

ISL85014EVAL1Z

Evaluation Board User Guide

UG113
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Description

The [ISL85014](#) is a 3.8V to 18V input, 14A synchronous buck regulator for applications with input voltage from multi-cell batteries or regulated 5V and 12V power rails. The device also provides an integrated bootstrap diode for the high-side gate driver to reduce the external parts count. The ISL85014EVAL1Z platform allows quick evaluation of the high-performance features of the ISL85014 buck regulator.

Specifications

This board has been configured and optimized for the following operating conditions:

- Input voltage ranges from 4.5V to 18V
- 1.8V nominal output voltage
- Up to 14A output current capability
- Default internally set to 600kHz switching frequency
- Default internally set to 3ms soft-start
- Operating temperature range: -40°C to +85°C

Key Features

- Switch selectable EN (enabled/disabled)
- Frequency synchronization option
- Jumper selectable mode (DEM/Forced CCM)
- Jumper selectable OCP mode (Hiccup/Latch-off)
- Jumper selectable frequency (600kHz/300kHz)
- Connectors and test points for easy probing
- Compact design

Related Literature

- For a full list of related documents, visit our website - [ISL85014](#) product pages

Ordering Information

| PART NUMBER | DESCRIPTION |
|----------------|----------------------------------|
| ISL85014EVAL1Z | Evaluation board for ISL85014FRZ |

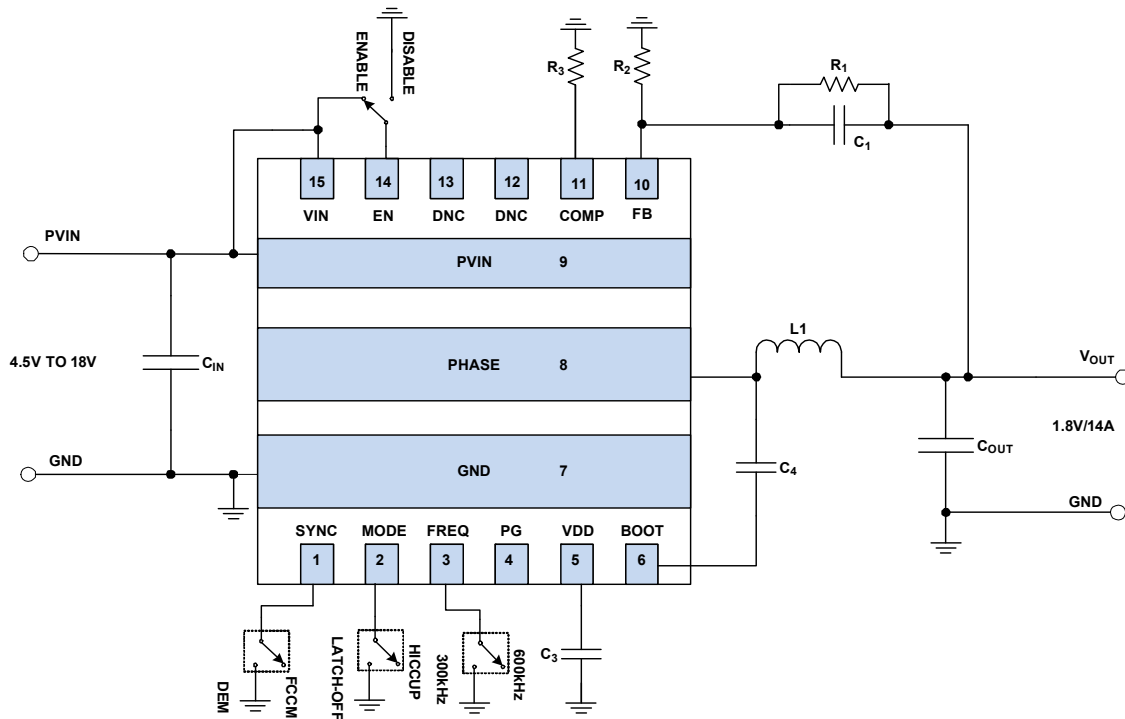


FIGURE 1. BLOCK DIAGRAM

Connector and Test Point Descriptions

The ISL85014EVAL1Z evaluation board includes I/O connectors and test points as shown in [Table 1](#).

