ISL85410DEMO1Z, ISL85418DEMO1Z Wide V_{IN} 1A and 800mA Synchronous Buck Regulators

Description

The ISL85410DEMO1Z, ISL85418DEMO1Z kits are intended for use for Point-of-Load applications sourcing from 3V to 40V. The kits are used to demonstrate the performance of the ISL85410, ISL85418 Wide V_{IN} Low Quiescent Current High Efficiency Sync Buck Regulators with 1A (ISL85410) and 800mA (ISL85418) output current.

The ISL85410, ISL85418 are offered in a 4mmx3mm 12 Ld DFN package with 1mm maximum height. The converter occupies 1.516cm^2 area.

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

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 800mA
- Internal or external soft-start
- Minimal external components required
- Power-good and enable functions available

References

- ISL85410 Datasheet
- ISL85418 Datasheet

Ordering Information

PART NUMBER	DESCRIPTION
ISL85410DEMO1Z	Demonstration Board (1A output current)
ISL85418DEMO1Z	Demonstration Board (800mA output current)

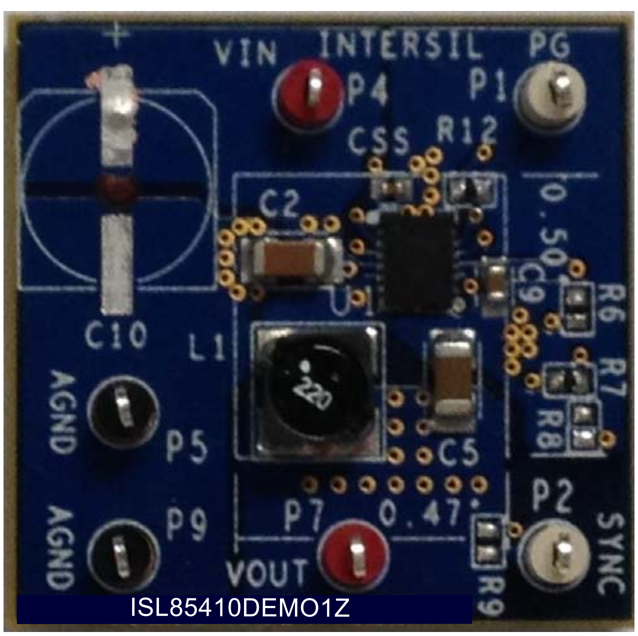


FIGURE 1. FRONT OF EVALUATION BOARD ISL85410DEMO1Z

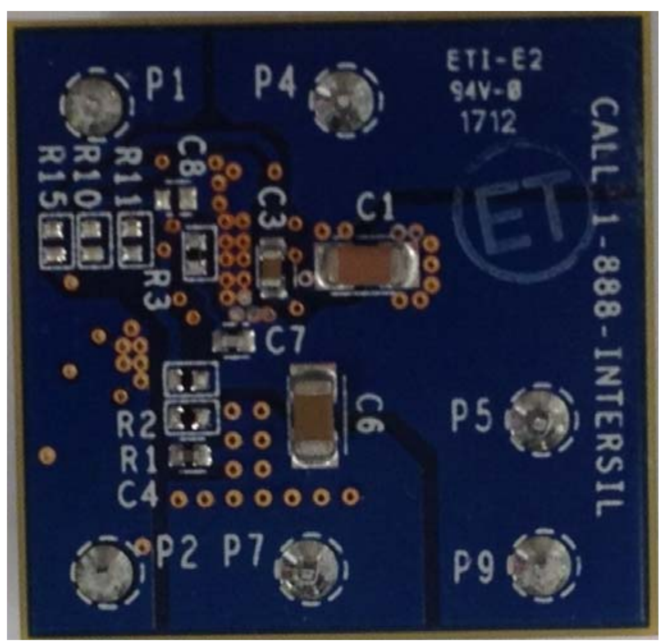


FIGURE 2. BACK OF EVALUATION BOARD ISL85410DEMO1Z

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_{OUT}.

Evaluating the Other Output Voltage

The ISL85410DEMO1Z, ISL85418DEMO1Z kit outputs are preset to 3.3V; however, output voltages can be adjusted from 0.6V to 15V. The output voltage programming resistor, R_2, will depend on the desired output voltage of the regulator and the value of the feedback resistor R_1, 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_1 is shorted. Please note that if V_{OUT} 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 and ISL85418 for further information.

Table 1 shows the component selection that should be used for the respective V_{OUT}.

TABLE 1. EXTERNAL COMPONENT SELECTION

V_{OUT} (V)	L_1 (µH)	C_5+C_6 (µF)	R_1 (kΩ)	R_2 (kΩ)	C_4 (pF)	R_{12} (kΩ)	R_3 (kΩ)	C_7 (pF)
12	22	2x22	90.9	4.75	22	115	150	470
5	22	47+22	90.9	12.4	27	DNP (Note 1)	100	470
3.3	22	47+22	90.9	20	27	DNP (Note 1)	100	470
2.5	22	47+22	90.9	28.7	27	DNP (Note 1)	100	470
1.8	12	47+22	90.9	45.5	27	DNP (Note 1)	70	470

NOTE:

1. Connect FS to Vcc

Frequency Control

The ISL85410, 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_{OUTs} when minimum on time would limit the operation otherwise. Default switching frequency is 500kHz when FS is tied to V_{CC} (R_{10} = 0). By removing R_{10}, the switching frequency could be changed from 300kHz (R_{12} = 340k) to 2MHz (R_{12} = 32.4k). Please refer to datasheets ISL85410 and ISL85418 for calculating the value of R_{10}. Do not leave this pin floating.

