

## Evaluation Board for the ADP2119/ADP2120 Step-Down Regulator

### GENERAL DESCRIPTION

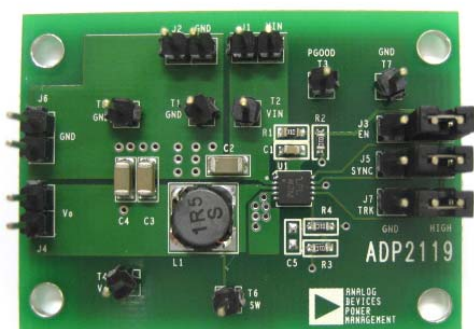
The [ADP2119/ADP2120](#) are synchronous, step-down, dc-to-dc regulators in a compact 3 mm × 3 mm LFCSP\_WD package.

The ADP2119/ADP2120 evaluation boards provide an easy way to evaluate the device. This user guide describes how to quickly set up the board to collect performance data. Full details on the ADP2119/ADP2120 are available in the ADP2119/ADP2120 data sheet, which is available from Analog Devices, Inc., and

should be consulted in conjunction with this user guide when using the evaluation boards.

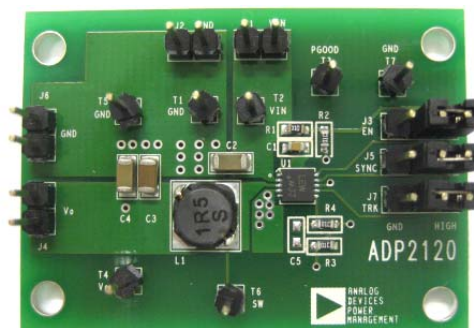
The ADP2119/ADP2120 run from input voltages of 2.3 V to 5.5 V and require minimal external components to provide a high efficiency solution with integrated power switch, synchronous rectifier, and internal compensation.

### ADP2119/ADP2120 EVALUATION BOARDS



09314-001

Figure 1. ADP2119 Evaluation Board



09314-002

Figure 2. ADP2120 Evaluation Board

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REVISION HISTORY

9/10—Revision 0: Initial Version

## SETTING UP THE EVALUATION BOARD

### POWERING UP THE EVALUATION BOARD

The ADP2119/ADP2120 evaluation boards are fully assembled and tested. Before applying power to the evaluation boards, follow the setup procedures in this section.

#### Jumper Settings

Refer to Table 1 for selecting the jumper positions.

Before selecting the jumper positions, make sure that the enable input, EN, is high.

**Table 1. Jumper Settings**

| Jumper         | States                        | Function                                                            |
|----------------|-------------------------------|---------------------------------------------------------------------|
| J3 (EN)        | High<br>Low                   | Enable V <sub>OUT</sub><br>Disable V <sub>OUT</sub>                 |
| J5 (SYNC/MODE) | High<br>Low<br>External clock | Force PWM (FPWM)<br>Enable PFM<br>Synchronize to the external clock |
| J7 (TRK)       | High<br>External voltage      | Tracking function not used<br>Tracking with the external voltage    |

#### Input Power Source Connection

Before connecting the power source to the ADP2119/ADP2120 evaluation boards, make sure that they are turned off. If the input power source includes a current meter, use that meter to monitor the input current.

Connect the positive terminal of the power source to the VIN terminal (J1) on the evaluation boards, and the negative terminal of the power source to the GND terminal (J2) of the board. If the power source does not include a current meter, connect a current meter in series with the input source voltage.

Connect the positive terminal of the power source to the ammeter positive terminal (+), the negative terminal of the power source to the GND terminal (J2) on the evaluation board, and the negative terminal (–) of the ammeter to the VIN terminal (J1) on the board.

#### Output Load Connection

Make sure that the board is turned off before connecting the load. If the load includes an ammeter, or if the current is not measured, connect the load directly to the evaluation board with the positive (+) load connection to the VOUT terminal (J4) and negative (–) load connection to the GND terminal (J6).

If an ammeter is used, connect it in series with the load; connect the positive (+) ammeter terminal to the evaluation board VOUT terminal (J4), the negative (–) ammeter terminal to the positive (+) load terminal, and the negative (–) load terminal to the evaluation board GND terminal (J6).

