

# ISL85410DEMO1Z, ISL854102DEMO1Z, ISL85418DEMO1Z

Demonstration Boards User Guide

AN1908  
Rev.3.00  
Nov 18, 2016

## Description

The ISL85410DEMO1Z, ISL854102DEMO1Z, and ISL85418DEMO1Z boards are intended for use in point-of-load applications sourcing from 3V to 40V. The boards are used to demonstrate the performance of the [ISL85410](#), [ISL854102](#), and [ISL85418](#) wide  $V_{IN}$ , low quiescent current, high-efficiency synchronous buck regulators with 1A (ISL85410), 1.2A (ISL854102), and 800mA (ISL85418) output current.

The ISL85410, ISL854102, and ISL85418 are offered in a 4mmx3mm 12 Ld DFN package with 1mm maximum height. The converter occupies 1.516cm<sup>2</sup> area.

## Key Specifications

These boards have been configured and optimized for the following operating conditions:

- $V_{IN} = 24V$
- $V_{OUT} = 3.3V$
- $I_{MAX} = 1A$  (ISL85410), 1.2A (ISL854102), and 800mA (ISL85418)
- $f_{SW} = 500kHz$
- Peak efficiency: >84% at 50% load
- Output ripple: <10mV at 1.2A
- Dynamic response: 4.5%
  - 0A to 1.2A and 1.2A to 0A steps, PWM,  $di/dt = 1A/\mu s$
- Board temperature: +25°C

## Key Features

- Wide input voltage range 3V to 40V
- Synchronous operation for high efficiency
- No compensation required
- Integrated high-side and low-side NMOS devices
- Selectable PFM or forced PWM mode at light loads
- Internal fixed (500kHz) or adjustable switching frequency 300kHz to 2MHz
- Continuous output current up to 1A (ISL85410), 1.2A (ISL854102) and 800mA (ISL85418)
- Internal or external soft-start
- Minimal external components required
- Power-good and enable functions available

## Related Literature

- For a full list of related documents, visit our website
  - [ISL85410](#), [ISL854102](#), and [ISL85418](#) product pages

## Ordering Information

| PART NUMBER     | DESCRIPTION                                |
|-----------------|--------------------------------------------|
| ISL85410DEMO1Z  | Demonstration Board (1A output current)    |
| ISL854102DEMO1Z | Demonstration Board (1.2A output current)  |
| ISL85418DEMO1Z  | Demonstration Board (800mA output current) |

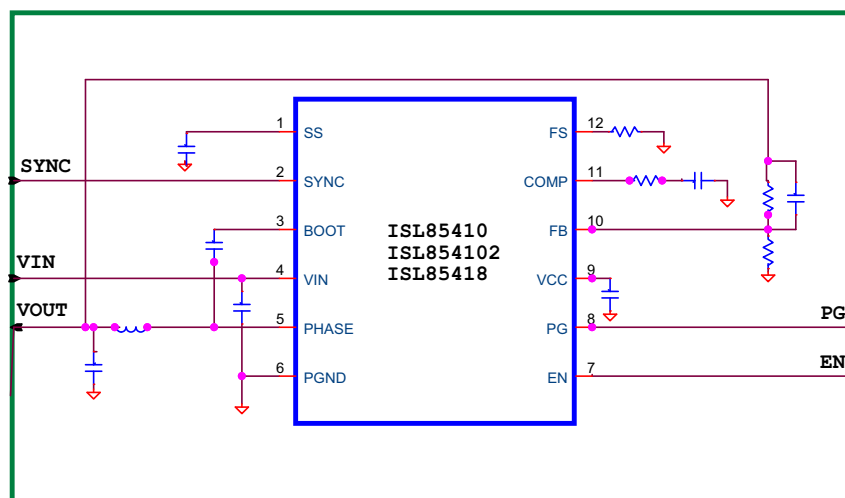


FIGURE 1. BLOCK DIAGRAM

## Recommended Equipment

The following materials are recommended to perform testing:

- 0V to 50V power supply with at least 2A source current capability
- Electronic loads capable of sinking current up to 2A
- Digital Multimeters (DMMs)
- 100MHz quad-trace oscilloscope
- Signal generator

## Quick Setup Guide

1. Ensure that the circuit is correctly connected to the supply and loads prior to applying any power.
2. Connect the bias supply to VIN, the plus terminal to VIN (P4) and the negative return to GND (P5).
3. Turn on the power supply.
4. Verify the output voltage is 3.3V for V<sub>OUT</sub>.

## Evaluating the Other Output Voltage

The ISL85410DEMO1Z, ISL854102DEMO1Z, and ISL85418DEMO1Z board outputs are preset to 3.3V; however, output voltages can be adjusted from 0.6V to 15V. The output voltage programming resistor, R<sub>2</sub>, will depend on the desired output voltage of the regulator and the value of the feedback resistor R<sub>1</sub>, as shown in [Equation 1](#).

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

If the output voltage desired is 0.6V, then R<sub>1</sub> is shorted. Please note that if V<sub>OUT</sub> is less than 1.8V, the switching frequency and compensation must be changed for 300kHz operation due to minimum on-time limitation. Please refer to datasheets [ISL85410](#), [ISL854102](#) and [ISL85418](#) for further information.

[Table 1](#) shows the component selection that should be used for the respective V<sub>OUT</sub>.

TABLE 1. EXTERNAL COMPONENT SELECTION

| V <sub>OUT</sub><br>(V) | L <sub>1</sub><br>(μH) | C <sub>5</sub> +C <sub>6</sub><br>(μF) | R <sub>1</sub><br>(kΩ) | R <sub>2</sub><br>(kΩ) | C <sub>4</sub><br>(pF) | R <sub>12</sub><br>(kΩ)           | R <sub>3</sub><br>(kΩ) | C <sub>7</sub><br>(pF) |
|-------------------------|------------------------|----------------------------------------|------------------------|------------------------|------------------------|-----------------------------------|------------------------|------------------------|
| 12                      | 22                     | 2x22                                   | 90.9                   | 4.75                   | 22                     | 115                               | 150                    | 470                    |
| 5                       | 22                     | 47+22                                  | 90.9                   | 12.4                   | 27                     | DNP<br>( <a href="#">Note 1</a> ) | 100                    | 470                    |
| 3.3                     | 22                     | 47+22                                  | 90.9                   | 20                     | 27                     | DNP<br>( <a href="#">Note 1</a> ) | 100                    | 470                    |
| 2.5                     | 22                     | 47+22                                  | 90.9                   | 28.7                   | 27                     | DNP<br>( <a href="#">Note 1</a> ) | 100                    | 470                    |
| 1.8                     | 12                     | 47+22                                  | 90.9                   | 45.5                   | 27                     | DNP<br>( <a href="#">Note 1</a> ) | 70                     | 470                    |

NOTE:

1. Connect FS to VCC.

## Frequency Control

The ISL85410, ISL854102, and ISL85418 have an FS pin that controls the frequency of operation. Programmable frequency allows for optimization between efficiency and external component size. It also allows low frequency operation for low V<sub>OUT</sub>s when minimum on-time would limit the operation otherwise. Default switching frequency is 500kHz when FS is tied to VCC (R<sub>10</sub> = 0). By removing R<sub>10</sub>, the switching frequency can be changed from 300kHz (R<sub>12</sub> = 340k) to 2MHz (R<sub>12</sub> = 32.4k). Please refer to datasheets [ISL85410](#), [ISL854102](#) and [ISL85418](#) for calculating the value of R<sub>10</sub>. Do not leave this pin floating.

## SYNC Control

The ISL85410, ISL854102, and ISL85418 demo boards have a SYNC pin that allows external synchronization frequency to be applied. Default board configuration has R<sub>6</sub> = 200k to V<sub>CC</sub>, which defaults to PWM operation mode and also to the preselected switching frequency set by R<sub>12</sub> (see datasheet and previous section "[Frequency Control](#)" for details). If this pin is tied to GND, the IC will operate in PFM mode. The S2 switch allows forced PFM or PWM modes.