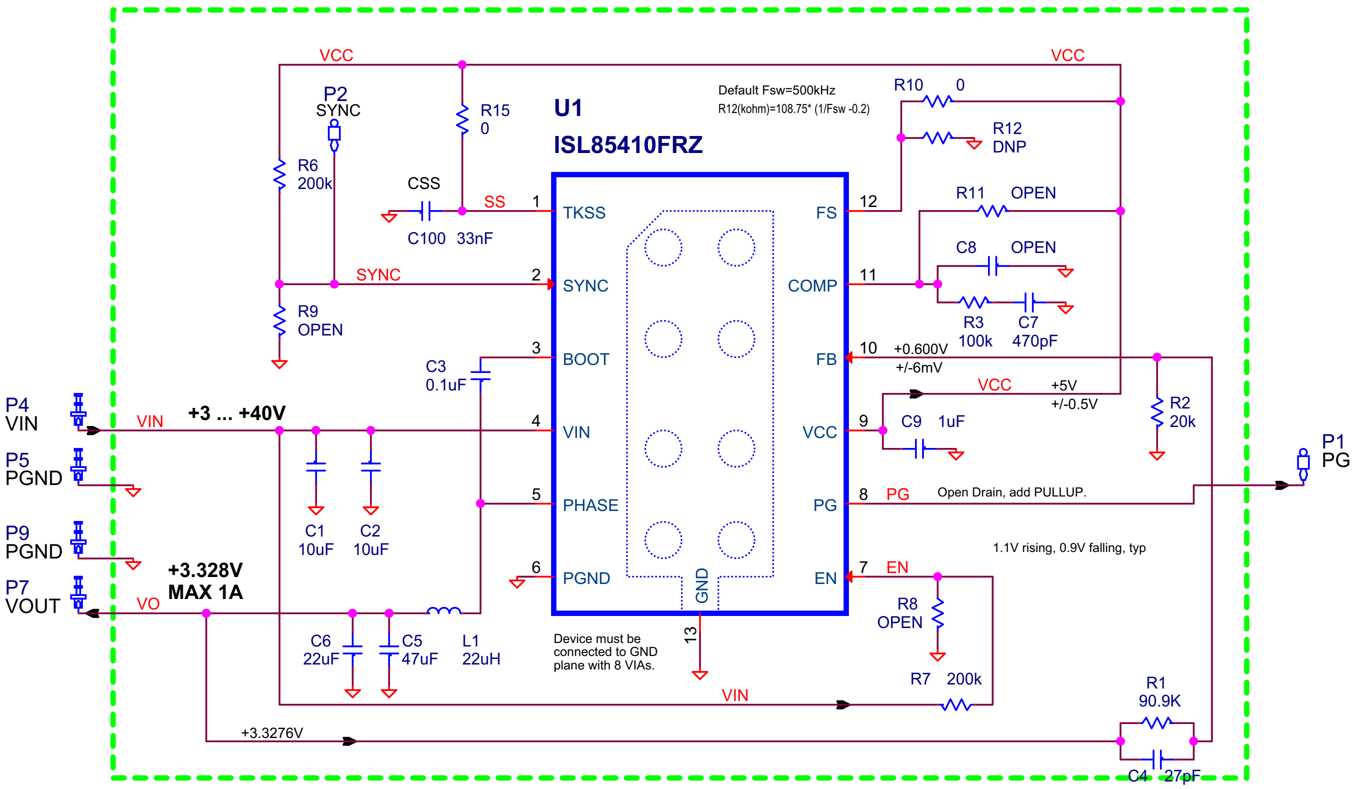
SYNC Control

The ISL85410, ISL85418 demo boards have a SYNC pin that allows external synchronization frequency to be applied. Default board configuration has R_6 = 200k to V_{CC}, which defaults to PWM operation mode and also to the preselected switching frequency set by R_{12} (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_{15} selects between internal (R_{15} = 0) and external soft-start. R_{11} selects between internal (R_{11} = 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 and ISL85418 datasheets.

ISL85410DEM01Z Schematic



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 3. ISL85410DEM01Z SCHEMATIC

ISL85410DEMO1Z, ISL85418DEMO1Z BOM

MANUFACTURER PART	QTY	UNITS	REFERENCE DESIGNATOR	DESCRIPTION	MANUFACTURER
ISL85400EVAL2ZREVAPCB	1	ea	LABEL-RENAME BOARD	PWB-PCB, ISL85400EVAL2Z, REVA, ROHS	INTERSIL
EEE-FK1H151P	1	ea	C10 (Optional)	CAP, SMD, 10.3mm, 150µF, 50V, 20%, ROHS, ALUM.ELEC.	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	2	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
74408943220	1	ea	L1	COIL-PWR INDUCTOR, SMD, 4.8mm, 22µH, 20%, 1.1A, ROHS	WURTH 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 ISL85418FRZ for ISL85418DEMO1Z	1	ea	U1	IC-500mA 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, ISL85418DEMO1Z Board Layout