#### Input and Output Voltmeter Connections

Measure the input and output voltages with voltmeters. Make sure that the voltmeters are connected to the appropriate test

points on the board. If the voltmeters are not connected to the right test point, the measured voltages may be incorrect due to the voltage drop across the leads and/or connections between the boards, the power source, and/or load.

Connect the positive (+) terminal of the input voltage measuring voltmeter to Test Point T2 and the negative (–) terminal to Test Point T1.

Connect the positive (+) terminal of the output voltage measuring voltmeter to Test Point T4 and the negative (–) terminal to Test Point T5.

#### Power On the Evaluation Board

When the power source and load are connected to the ADP2119/ADP2120 evaluation board, it can be powered up for operation. If the input power source is above 2.3 V, the output voltage rises to 1.2 V as the default setting.

### MEASURING EVALUATION BOARD PERFORMANCE

#### Measuring the Switching Waveform

To observe the switching waveform with an oscilloscope, place the oscilloscope probe tip at Test Point T6 with the probe ground connected to GND. Set the oscilloscope to a dc coupling, 2 V/division, and 1 μs/division time base. The switching waveform should alternate between 0 V and approximately the input voltage.

#### Measuring Load Regulation

Load regulation should be tested by increasing the load at the output and measuring the output voltage between the T4 and T5 test points.

#### Measuring Line Regulation

Vary the input voltage and measure the output voltage at a fixed output current. Input voltage can be measured between T2 and T1. The output voltage is measured between T4 and T5.

#### Measuring Efficiency

The efficiency,  $\eta$ , is measured by comparing the input power with the output power.

$$\eta = \frac{V_{OUT} \times I_{OUT}}{V_{IN} \times I_{IN}}$$

#### Measuring Inductor Current

The inductor current can be measured by removing one end of the inductor from the pad on the board and using a wire connected between the pad and the inductor. Then, a current probe can be used to measure the inductor current.

#### Measuring Output Voltage Ripple

To observe the output voltage ripple, place an oscilloscope probe across the output capacitor (C4) with the probe ground lead placed at the negative (–) capacitor terminal and the probe tip placed at the positive (+) capacitor terminal. Set the oscillo-

scope to an ac coupling, 10 mV/division, 2  $\mu$ s/division time base and 20 MHz bandwidth.

A standard oscilloscope probe has a long wire ground clip. For high frequency measurements, this ground clip picks up high frequency noise and injects it into the measured output ripple. Figure 3 shows an easy way to measure the output ripple properly. It requires removing the oscilloscope probe sheath and wrapping a nonshielded wire around the oscilloscope probe. By keeping the ground lengths of the oscilloscope probe as short as possible, true ripple can be measured.

### Output Voltage Change

The ADP2119/ADP2120 evaluation board output is preset to 1.2 V; however, the output voltage can be adjusted using the following equation:

$$V_{OUT} = 0.6 \text{ V} \times \left( \frac{R4 + R3}{R4} \right)$$

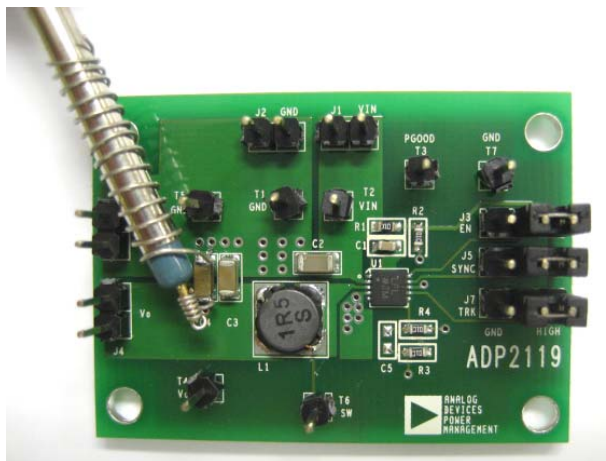


Figure 3. Output Ripple Measurement

## TYPICAL PERFORMANCE CHARACTERISTICS

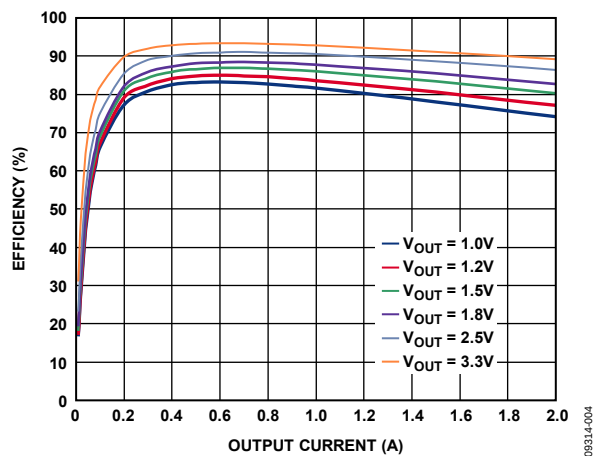
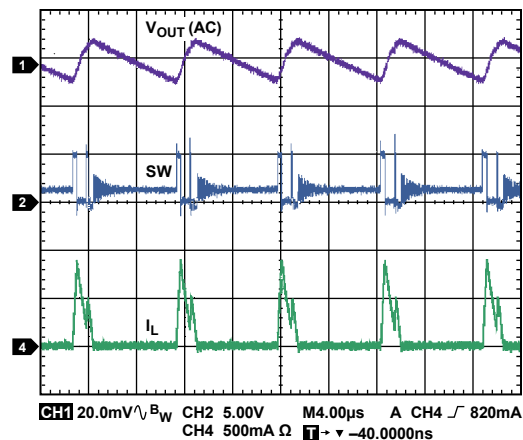
Figure 4. ADP2119 Efficiency,  $V_{IN} = 5V$ , FPWM

Figure 7. PFM Mode (ADP2120)

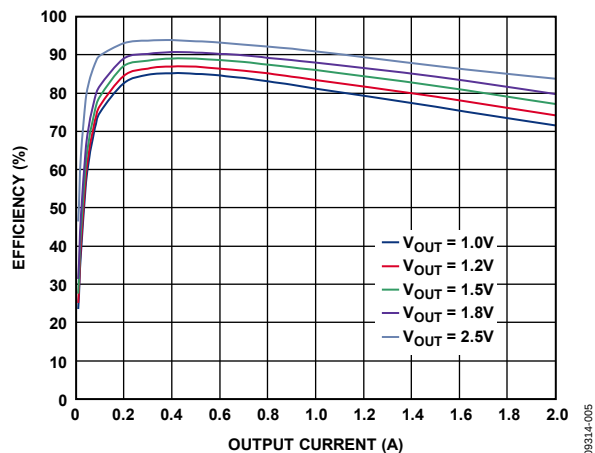
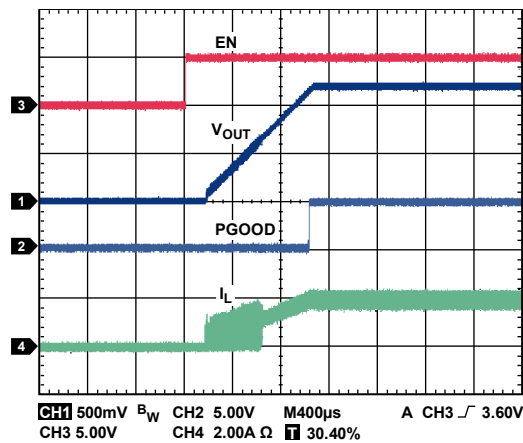
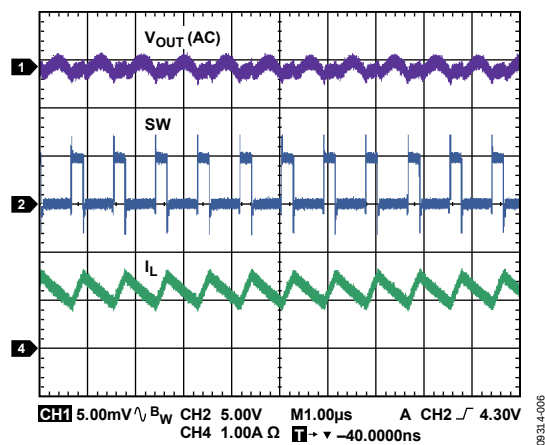
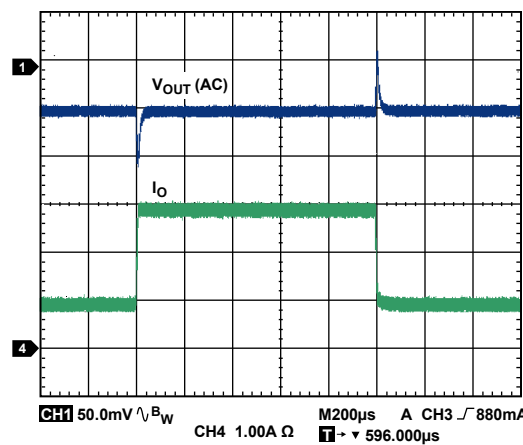
Figure 5. ADP2119 Efficiency,  $V_{IN} = 3.3V$ , FPWMFigure 8. Soft Start (ADP2119,  $V_{IN} = 5V$ ,  $V_{OUT} = 1.2V$ )