## Soft-Start/COMP Control

R<sub>15</sub> selects between internal (R<sub>15</sub> = 0) and external soft-start. R<sub>11</sub> selects between internal (R<sub>11</sub> = 0) and external compensation. For applications where repetitive restarts of the IC are required, it is recommended to add a 350kΩ resistor in parallel to CSS in order to allow its fast discharge. Please refer to Pin Description Table of the [ISL85410](#), [ISL854102](#) and [ISL85418](#) datasheets.

## Demonstration Boards (Front and Back)

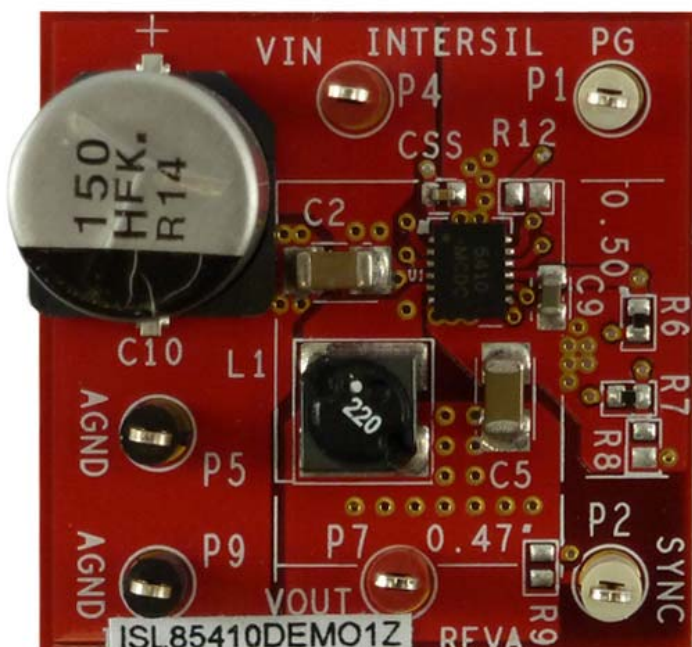


FIGURE 2. ISL85410DEMO1Z DEMONSTRATION BOARD (TOP)

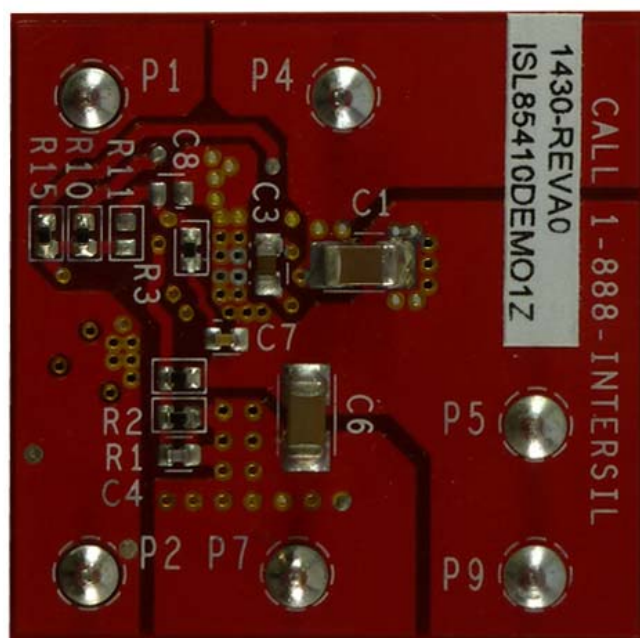


FIGURE 3. ISL85410DEMO1Z DEMONSTRATION BOARD (BOTTOM)



FIGURE 4. ISL854102DEMO1Z DEMONSTRATION BOARD (TOP)

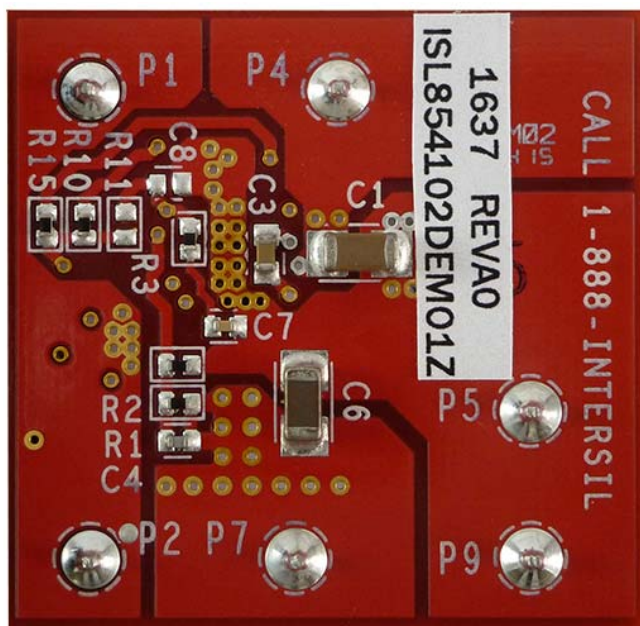


FIGURE 5. ISL854102DEMO1Z DEMONSTRATION BOARD (BOTTOM)

## Demonstration Boards (Front and Back) (Continued)



FIGURE 6. ISL85418DEMO1Z DEMONSTRATION BOARD (TOP)

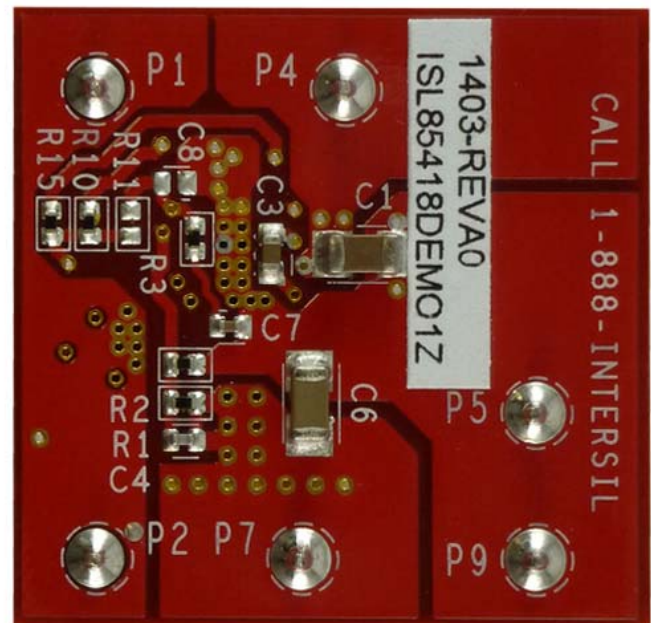
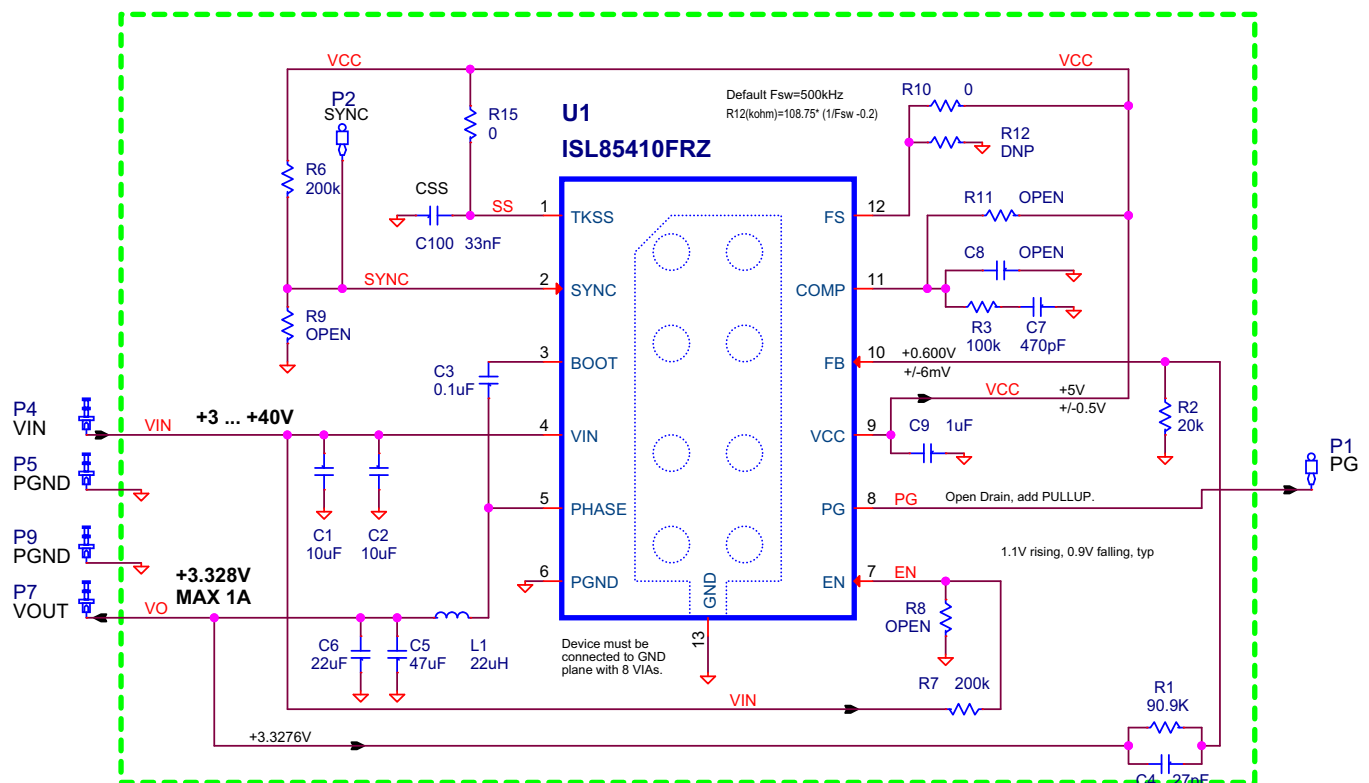