TABLE 1. CONNECTORS AND TEST POINTS

| REFERENCE DESIGNATOR | DESCRIPTION |
|----------------------|---|
| J1 | Input voltage positive connection |
| J2 | Output voltage positive connection |
| J3 | Input voltage return connection |
| J4 | Output voltage return connection |
| J6 | Two-position socket connector for PHASE to GND test |
| J7 | Two-position socket connector for VOUT to GND test |
| PVIN | PVIN positive test point |
| GND | GND test point |
| VIN | VIN positive test point |
| VOUT | Output voltage positive test point |
| SYNC | External synchronization clock connection |
| EN | Enable test point |
| VDD | Internal LDO output test point |
| PG | Power-good output |

Selection Switch and Jumper Descriptions

- Switch SW5 (Enable)
The switch enables and disables the ISL85014:
 - When the switch is in the ON position, the ISL85014 is enabled.
 - When the switch is in the OFF position, the ISL85014 is disabled.
- Jumper J9
The jumper provides the selection of different operating modes, detailed as follows:
 - When the jumper is in the FCCM position, the ISL85014 operates in Forced CCM.
 - When the jumper is in the DEM position, the ISL85014 operates in Diode Emulation mode and enables automatic transition from CCM to DCM at light-load conditions.
- Jumper J10 sets the switching frequency at either 600kHz or 300kHz.
- Jumper J11 sets the OCP scheme in either Hiccup mode or Latch-Off mode.

Quick Setup Guide

Refer to the following instructions to configure and power-up the board for proper operation.

1. Set the power supply voltage to 12V and turn off the power supply. Connect the positive output of the power supply to J1 (PVIN) and the negative output to J3 (GND).
2. Connect an electronic load to J2 (VOUT) for the positive connection and J4 (GND) for the negative connection.
3. Measure the output voltage (test points VOUT and GND) with the voltmeter.
4. Place scope probes on VOUT test point (J7) and other test points of interest.
5. Toggle selection switch SW5 to ON position.
6. Set the load current to 0.1A and turn on the power supply. The output voltage should be in regulation with a nominal 1.8V output.
7. Slowly increase the load up to 14A while monitoring the output voltage, which should remain in regulation with a nominal 1.8V output.
8. Slowly sweep VIN from 4.5V to 18V. The output voltage should remain in regulation with a nominal 1.8V output.
9. Decrease the input voltage to 0V to shut down the regulator.

Frequency Synchronization

The ISL85014 can be synchronized to an external clock with frequency ranges from 100kHz to 1MHz by applying the external clock to test point SYNC on the ISL85014EVAL1Z evaluation board. The external clock should meet the specifications of pulse width and voltage level described in the [ISL85014](#) datasheet.

Evaluating Other Output Voltages

The ISL85014EVAL1Z has a nominal 1.8V output voltage. The output voltage is programmable by an external resistor divider formed by R_1 and R_2 as shown in [Figure 1](#) on [page 1](#). R_1 is usually chosen first, then the value for R_2 can be calculated based on R_1 and the desired output voltage using [Equation 1](#):

$$R_2 = \frac{R_1 \cdot 0.6V}{V_{OUT} - 0.6V} \quad (\text{EQ. 1})$$

PCB Layout Considerations

The PCB layout is critical for proper operation of the ISL85014. The following guidelines should be followed to achieve good performance.

1. Use a multilayer PCB structure to achieve optimized performance. A four-layer PCB is recommended for this design.
2. Use a combination of bulk capacitors and smaller ceramic capacitors with lower ESL for the input capacitors, and place them as close to the IC as possible.
3. Place the VDD decoupling capacitor close to the IC between VDD and GND. A $1\mu\text{F}$ ceramic capacitor is typically used.
4. Place a bootstrap capacitor close to the IC between the BOOT and PHASE pins. A $0.1\mu\text{F}$ ceramic capacitor is typically used.
5. Connect the feedback resistor divider between the output capacitor positive terminal and AGND pin of the IC, and place the resistors close to the FB pin of the IC.
6. Connect the GND of the IC to the ground planes underneath using multiple thermal vias to improve thermal performance.