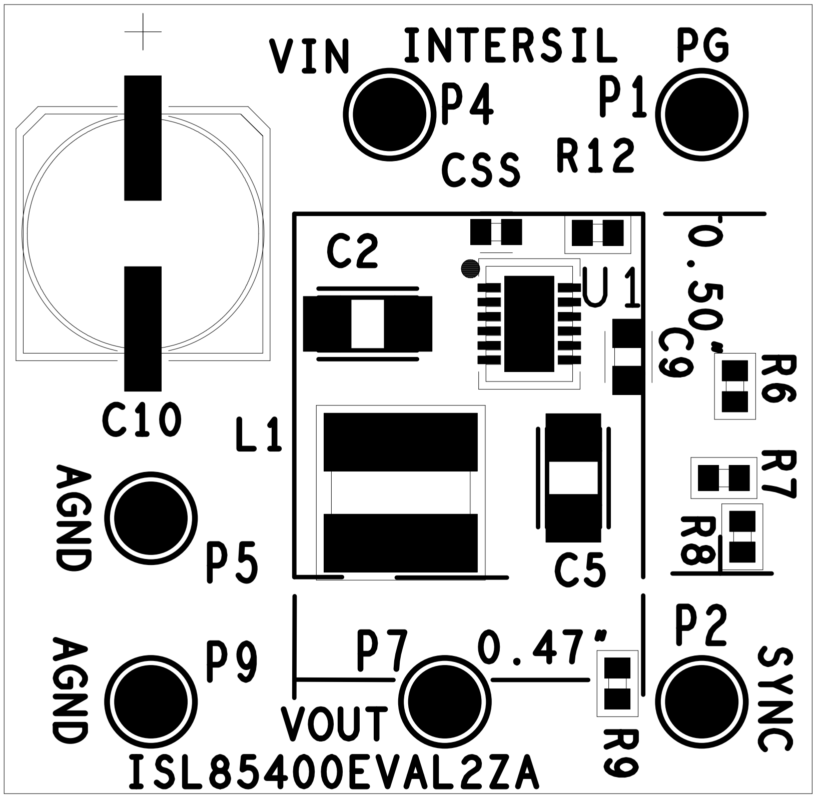


FIGURE 4. SILK SCREEN TOP

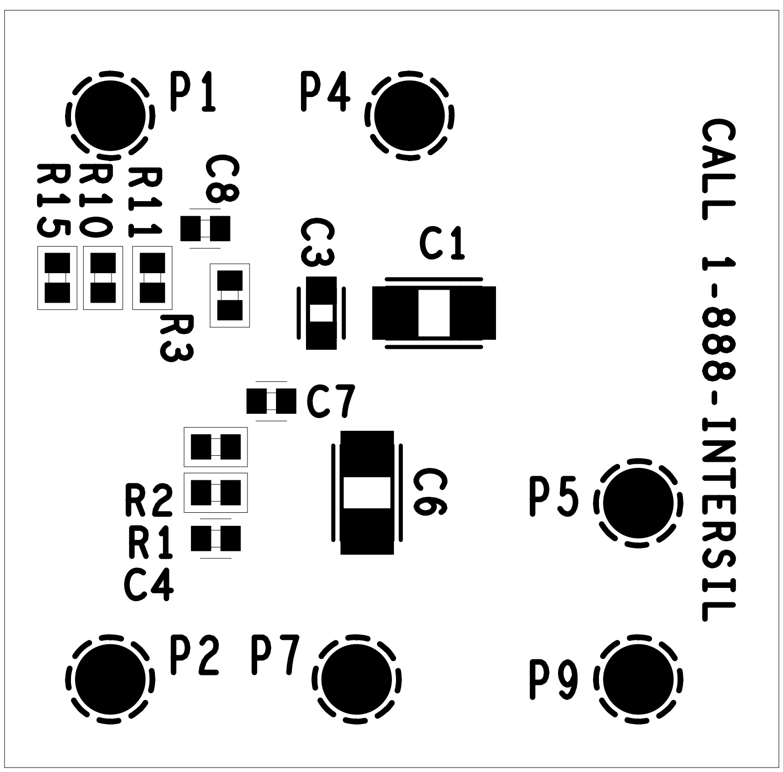


FIGURE 5. SILK SCREEN BOTTOM

ISL85410 Efficiency Curves f_{SW} = 500kHz, T_A = +25°C

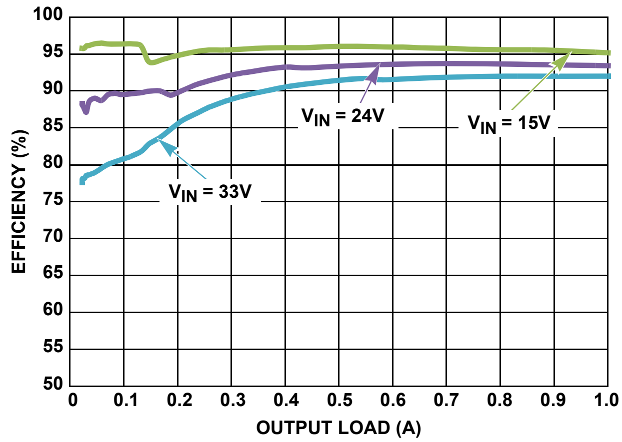


FIGURE 6. EFFICIENCY vs LOAD, PFM, V_{OUT} = 12V

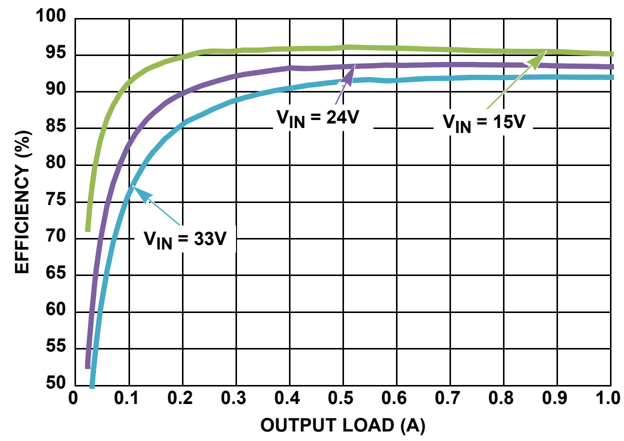


FIGURE 7. EFFICIENCY vs LOAD, PWM, V_{OUT} = 12V

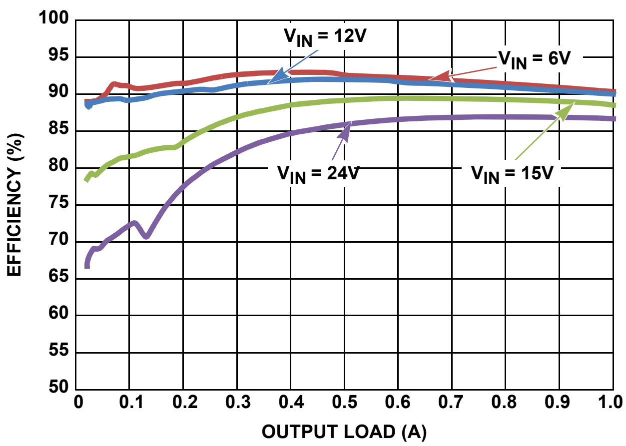