FIGURE 7. ISL85418DEMO1Z DEMONSTRATION BOARD (BOTTOM)

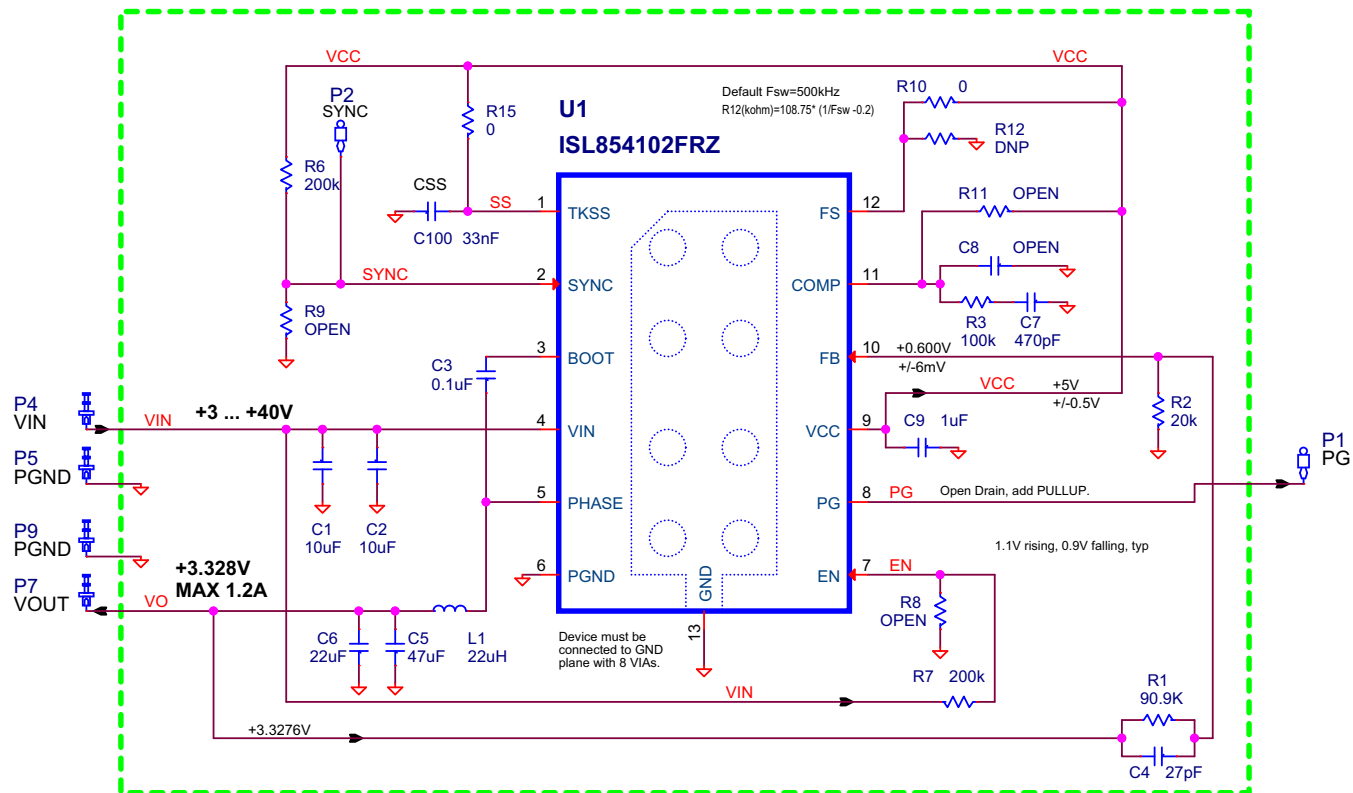
## ISL85410DEMO1Z, ISL854102DEMO1Z, AND ISL85418DEMO1Z Schematics



NOTE: The input electrolytic capacitor  $C_{10}$  is optional and it is used to prevent transient voltages when the input test leads have large parasitic inductance. It can be removed if the IC is used in a system application.

