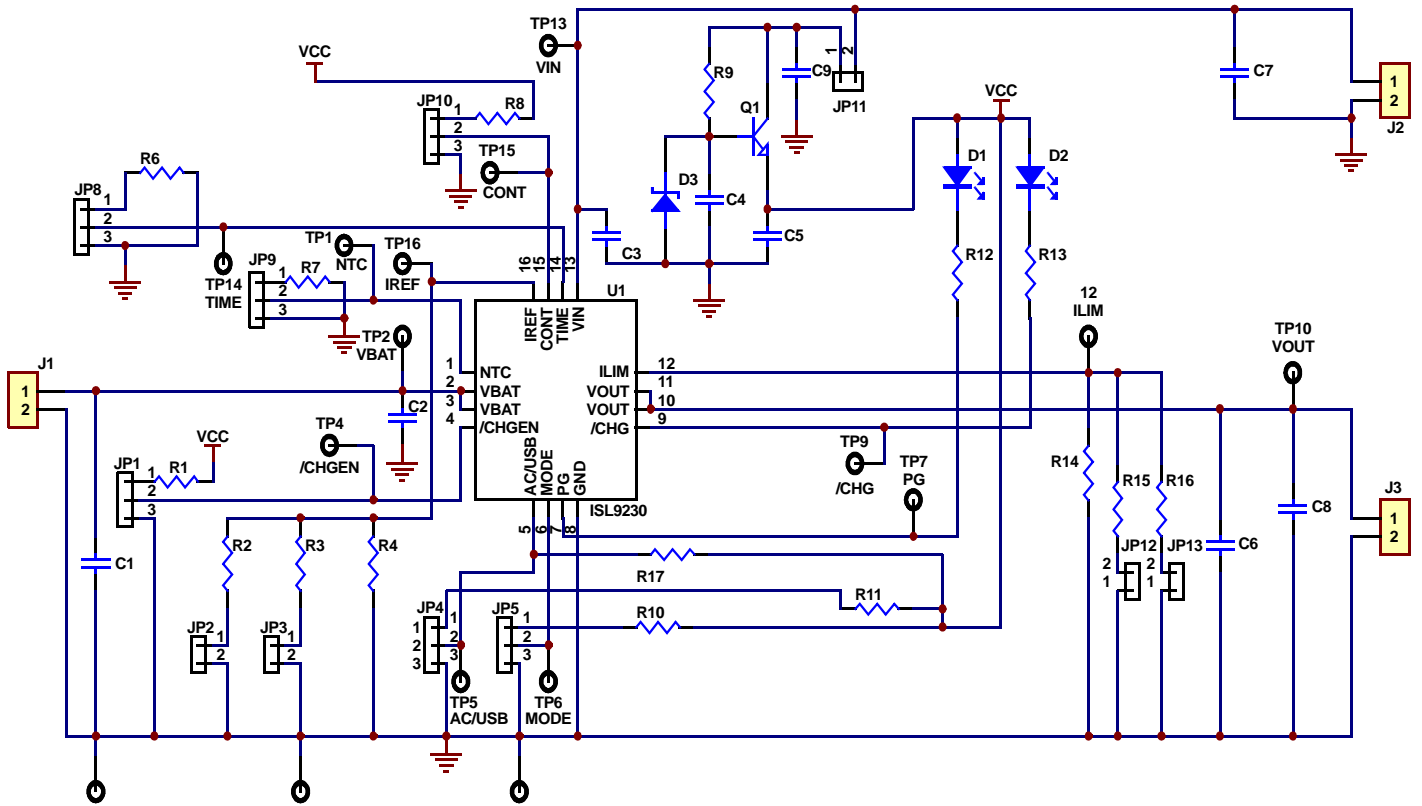


FIGURE 2. SCHEMATIC

## PCB Layout

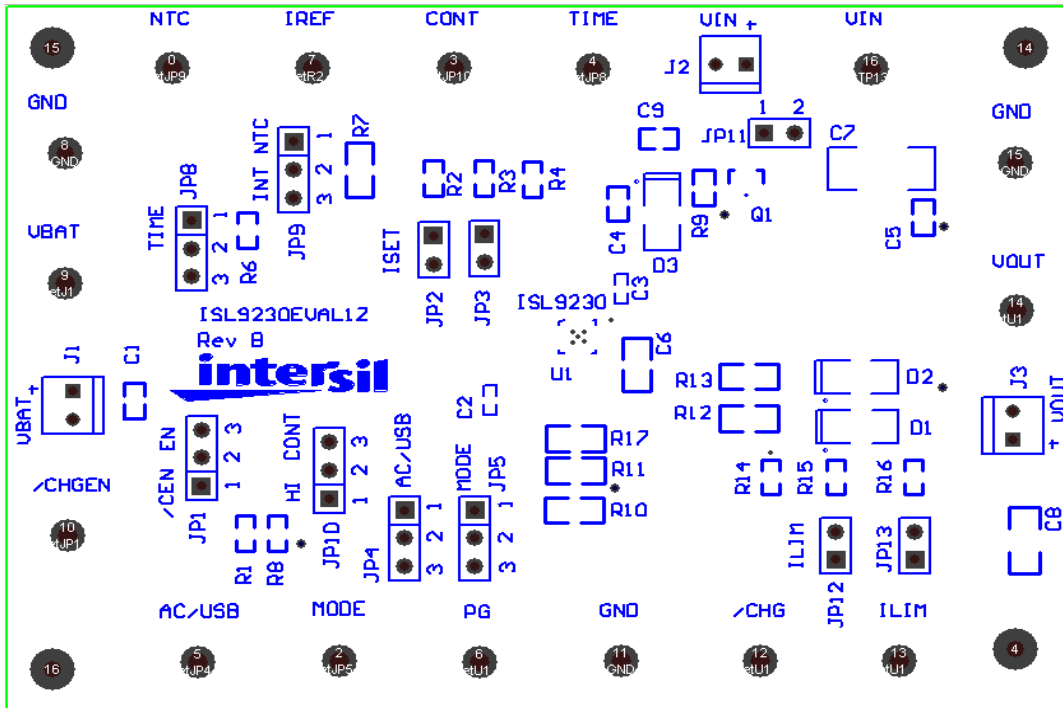