FIGURE 8. EFFICIENCY vs LOAD, PFM, V_{OUT} = 5V, L_1 = 30µH

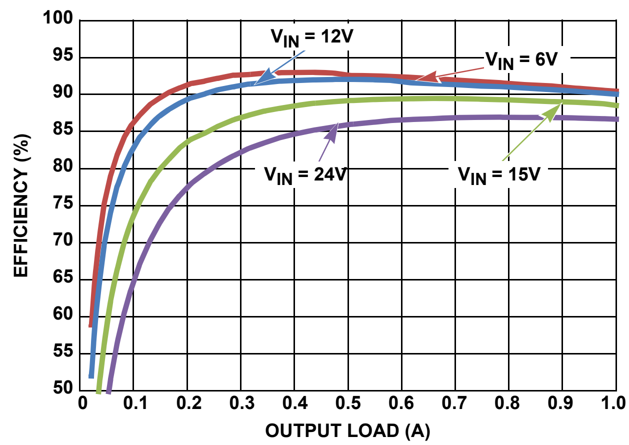


FIGURE 9. EFFICIENCY vs LOAD, PWM, V_{OUT} = 5V, L_1 = 30µH

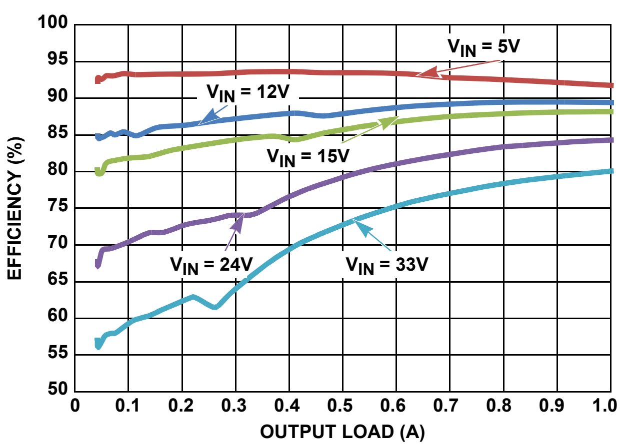


FIGURE 10. EFFICIENCY vs LOAD, PFM, V_{OUT} = 3.3V

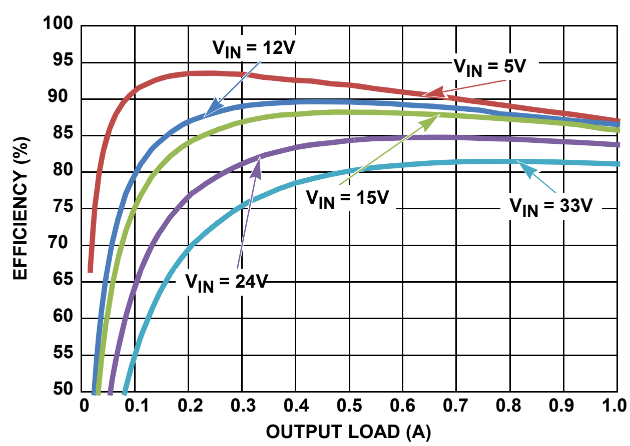


FIGURE 11. EFFICIENCY vs LOAD, PWM, V_{OUT} = 3.3V

ISL85410 Efficiency Curves f_{SW} = 500kHz, T_A = +25°C (Continued)