FIGURE 8. ISL85410DEMO1Z SCHEMATIC

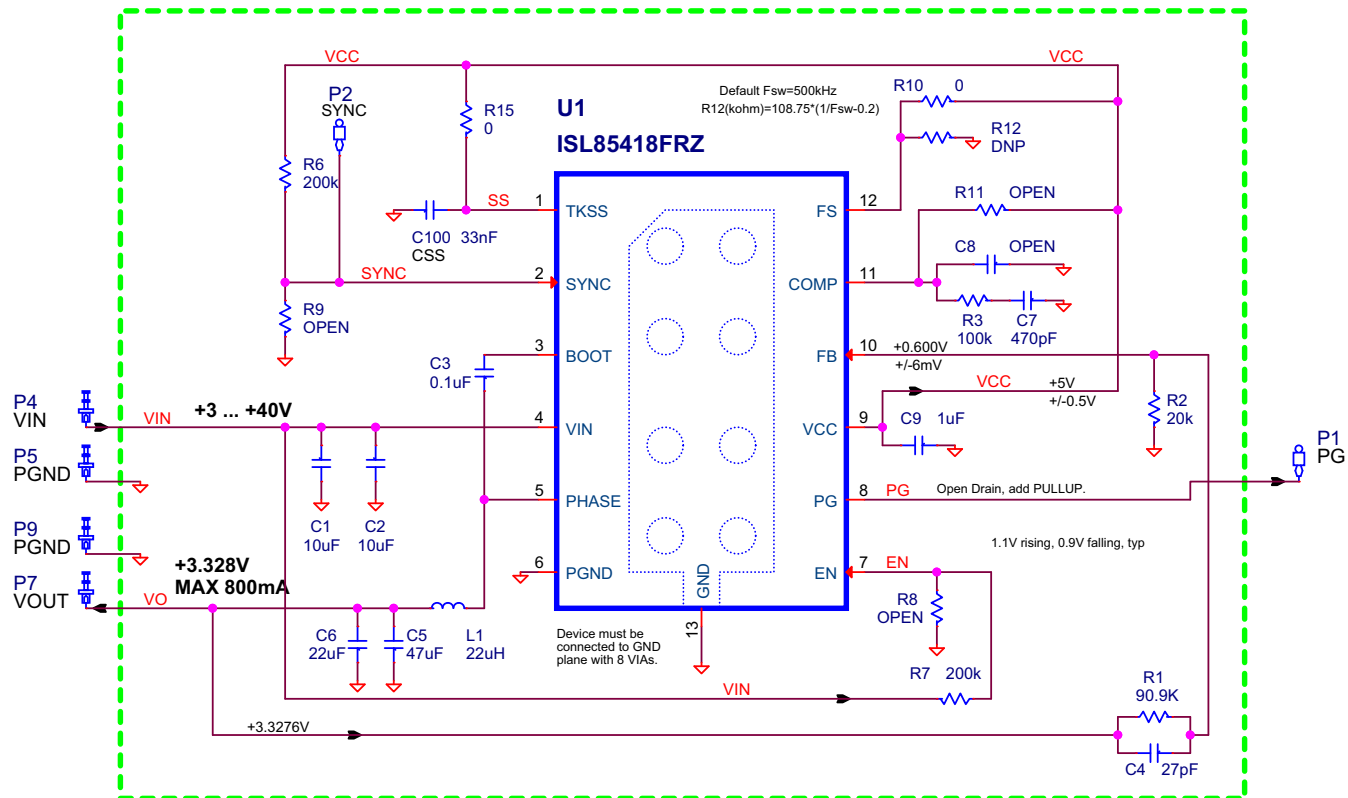
# ISL85410DEMO1Z, ISL854102DEMO1Z, AND ISL85418DEMO1Z Schematics (Continued)



NOTE: The input electrolytic capacitor C<sub>10</sub> is optional and it is used to prevent transient voltages when the input test leads have large parasitic inductance. It can be removed if the IC is used in a system application.

FIGURE 9. ISL854102DEMO1Z SCHEMATIC

# ISL85410DEMO1Z, ISL854102DEMO1Z, AND ISL85418DEMO1Z Schematics (Continued)



NOTE: The input electrolytic capacitor C<sub>10</sub> is optional and it is used to prevent transient voltages when the input test leads have large parasitic inductance. It can be removed if the IC is used in a system application.

FIGURE 10. ISL85418DEMO1Z SCHEMATIC

**ISL85410DEMO1Z, ISL854102DEMO1Z, ISL85418DEMO1Z BOM**

| MANUFACTURER PART                                                                                    | QTY | UNITS | REFERENCE DESIGNATOR | DESCRIPTION                                        | MFR.              |
|------------------------------------------------------------------------------------------------------|-----|-------|----------------------|----------------------------------------------------|-------------------|
| ISL85400EVAL2ZREVAPCB                                                                                | 1   | ea    | LABEL-RENAME BOARD   | PWB-PCB, ISL85400EVAL2Z, REVA, ROHS                | IMAGINEERING      |
| EEE-FK1H151P                                                                                         | 1   | ea    | C10 (OPTIONAL)       | CAP, SMD, 10.3mm, 150µF, 50V, 20%, AL.EL., ROHS    | PANASONIC         |
| GRM36COG270J050AQ                                                                                    | 1   | ea    | C4                   | CAP, SMD, 0402, 27pF, 50V, 5%, NP0, ROHS           | MURATA            |
| GRM36X7R333K016AQ                                                                                    | 1   | ea    | CSS                  | CAP, SMD, 0402, 33000pF, 16V, 10%, X7R, ROHS       | MURATA            |
| ECJ-0EB1H471K                                                                                        | 1   | ea    | C7                   | CAP, SMD, 0402, 470pF, 50V, 10%, X7R, ROHS         | PANASONIC         |
|                                                                                                      | 0   | ea    | C8                   | CAP, SMD, 0402, DNP-PLACE HOLDER, ROHS             |                   |
| 06035C104KAT2A                                                                                       | 1   | ea    | C3                   | CAP, SMD, 0603, 0.1µF, 50V, 10%, X7R, ROHS         | AVX               |
| GRM188R61C105KA12D                                                                                   | 1   | ea    | C9                   | CAP, SMD, 0603, 1µF, 16V, 10%, X5R, ROHS           | MURATA            |
| C3216X5R1H106K                                                                                       | 2   | ea    | C1, C2               | CAP, SMD, 1206, 10µF, 50V, 10%, X5R, ROHS          | TDK               |
| GRM31CR60J226KE19L                                                                                   | 1   | ea    | C6                   | CAP, SMD, 1206, 22µF, 6.3V, 10%, X5R, ROHS         | MURATA            |
| GRM31CR60J476KE19L                                                                                   | 1   | ea    | C5                   | CAP, SMD, 1206, 47µF, 6.3V, 10%, X5R, ROHS         | MURATA            |
| 74404054220                                                                                          | 1   | ea    | L1                   | COIL-PWR INDUCTOR, SMD, 5mm, 22µH, 20%, 1.5A, ROHS | Würth Electronics |
| 5000                                                                                                 | 2   | ea    | P4, P7               | CONN-MINI TEST PT, VERTICAL, RED, ROHS             | KEYSTONE          |
| 5001                                                                                                 | 2   | ea    | P5, P9               | CONN-MINI TEST PT, VERTICAL, BLK, ROHS             | KEYSTONE          |
| 5002                                                                                                 | 2   | ea    | P1, P2               | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS        | KEYSTONE          |
| ISL85410FRZ for ISL85410DEMO1Z<br>ISL854102FRZ for ISL854102DEMO1Z<br>ISL85418FRZ for ISL85418DEMO1Z | 1   | ea    | U1                   | IC-40V, BUCK REGULATOR, 12P, DFN, 3X4, ROHS        | INTERSIL          |
| CR0402-16W-00T                                                                                       | 2   | ea    | R10, R15             | RES, SMD, 0402, 0Ω, 1/16W, 5%, TF, ROHS            | VENKEL            |
| ERJ2RKF1003                                                                                          | 1   | ea    | R3                   | RES, SMD, 0402, 100k, 1/16W, 1%, TF, ROHS          | PANASONIC         |
| ERJ2RKF2001                                                                                          | 1   | ea    | R2                   | RES, SMD, 0402, 20k, 1/16W, 1%, TF, ROHS           | PANASONIC         |
| MCR01MZPF2003                                                                                        | 2   | ea    | R6, R7               | RES, SMD, 0402, 200k, 1/16W, 1%, TF, ROHS          | ROHM              |
| CRCW040290K9FKED                                                                                     | 1   | ea    | R1                   | RES, SMD, 0402, 90.9k, 1/16W, 1%, TF, ROHS         | VISHAY/DALE       |
|                                                                                                      | 0   | ea    | R12                  | RES, SMD, 0402, DNP, DNP, DNP, TF, ROHS            |                   |
|                                                                                                      | 0   | ea    | R8, R9, R11          | RES, SMD, 0402, DNP, DNP, DNP, TF, ROHS            |                   |