ISL85014EVAL1Z Evaluation Board

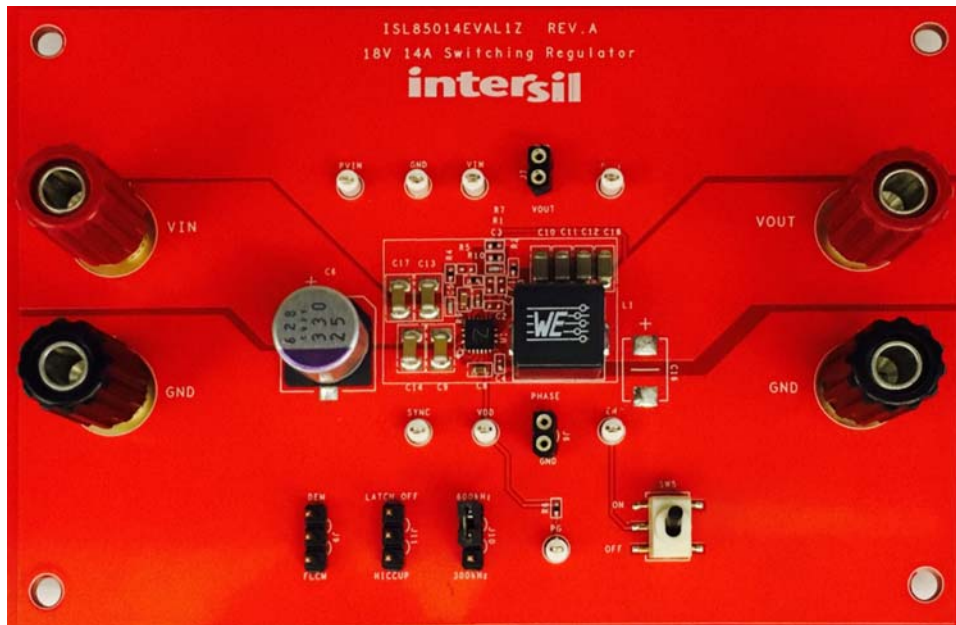


FIGURE 2. TOP VIEW

ISL85014EVAL1Z Schematic

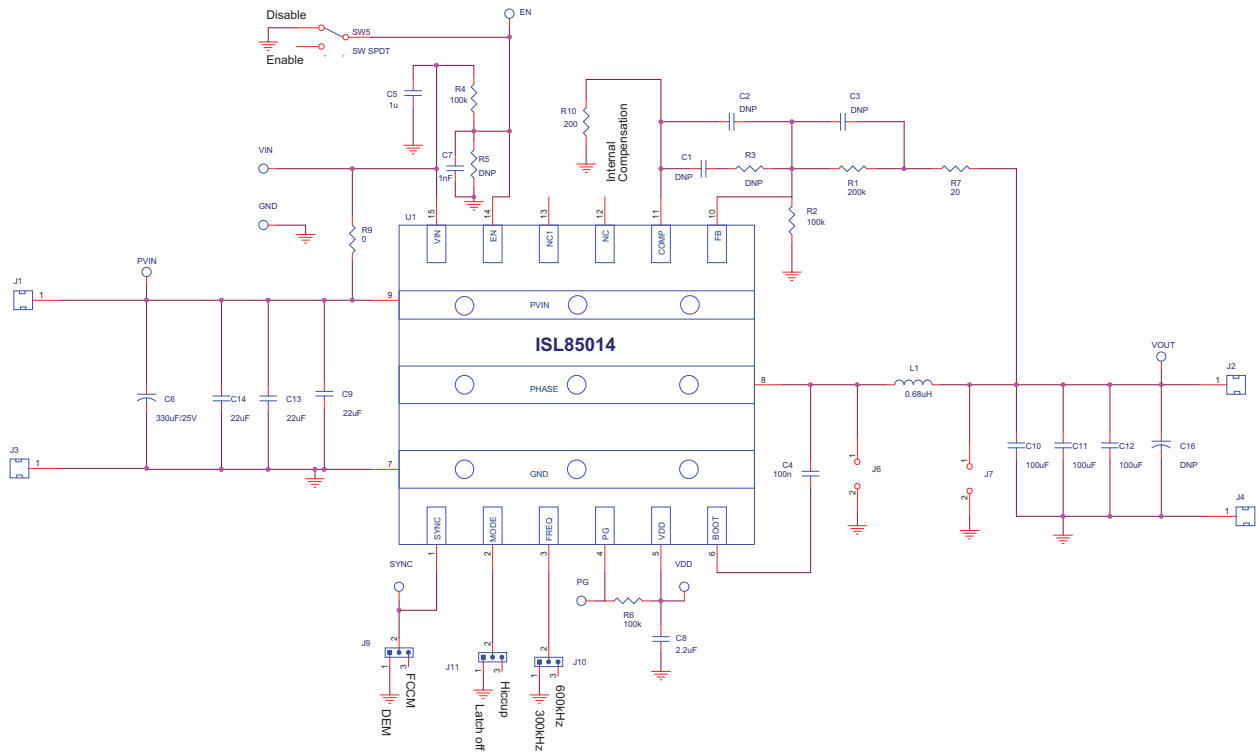


FIGURE 3. ISL85014EVAL1Z SCHEMATIC

Bill of Materials

| REFERENCE DESIGNATOR | QTY | DESCRIPTION | PART NUMBER | MANUFACTURER |
|---|-----|---|----------------------|-----------------------------|
| U1 | 1 | IC-14A BUCK REGULATOR, 15P, TDFN, 3.5x3.5, ROHS | ISL85014FRZ | INTERSIL |
| C6 | 1 | CAP-OSCON, SMD, 10.3x10.3mm, 330µF, 25V, 20%, 14mΩ, ROHS | 25SVPF330M | SANYO |
| C4 | 1 | CAP, SMD, 0402, 0.1µF, 50V, 10%, X7R, ROHS | C1005X7R1H104K | TDK |
| C5 | 1 | CAP, SMD, 0603, 1.0µF, 25V, 10%, X5R, ROHS | GRM188R61E105KA12D | MURATA |
| C8 | 1 | CAP, SMD, 0603, 2.2µF, 10V, 10%, X7R, ROHS | GRM188R71A225KE15D | MURATA |
| C10, C11, C12, C18 | 4 | CAP, SMD, 1206, 100µF, 6.3V, 20%, X5R, ROHS | GRM31CR60J107ME39L | MURATA |
| C9, C13, C14, C17 | 4 | CAP, SMD, 1210, 22µF, 25V, 10%, X7R, ROHS | GRM32ER71E226KE15L | MURATA |
| J6, J7 | 2 | CONN-SOCKET STRIP, TH, 2P, 2.54mmPITCH, ROHS | 310-87-102-41-001101 | PRECI-DIP |
| VDD, SYNC, PG, EN, GND, VIN, PVIN, VOUT | 8 | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS | 5002 | KEYSTONE |