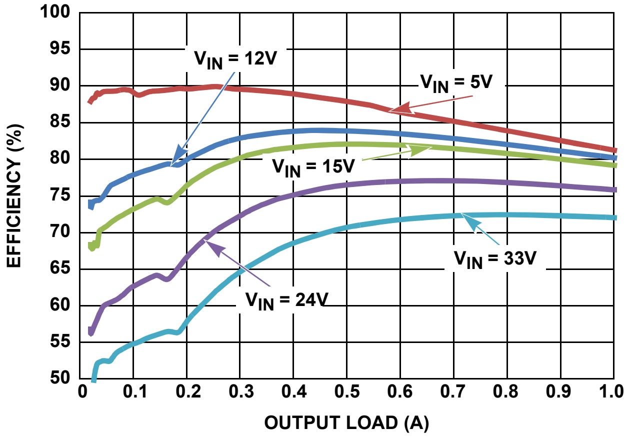


FIGURE 12. EFFICIENCY vs LOAD, PFM, V_{OUT} = 1.8V

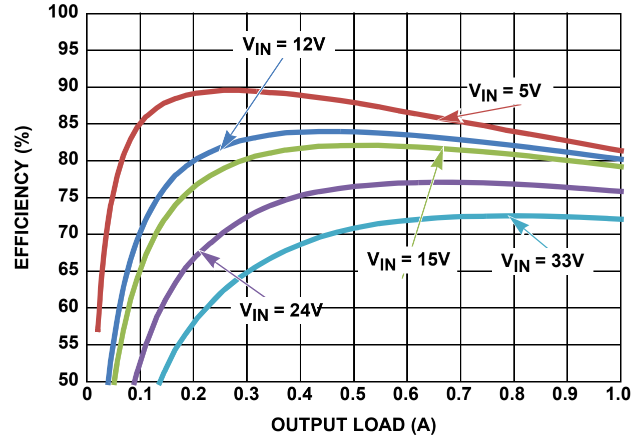


FIGURE 13. EFFICIENCY vs LOAD, PWM, V_{OUT} = 1.8V

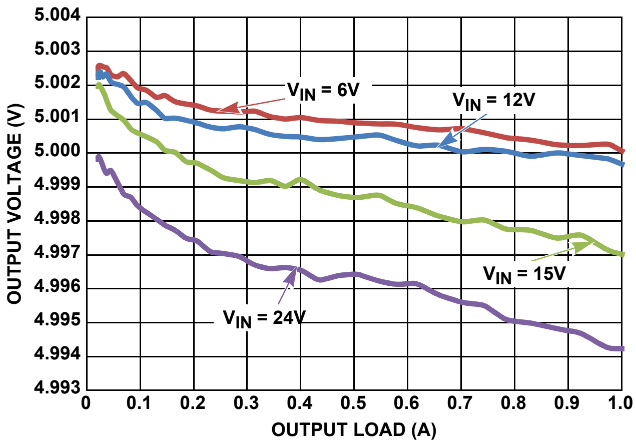


FIGURE 14. EFFICIENCY vs LOAD, PWM, V_{OUT} = 5V, L_1 = 30µH

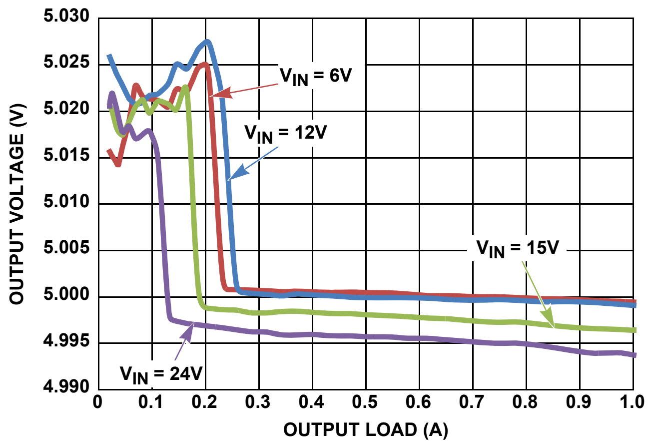


FIGURE 15. V_{OUT} REGULATION vs LOAD, PFM, V_{OUT} = 5V, L_1 = 30µH

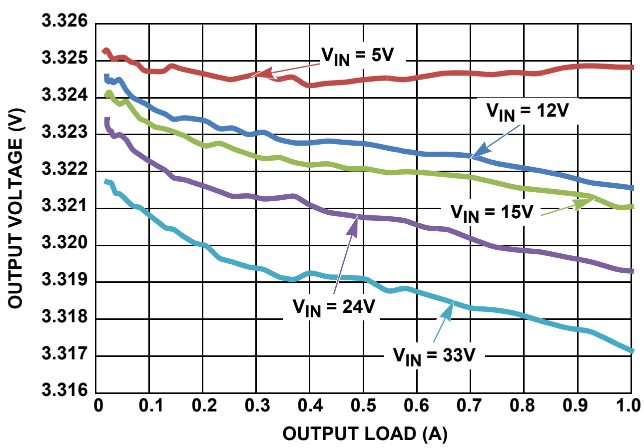


FIGURE 16. V_{OUT} REGULATION vs LOAD, PWM, V_{OUT} = 3.3V

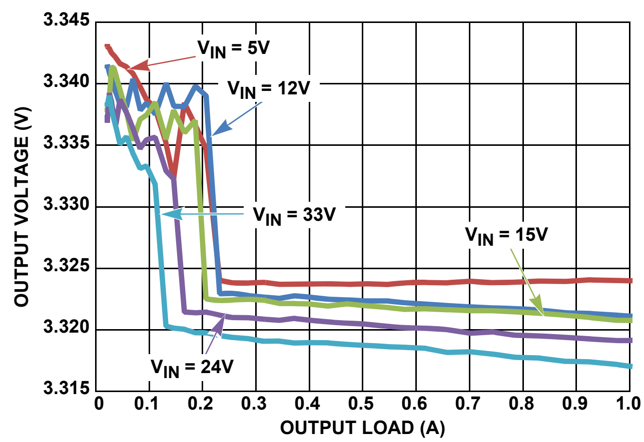


FIGURE 17. V_{OUT} REGULATION vs LOAD, PFM, V_{OUT} = 3.3V

ISL85410 Efficiency Curves f_{SW} = 500kHz, T_A = +25°C (Continued)