FIGURE 3. SILK LAYER

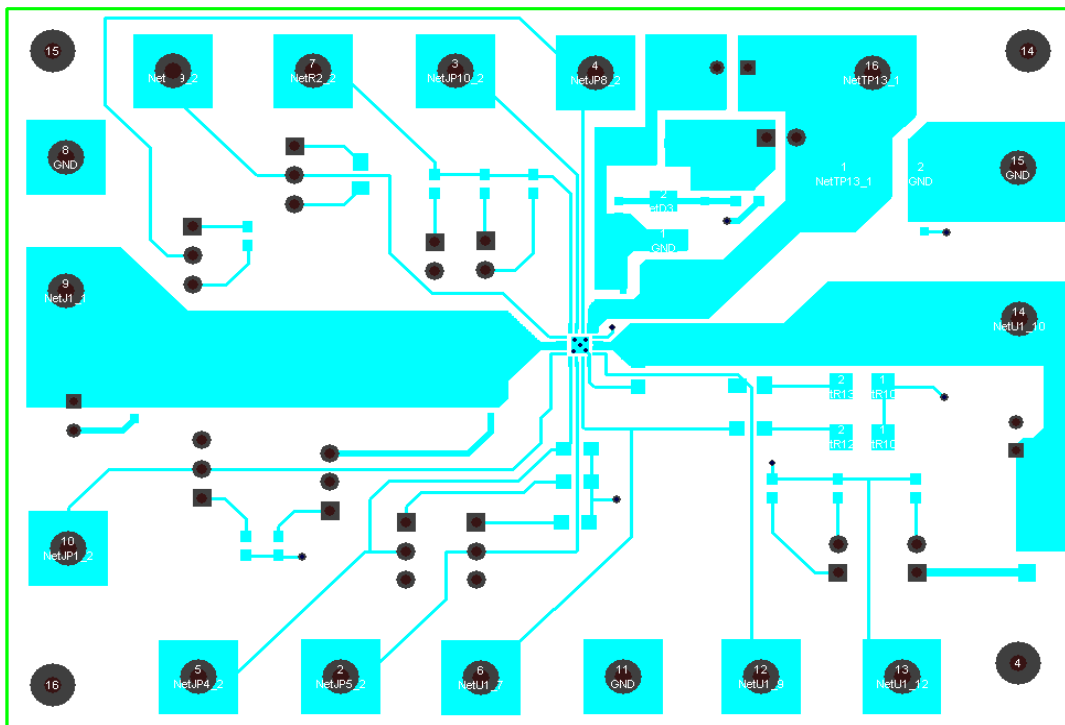


FIGURE 4. TOP LAYER

## PCB Layout (Continued)

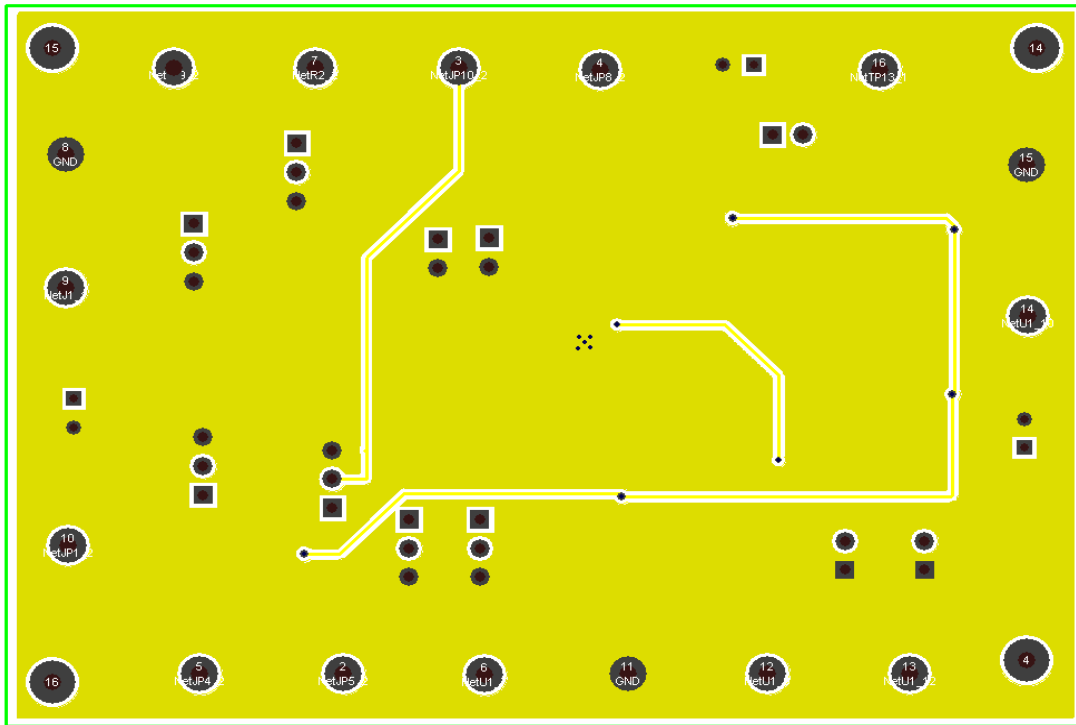


FIGURE 5. BOTTOM LAYER

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### ISL9230EVAL1Z Bill Of Materials