Figure 6. Continuous Conduction Mode (ADP2120)

Figure 9. Load Transient (ADP2119, FPWM,  $V_{IN} = 5V$ ,  $V_{OUT} = 1.2V$ )

## EVALUATION BOARD SCHEMATICS AND ARTWORK

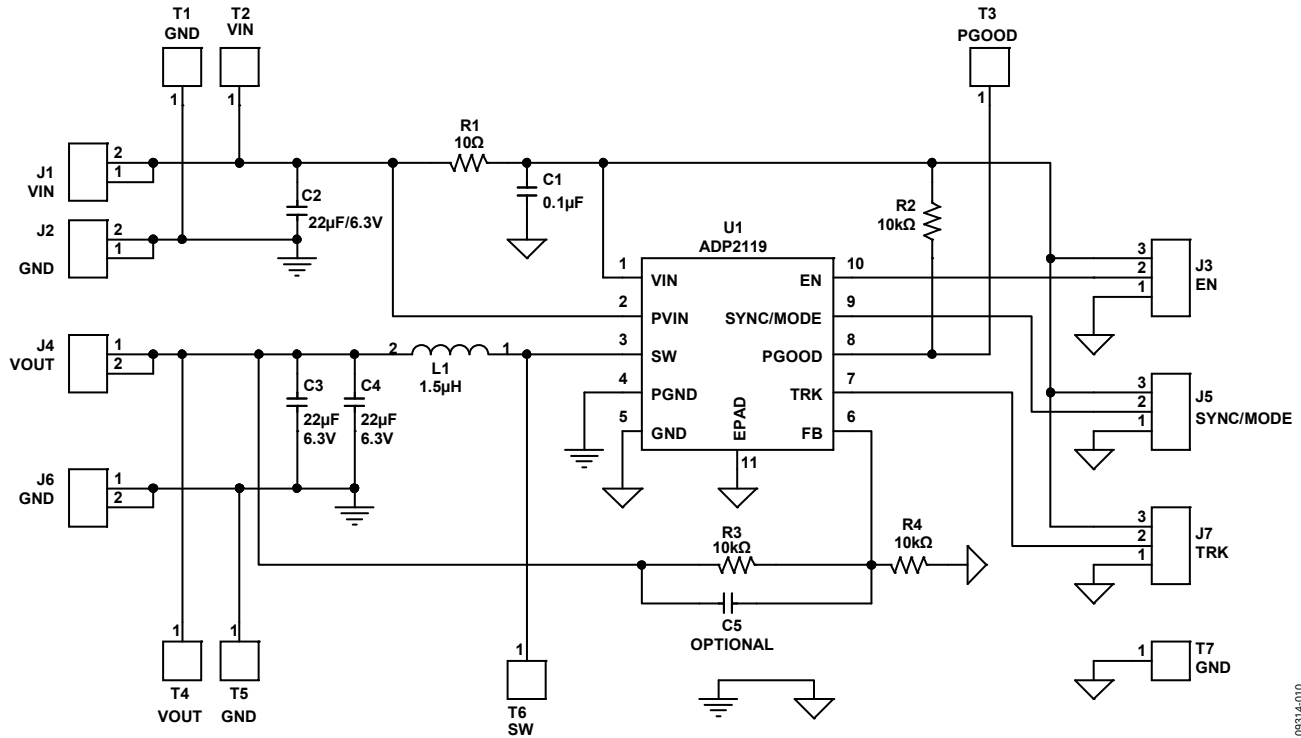