# ISL85410DEMO1Z, ISL854102DEMO1Z and ISL85418DEMO1Z Board Layout

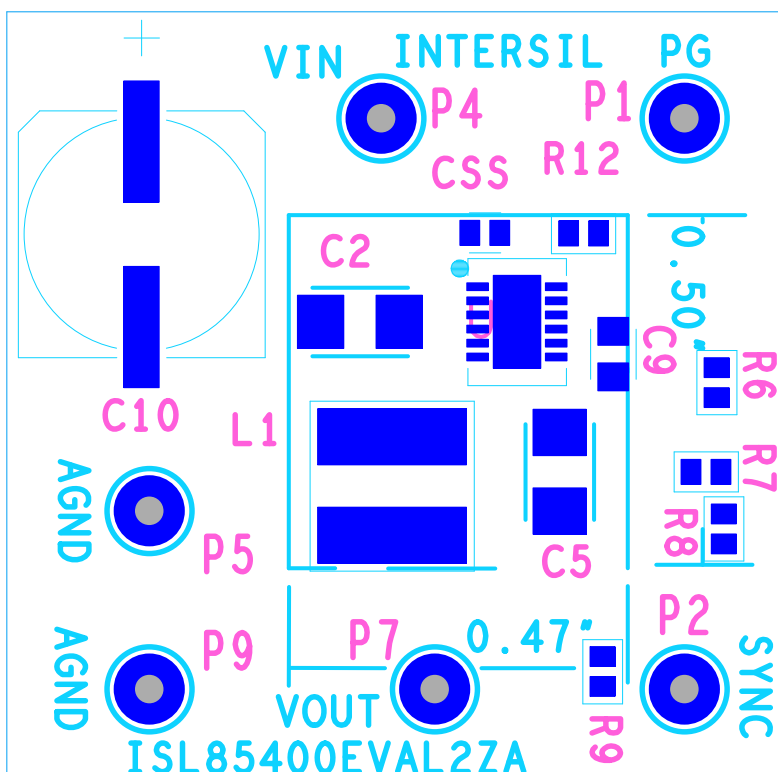


FIGURE 11. SILK SCREEN TOP

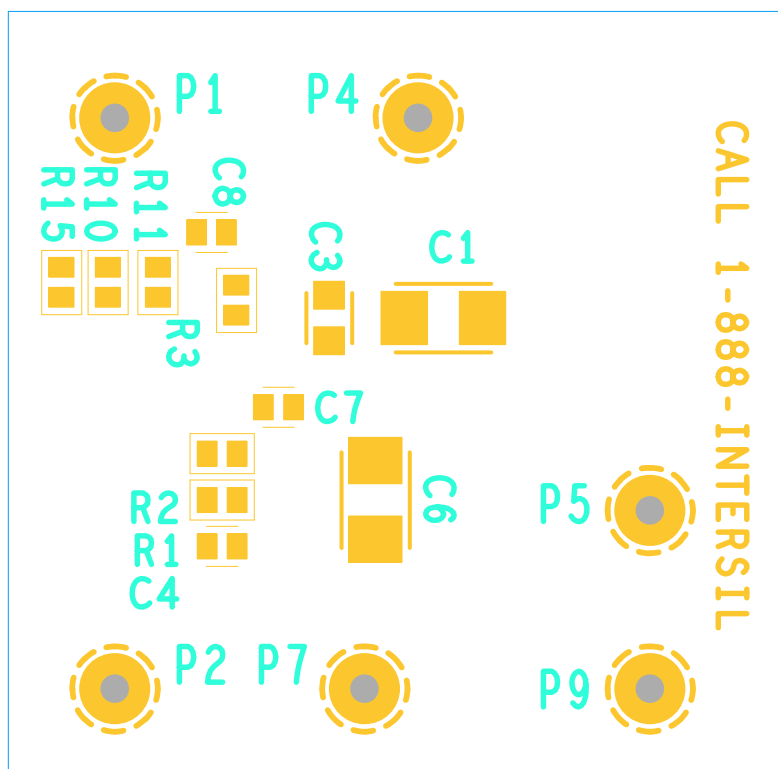


FIGURE 12. SILK SCREEN BOTTOM

# ISL85410DEMO1Z, ISL854102DEMO1Z and ISL85418DEMO1Z Board Layout (Continued)

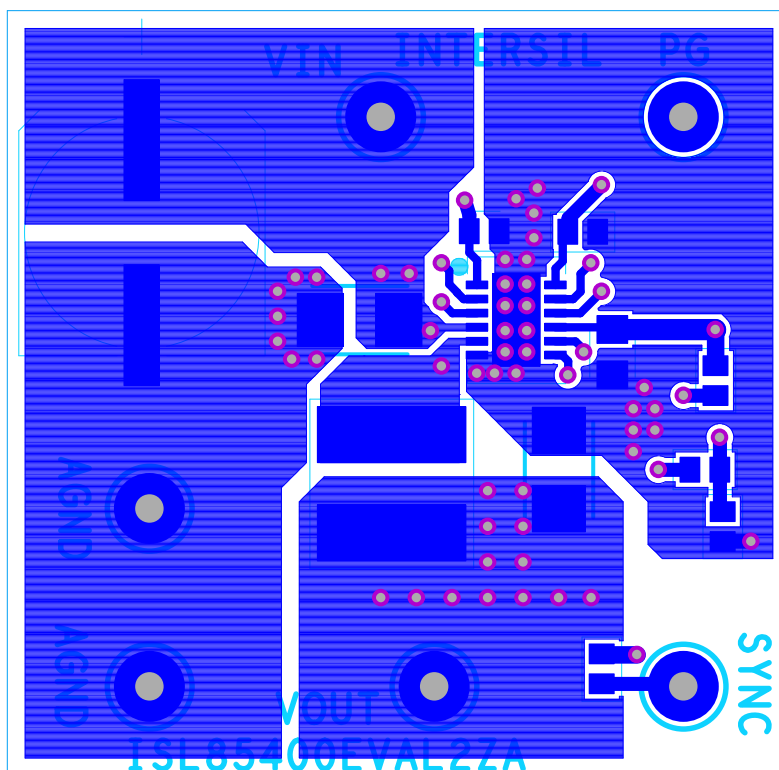


FIGURE 13. LAYER 1

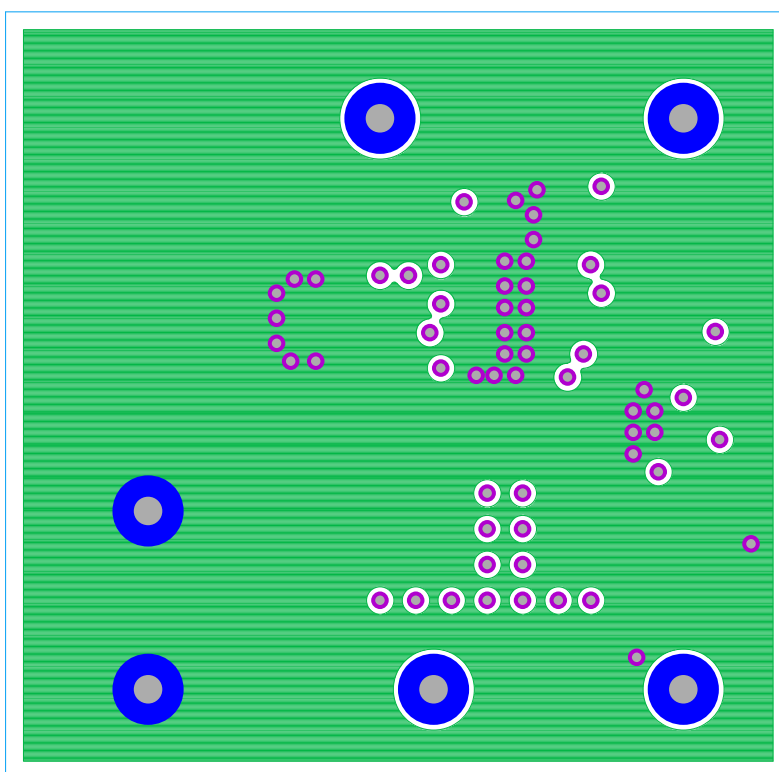


FIGURE 14. LAYER 2

## ISL85410DEMO1Z, ISL854102DEMO1Z and ISL85418DEMO1Z Board Layout (Continued)

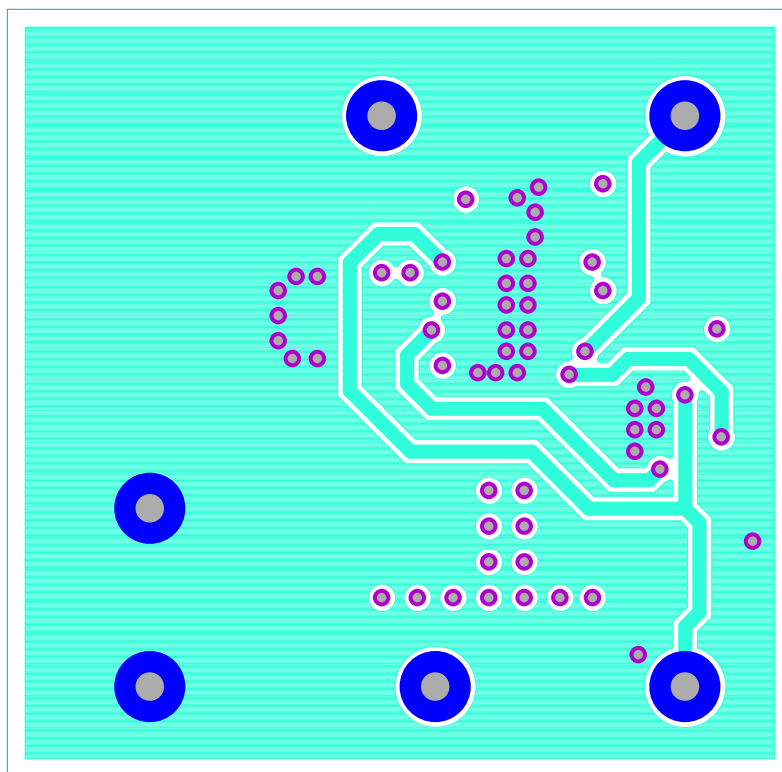


FIGURE 15. LAYER 3

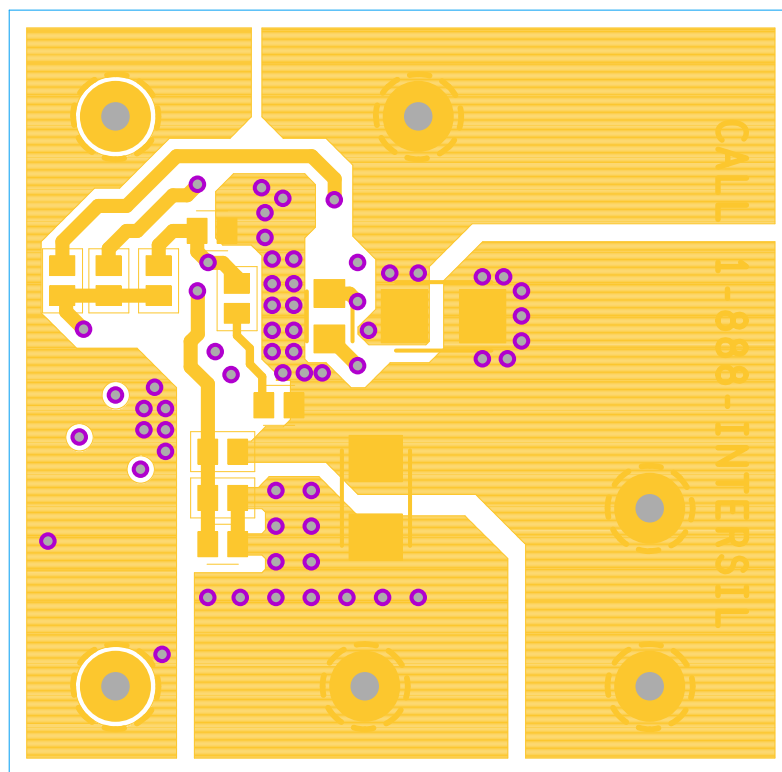


FIGURE 16. LAYER 4 BOTTOM VIEW

# ISL85410 Efficiency Curves $f_{SW} = 500kHz, T_A = +25^{\circ}C$

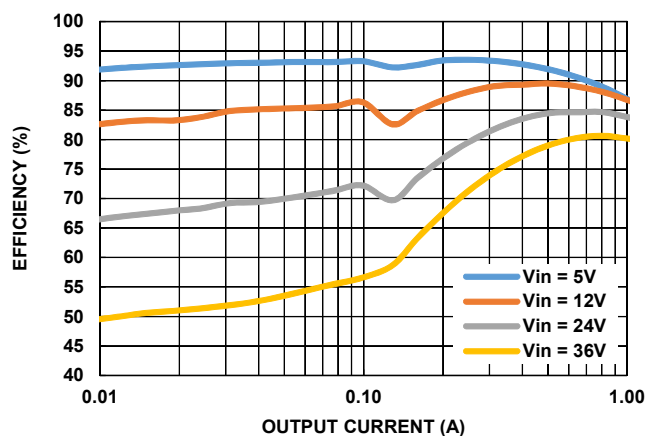