| J9, J10, J11 | 3 | CONN-HEADER, 1x3, BREAKAWY 1x36, 2.54mm, ROHS | 68001-203HLF | BERG/FCI |
| L1 | 1 | COIL-PWR CHOKE, SMD, 10x10x9.0mm, 0.68µH, 20%, ROHS | 7443330068 | WURTH ELEKTRONIK |
| R7 | 1 | RES, SMD, 0402, 20Ω, 1/16W, 1%, TF, ROHS | ERJ2RKF20R0 | PANASONIC |
| R9 | 1 | RES, SMD, 0402, 0Ω, 1/16W, 5%, TF, ROHS | CR0402-16W-00T | VENKEL |
| R2, R4, R6 | 3 | RES, SMD, 0402, 100k, 1/16W, 1%, TF, ROHS | ERJ2RKF1003 | PANASONIC |
| R10 | 1 | RES, SMD, 0402, 200Ω, 1/16W, 1%, TF, ROHS | ERJ-2RKF2000X | PANASONIC |
| R1 | 1 | RES, SMD, 0402, 200k, 1/16W, 1%, TF, ROHS | MCR01MZPF2003 | ROHM |
| C7 | 1 | CAP, SMD, 0402, 1nF, 50V, 10%, X7R, ROHS | | MURATA |
| SW5 | 1 | SWITCH-TOGGLE, SMD, 6PIN, SPDT, 2POS, ON-NONE-ON, ROHS | GT11MSCBE-T | ITT INDUSTRIES/C&K DIVISION |
| J1, J2 | 2 | CONN-GEN, BIND. POST, INSUL-RED, THMBNUT-GND | 111-0702-001 | JOHNSONS |
| J3, J4 | 2 | CONN-GEN, BIND. POST, INSUL-BLK, THMBNUT-GND | 111-0703-001 | JOHNSONS |
| Jumper | 1 | CONN-JUMPER, SHORTING, 2PIN, BLK, OPEN TOP, 2.54mmPITCH, ROHS | 929950-00 | 3M |
| R3, R5 | 0 | RES, SMD, 0402, DNP, TF, ROHS | | |
| C1, C2, C3, C16 | 0 | CAP, SMD DNP-PLACE HOLDER, ROHS | | |
| PCB | 1 | PWB-PCB, ISL85014EVAL1Z, REVA, ROHS | ISL85014EVAL1Z | Any |