Figure 10. ADP2119 Evaluation Board Schematic

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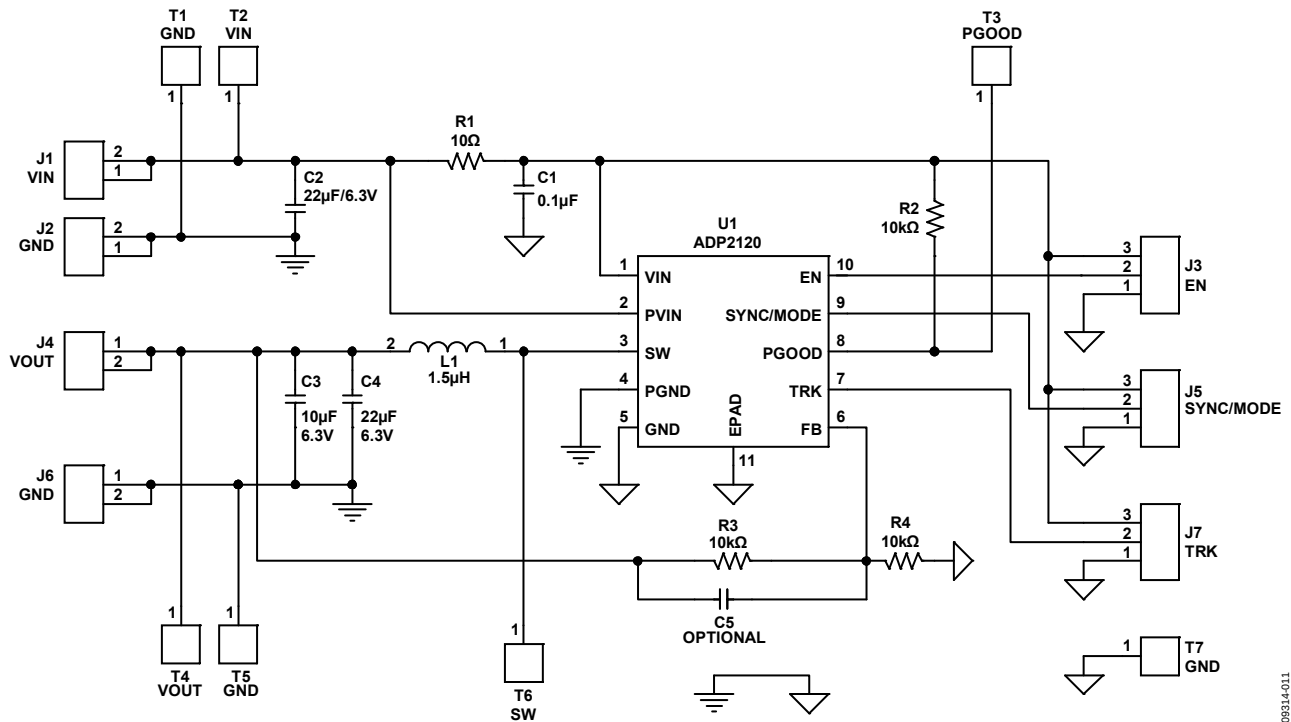
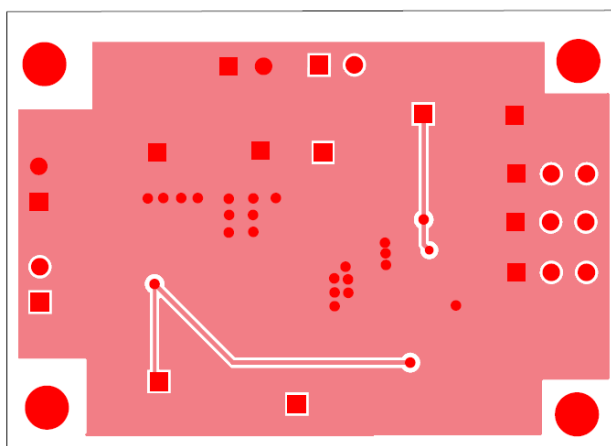