FIGURE 17. EFFICIENCY vs LOAD, PFM,  $V_{OUT} = 3.3V$

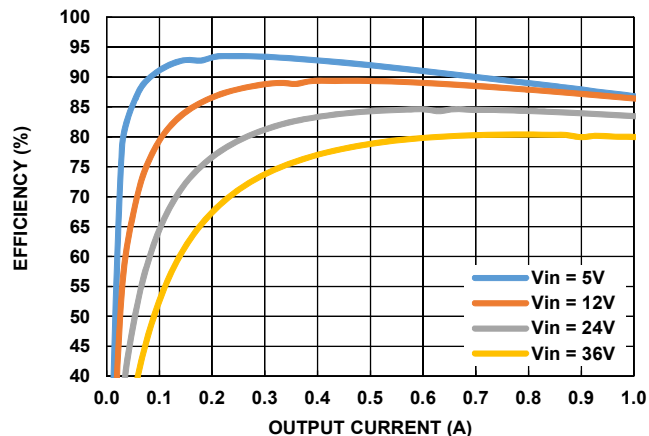


FIGURE 18. EFFICIENCY vs LOAD, PWM,  $V_{OUT} = 3.3V$

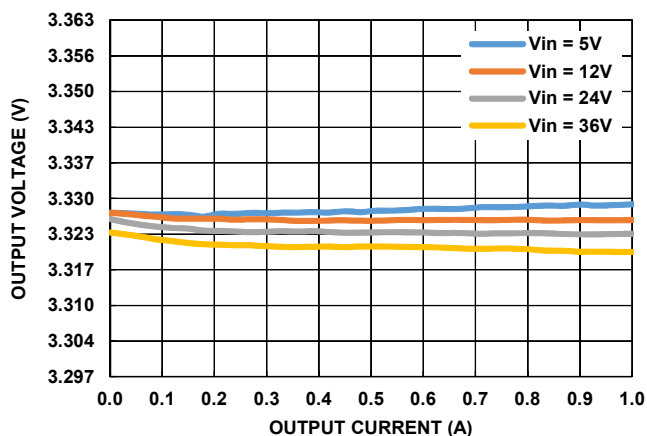


FIGURE 19.  $V_{OUT}$  REGULATION vs LOAD, PWM,  $V_{OUT} = 3.3V$

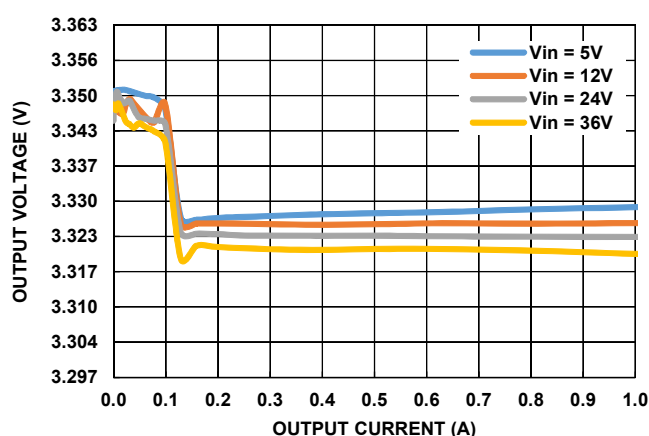


FIGURE 20.  $V_{OUT}$  REGULATION vs LOAD, PFM,  $V_{OUT} = 3.3V$

# ISL85410 Measurement $f_{SW} = 500kHz, V_{IN} = 24V, V_{OUT} = 3.3V, T_A = +25^{\circ}C$

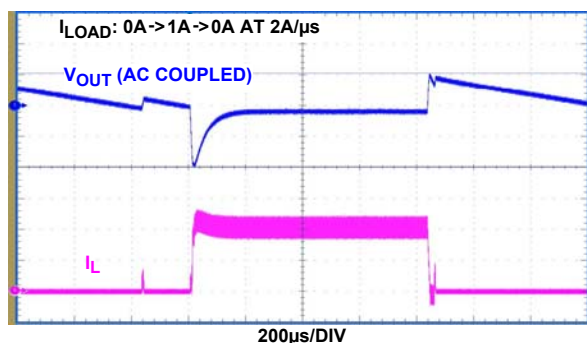


FIGURE 21. LOAD TRANSIENT, PFM

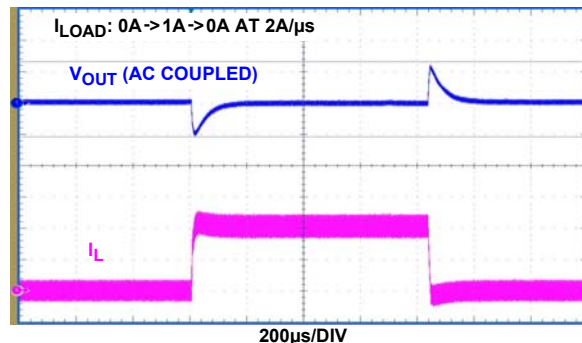


FIGURE 22. LOAD TRANSIENT, PWM