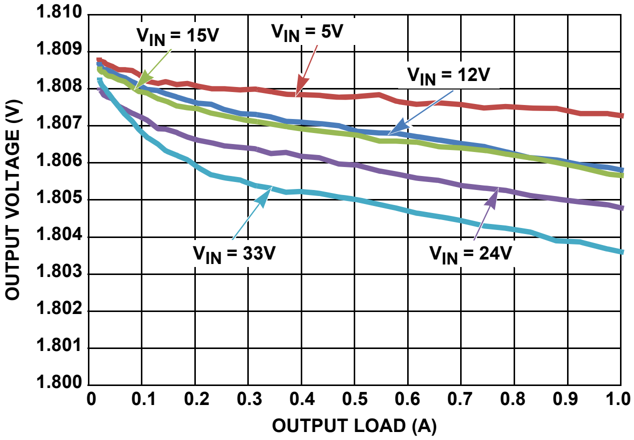


FIGURE 18. V_{OUT} REGULATION vs LOAD, PWM, V_{OUT} = 1.8V

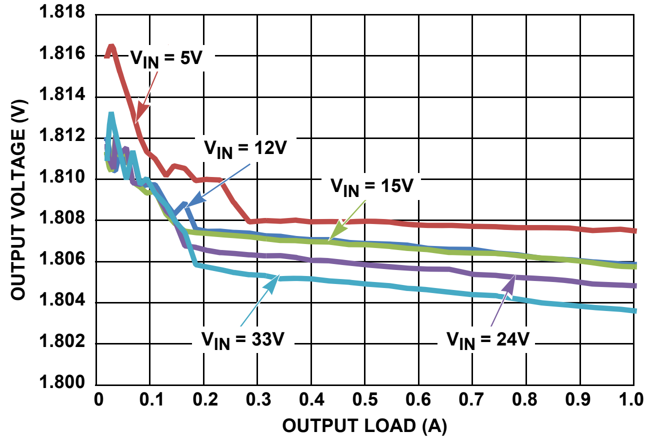


FIGURE 19. V_{OUT} REGULATION vs LOAD, PFM, V_{OUT} = 1.8V

ISL85410 Typical Performance Curves f_{SW} = 500kHz, V_{IN} = 24V, V_{OUT} = 3.3V, T_A = +25°C

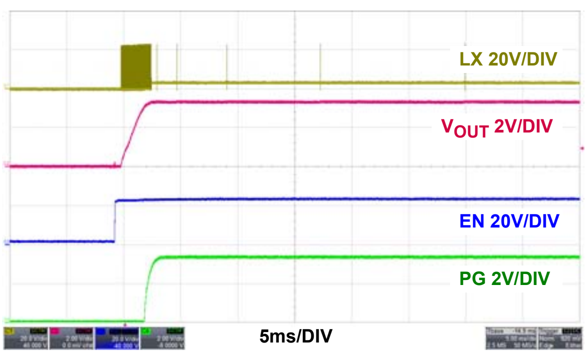


FIGURE 20. START-UP AT NO LOAD, PFM

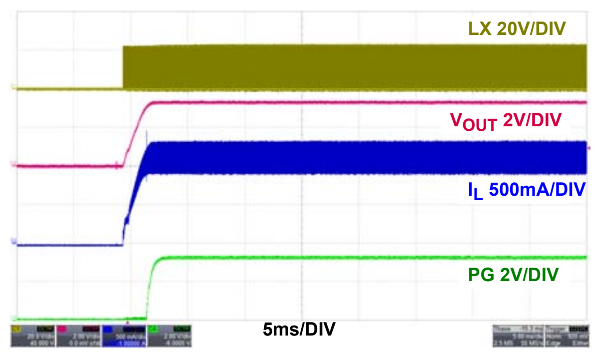


FIGURE 21. START-UP AT 1A, PWM

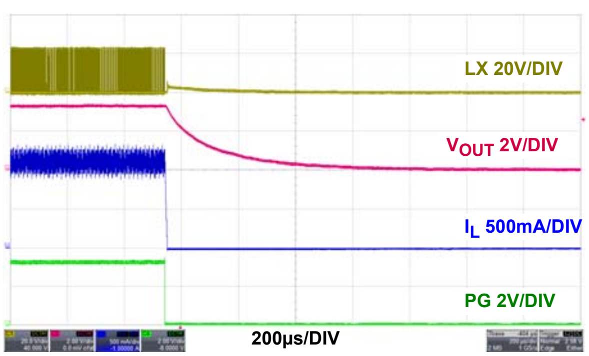


FIGURE 22. SHUTDOWN AT 1A, PWM

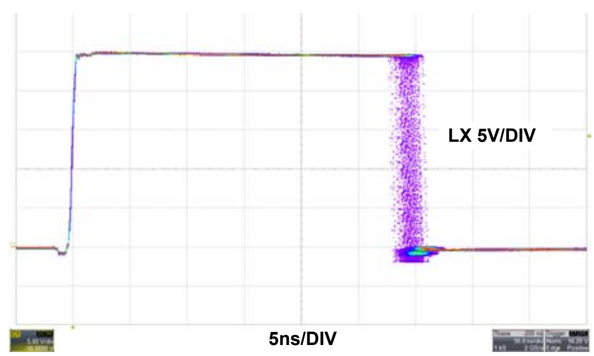


FIGURE 23. JITTER AT 1A LOAD, PWM

ISL85410 Typical Performance Curves f_{SW} = 500kHz, V_{IN} = 24V, V_{OUT} = 3.3V, T_A = +25°C (Continued)