ISL85014EVAL1Z PCB Layout

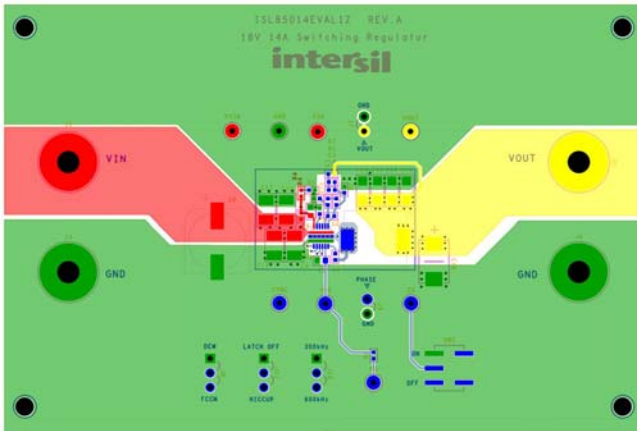


FIGURE 4. TOP LAYER



FIGURE 5. LAYER 2

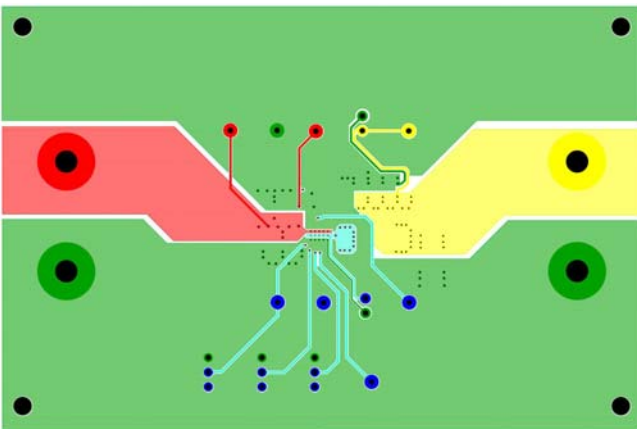


FIGURE 6. LAYER 3

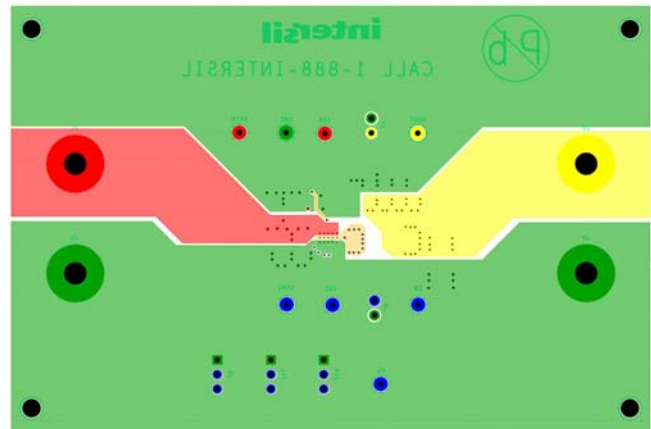


FIGURE 7. BOTTOM LAYER

Typical Performance Curves

$V_{IN} = 12V$, $V_{OUT} = 1.8V$, $L = 0.68\mu H$, $f_{SW} = 600kHz$, $T_A = +25^\circ C$, unless otherwise noted.