## ISL854102 Efficiency Curves $f_{SW} = 500\text{kHz}$ , $T_A = +25^\circ\text{C}$

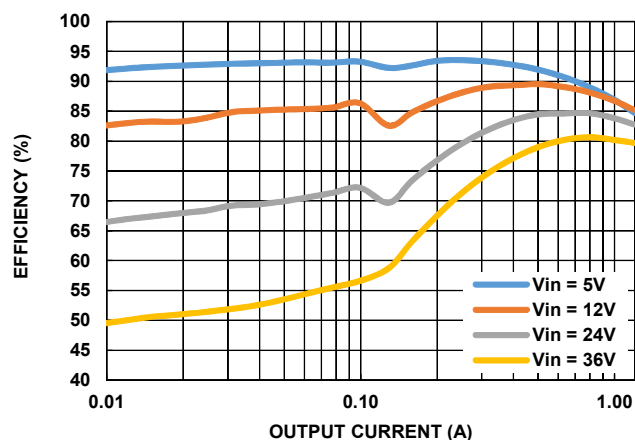


FIGURE 23. EFFICIENCY vs LOAD, PFM,  $V_{OUT} = 3.3\text{V}$ ,  $L_1 = 22\mu\text{H}$

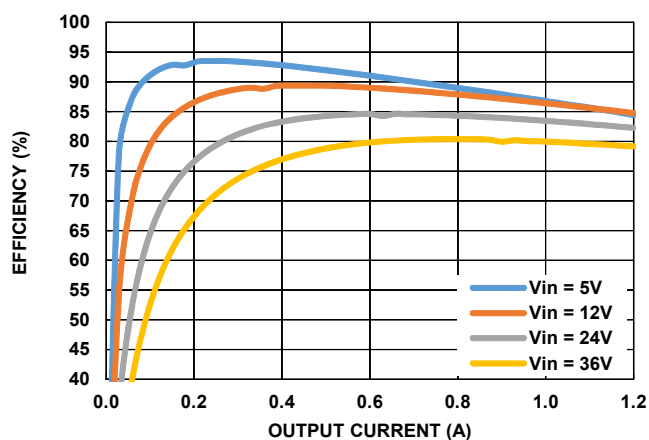


FIGURE 24. EFFICIENCY vs LOAD, PWM,  $V_{OUT} = 3.3\text{V}$ ,  $L_1 = 22\mu\text{H}$

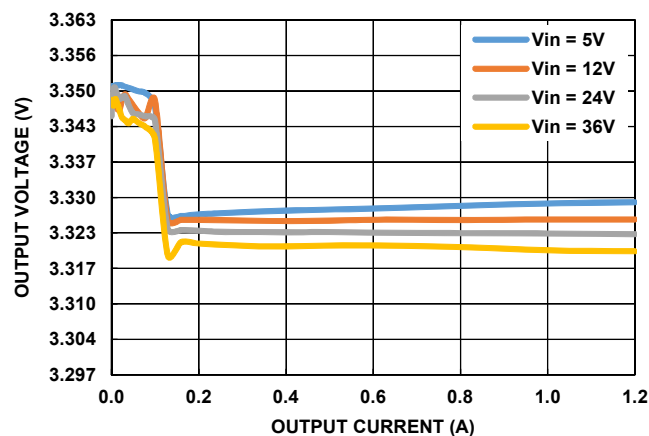


FIGURE 25.  $V_{OUT}$  REGULATION vs LOAD, PFM,  $V_{OUT} = 3.3\text{V}$

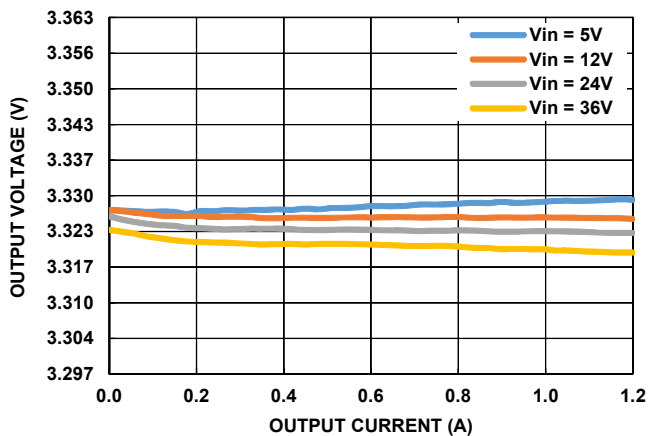


FIGURE 26.  $V_{OUT}$  REGULATION vs LOAD vs LOAD, PWM,  $V_{OUT} = 3.3\text{V}$

## ISL854102 Measurement $f_{SW} = 500\text{kHz}$ , $V_{IN} = 24\text{V}$ , $V_{OUT} = 3.3\text{V}$ , $T_A = +25^\circ\text{C}$