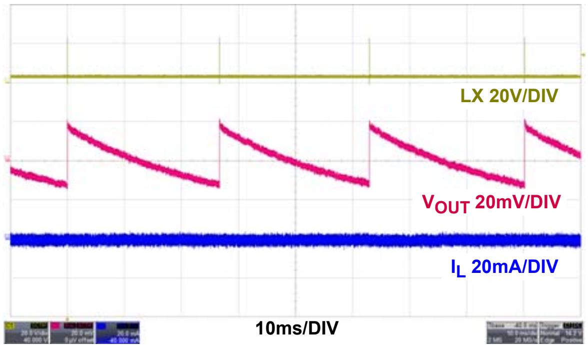


FIGURE 24. STEADY STATE AT NO LOAD, PFM

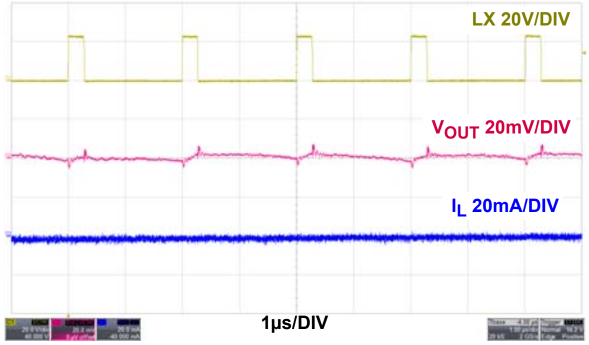


FIGURE 25. STEADY STATE AT NO LOAD, PWM

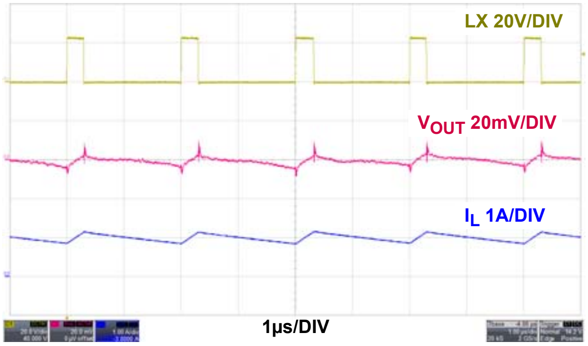


FIGURE 26. STEADY STATE AT 1A, PWM

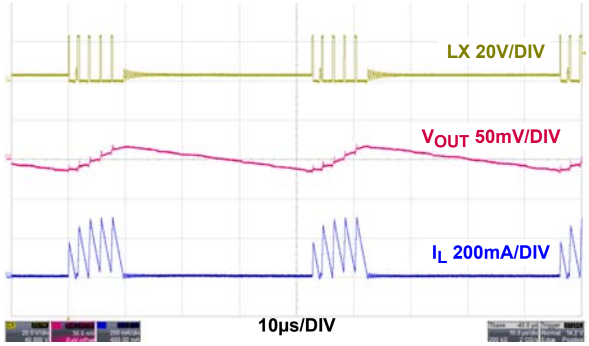


FIGURE 27. LIGHT LOAD OPERATION AT 20mA, PFM

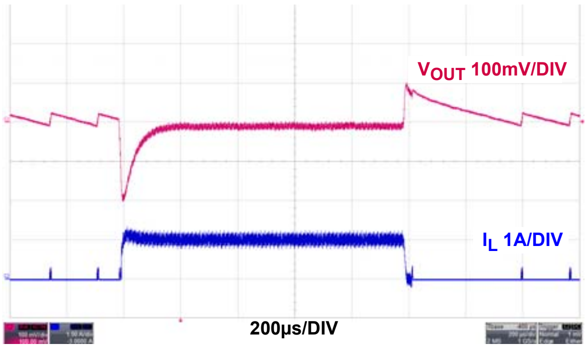


FIGURE 28. LOAD TRANSIENT, PFM

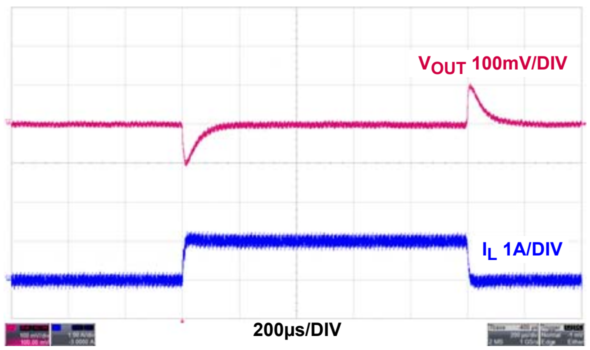


FIGURE 29. LOAD TRANSIENT, PWM

ISL85410 Typical Performance Curves f_{SW} = 500kHz, V_{IN} = 24V, V_{OUT} = 3.3V, T_A = +25°C (Continued)