| ITEM | QTY | REFERENCE                     | PART DESCRIPTION         | PCB FOOTPRINT                   | PART NUMBER    | VENDOR    |
|------|-----|-------------------------------|--------------------------|---------------------------------|----------------|-----------|
| 1    | 1   | U1                            | Charger IC               | 3x3 TQFN                        | ISL9230        | Intersil  |
| 2    | 2   | R1, R8                        | 10k                      | 0603                            |                | Any       |
| 3    | 1   | R2                            | 1.96k 1%                 | 0603                            |                | Any       |
| 4    | 1   | R3                            | 2.49k, 1%                | 0603                            |                | Any       |
| 5    | 1   | R4                            | 2.43k, 1%                | 0603                            |                | Any       |
| 6    | 1   | R6,                           | 49.9k, 1%                | 0603                            |                | Any       |
| 7    | 3   | R7, R10, R11                  | 10k, 1%                  | 0805                            |                | Any       |
| 8    | 1   | R9                            | 3.3k, 5%                 | 0603                            |                | Any       |
| 9    | 2   | R12, R13                      | 330Ω, 5%, SMD Resistor   | 0805                            | ERJ-6GEYJ331V  | Panasonic |
| 10   | 1   | R14                           | 3.09k 1%                 | 603                             |                | Any       |
| 11   | 1   | R15                           | 3.4k 1%                  | 603                             |                | Any       |
| 12   | 1   | R16                           | 3.16k 1%                 | 603                             |                | Any       |
| 13   | 1   | R17                           | 301k 1%                  | 0805                            |                | Any       |
| 14   | 1   | C1                            | 2.2μF/6.3V, X7R Ceramic  | 0603                            |                | Any       |
| 15   | 1   | C2                            | 0.1μF/6.3V, X7R Ceramic  | 0402                            |                | Any       |
| 16   | 1   | C3                            | 0.1μF/35V, X7R Ceramic   | 0402                            |                | Any       |
| 17   | 3   | C4, C5, C9                    | 0.1μF, 50V, X7R Ceramic  | 0603                            | ECJ-1VB1H104K  | Panasonic |
| 18   | 1   | C6                            | 0.1μF, 50V, X7R Ceramic  | 805                             |                | Any       |
| 19   | 1   | C7                            | 4.7μF, 35V, Tantalum     | 6032-28                         | ECS-T1VC475R   |           |
| 20   | 1   | C8                            | 4.7μF, 6.3V, X7R Ceramic | 1206                            |                | Any       |
| 21   | 1   | D1                            | RED                      | SML-LX1206IW-TR                 | 67-1003-2-ND   | Digikey   |
| 22   | 1   | D2                            | GREEN                    | SML-LX1206GW-TR                 | 67-1002-2-ND   | Digikey   |
| 23   | 1   | D3                            | DIODE ZENER 6.2V 500MW   | SOD-123                         | BZT52C6V2-7-F  | Digikey   |
| 24   | 1   | Q1                            | 60V, 1A NPN transistor   | SOT-23                          | FMMT491TA      | Zetex     |
| 25   | 10  | General test points           | TEST POINT               | TEST POINT PC MULTI PURPOSE YEL | 5014K-ND       | Digikey   |
| 26   | 3   | GND                           | TEST POINT               | TEST POINT PC MULTI PURPOSE BLK | 5011K-ND       | Digikey   |
| 27   | 3   | VIN, VBAT, VOUT               | TEST POINT               | TEST POINT PC MULTI PURPOSE RED | 5010K-ND       | Digikey   |
| 28   | 5   | JP2, JP3, JP11, JP12, JP13    | CON2                     | JUMPER                          | 538-22-28-4020 | Mouser    |
| 29   | 6   | JP1, JP4, JP5, JP8, JP9, JP10 | CON3                     | JUMPER                          | 538-22-28-4020 | Mouser    |
| 30   | 3   | J1, J2, J3                    | CONN                     | CONN HEADER VERT 2POS 0.100 TIN | A1921-ND       | Digikey   |

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