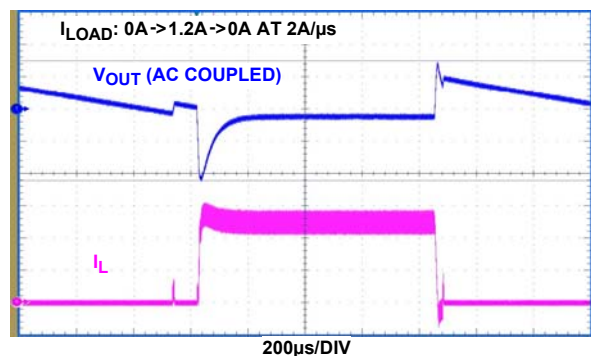


FIGURE 27. LOAD TRANSIENT, PFM

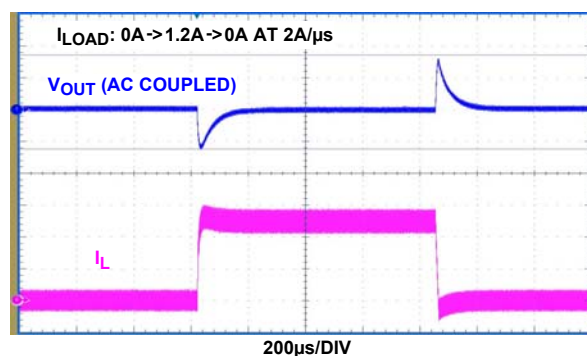


FIGURE 28. LOAD TRANSIENT, PWM

## ISL85418 Efficiency Curves $f_{SW} = 500\text{kHz}$ , $T_A = +25^\circ\text{C}$ .

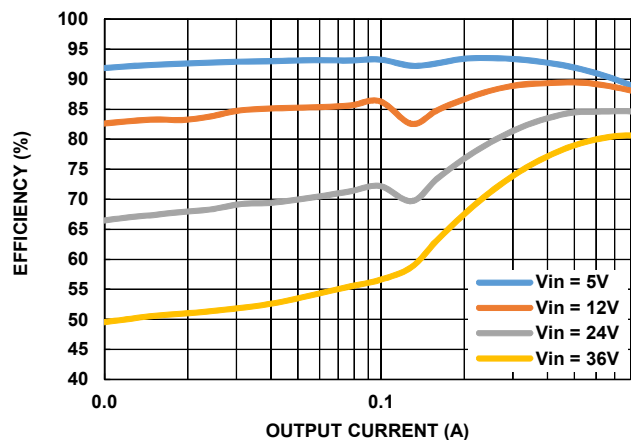


FIGURE 29. EFFICIENCY vs LOAD, PFM,  $V_{OUT} = 3.3\text{V}$

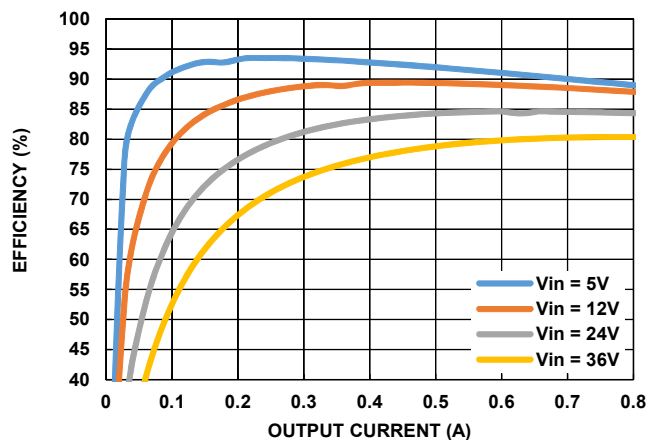


FIGURE 30. EFFICIENCY vs LOAD, PWM,  $V_{OUT} = 3.3\text{V}$

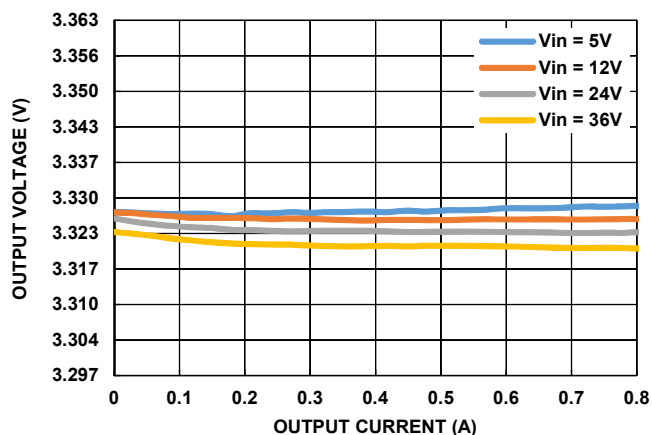


FIGURE 31.  $V_{OUT}$  REGULATION vs LOAD, PWM,  $V_{OUT} = 3.3\text{V}$

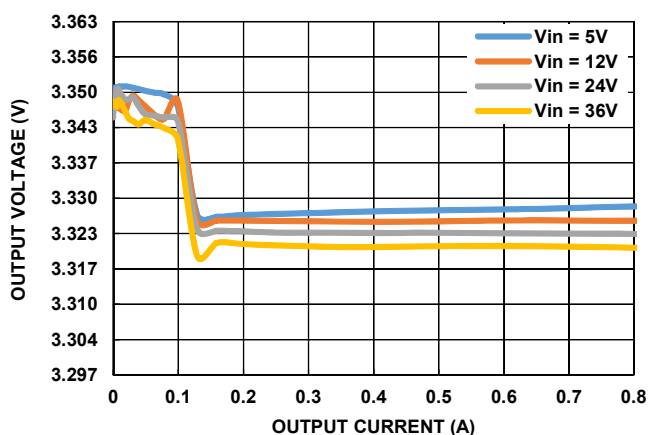


FIGURE 32.  $V_{OUT}$  REGULATION vs LOAD, PFM,  $V_{OUT} = 3.3\text{V}$

## ISL85418 Measurement $f_{SW} = 500\text{kHz}$ , $V_{IN} = 24\text{V}$ , $V_{OUT} = 3.3\text{V}$ , $T_A = +25^\circ\text{C}$

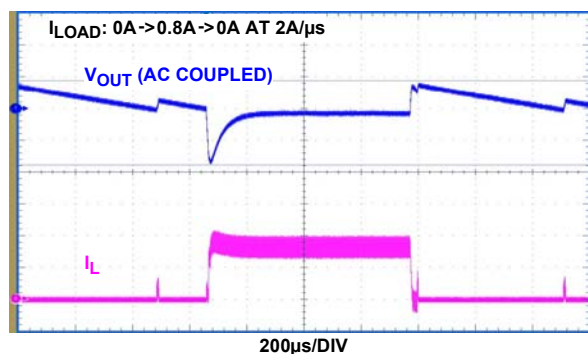


FIGURE 33. LOAD TRANSIENT, PFM

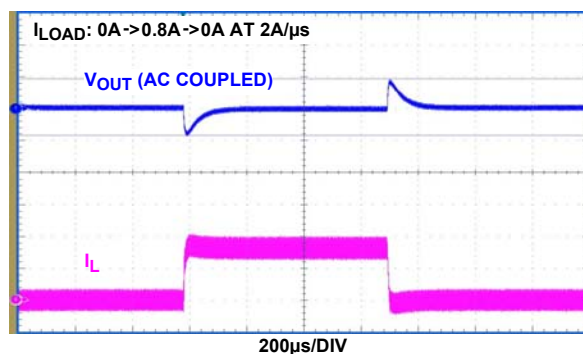


FIGURE 34. LOAD TRANSIENT, PWM

## Notice

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(Rev.4.0-1 November 2017)



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**Renesas Electronics America Inc.**  
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.  
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9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3  
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Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K  
Tel: +44-1628-651-700, Fax: +44-1628-651-804

**Renesas Electronics Europe GmbH**  
Arcadiastrasse 10, 40472 Düsseldorf, Germany  
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

**Renesas Electronics (China) Co., Ltd.**  
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China  
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

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Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

**Renesas Electronics Hong Kong Limited**  
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong  
Tel: +852-2265-6688, Fax: +852-2886-9022

**Renesas Electronics Taiwan Co., Ltd.**  
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan  
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80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949  
Tel: +65-6213-0200, Fax: +65-6213-0300

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**Renesas Electronics India Pvt. Ltd.**  
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Tel: +91-80-67208700, Fax: +91-80-67208777

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