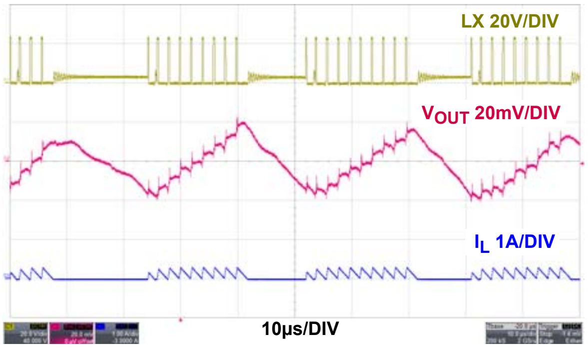


FIGURE 30. PFM TO PWM TRANSITION

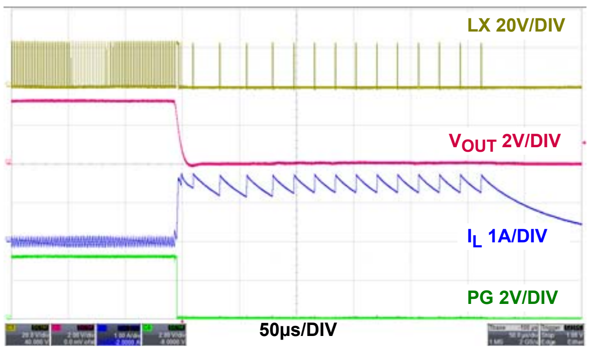


FIGURE 31. OVERCURRENT PROTECTION, PWM

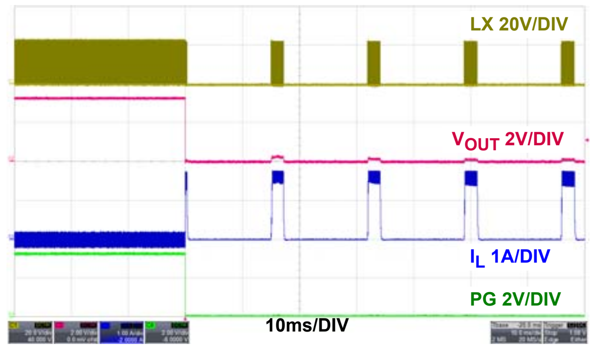


FIGURE 32. OVERCURRENT PROTECTION HICCUP, PWM

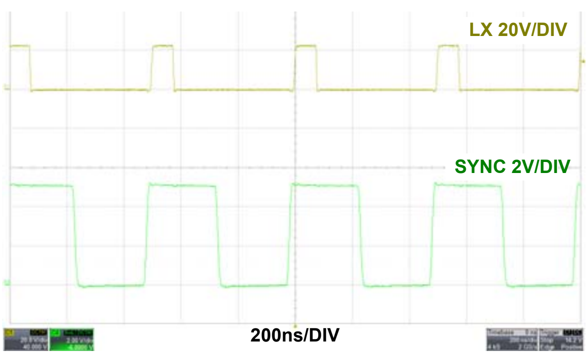


FIGURE 33. SYNC AT 1A LOAD, PWM

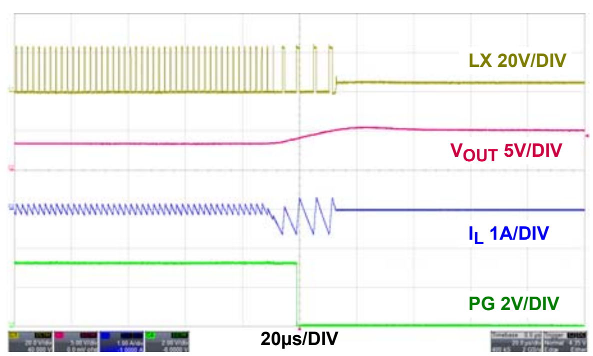


FIGURE 34. NEGATIVE CURRENT LIMIT, PWM

ISL85410 Typical Performance Curves f_{SW} = 500kHz, V_{IN} = 24V, V_{OUT} = 3.3V, T_A = +25°C (Continued)

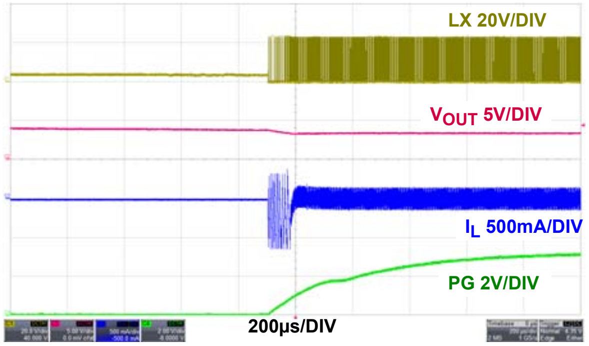


FIGURE 35. NEGATIVE CURRENT LIMIT RECOVERY, PWM

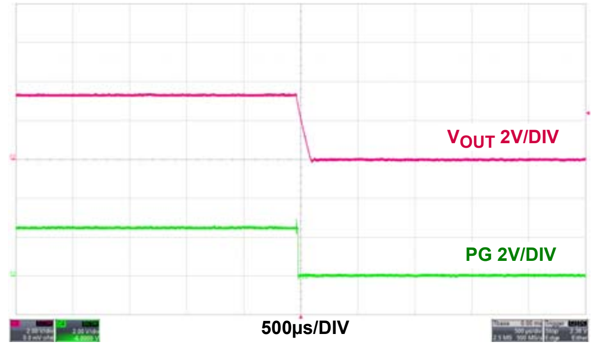


FIGURE 36. OVER-TEMPERATURE PROTECTION, PWM