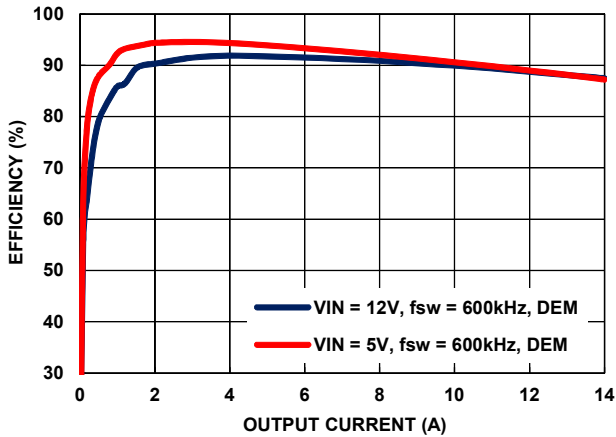


FIGURE 8. EFFICIENCY vs LOAD

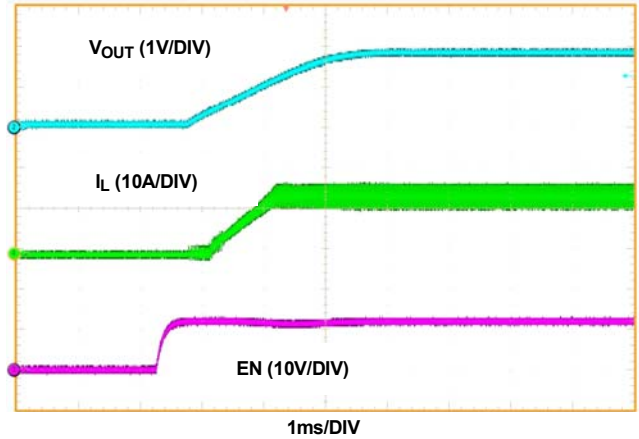


FIGURE 9. START-UP WITH EN, $I_{OUT} = 14A$

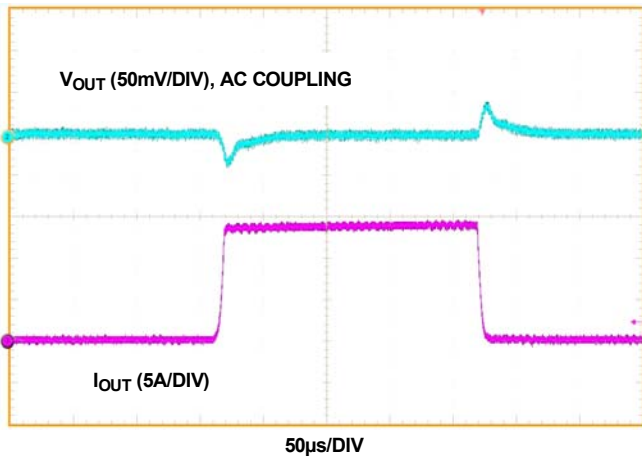


FIGURE 10. LOAD TRANSIENT, $0A \rightarrow 14A \rightarrow 0A$, $2.5A/\mu s$

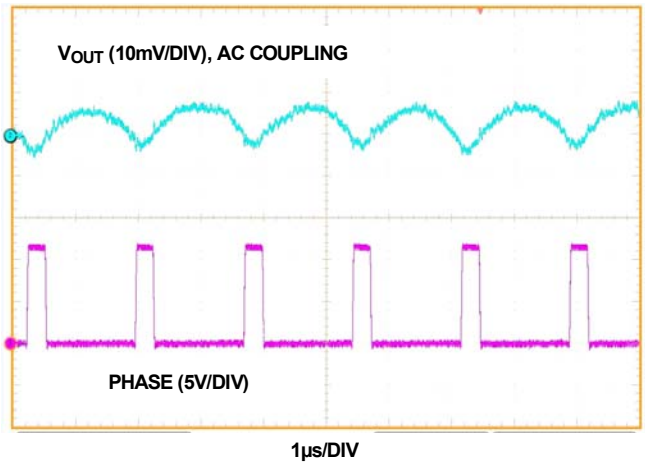


FIGURE 11. OUTPUT VOLTAGE RIPPLE, $I_{OUT} = 14A$

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