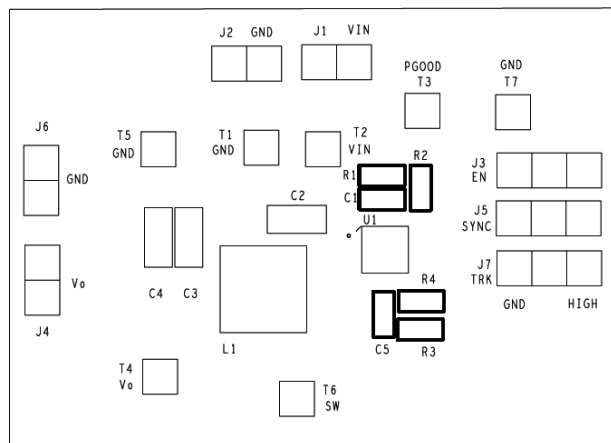
Figure 11. ADP2120 Evaluation Board Schematic

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09314-014



09314-013

## ORDERING INFORMATION

### BILL OF MATERIALS

Table 2. ADP2119 Evaluation Board Bill of Materials

| Qty | Part Reference            | Type       | Description            | PCB Footprint    | Vendor         | Part Number        |
|-----|---------------------------|------------|------------------------|------------------|----------------|--------------------|
| 1   | C1                        | Capacitor  | 0.1 $\mu$ F, 50 V      | C0603            | Murata         | GRM188F51H104ZA01  |
| 3   | C2, C3, C4                | Capacitor  | 22 $\mu$ F, 6.3 V, X5R | C1206            | Murata         | GRM31CR60J226KE19  |
| 1   | C5                        | Capacitor  | Optional               | C0603            | Murata         | Optional           |
| 1   | L1                        | Inductor   | 1.5 $\mu$ H            | Sumida_CDRH5D18  | Sumida         | CDRH5D18BHPNP-1R5M |
| 1   | R1                        | Resistor   | 10 $\Omega$            | R0603            | Vishay Dale    | CRCW060310R0FKEA   |
| 3   | R2, R3, R4                | Resistor   | 10 k $\Omega$ , 1%     | R0603            | Vishay Dale    | CRCW060310K0JKTA   |
| 1   | U1                        | IC         | 2 A buck regulator     | 10-lead LFCSP_WD | Analog Devices | ADP2119ACPZ-R7     |
| 7   | T1,T2, T3, T4, T5, T6, T7 | Test point | SIP1                   | SIP1             | Harwin         | M20-9990245        |
| 4   | J1, J2, J4, J6            | Connector  | SIP2                   | SIP2             | Harwin         | M20-9990245        |
| 3   | J3, J5, J7                | Jumper     | SIP3                   | SIP3             | Harwin         | M20-9990346        |

Table 3. ADP2120 Evaluation Board Bill of Materials

| Qty | Part Reference            | Type       | Description            | PCB Footprint    | Vendor         | Part Number        |
|-----|---------------------------|------------|------------------------|------------------|----------------|--------------------|
| 1   | C1                        | Capacitor  | 0.1 $\mu$ F, 50 V      | C0603            | Murata         | GRM188F51H104ZA01  |
| 2   | C2, C4                    | Capacitor  | 22 $\mu$ F, 6.3 V, X5R | C1206            | Murata         | GRM31CR60J226KE19  |
| 1   | C3                        | Capacitor  | 10 $\mu$ F, 6.3 V, X5R | C1206            | Murata         | GRM319R60J106KE19  |
| 1   | C5                        | Capacitor  | Optional               | C0603            | Murata         | Optional           |
| 1   | L1                        | Inductor   | 1.5 $\mu$ H            | Sumida_CDRH5D18  | Sumida         | CDRH5D18BHPNP-1R5M |
| 1   | R1                        | Resistor   | 10 $\Omega$            | R0603            | Vishay Dale    | CRCW060310R0FKEA   |
| 3   | R2, R3, R4                | Resistor   | 10 k $\Omega$ , 1%     | R0603            | Vishay Dale    | CRCW060310K0JKTA   |
| 1   | U1                        | IC         | 1.25 A buck regulator  | 10-lead LFCSP_WD | Analog Devices | ADP2120ACPZ-R7     |
| 7   | T1,T2, T3, T4, T5, T6, T7 | Test point | SIP1                   | SIP1             | Harwin         | M20-9990245        |
| 4   | J1, J2, J4, J6            | Connector  | SIP2                   | SIP2             | Harwin         | M20-9990245        |
| 3   | J3, J5, J7                | Jumper     | SIP3                   | SIP3             | Harwin         | M20-9990346        |



#### ESD Caution

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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