

ISL73847MDEMO2Z

The ISL73847MDEMO2Z demonstration board demonstrates the performance of the [ISL73847M](#) dual-phase buck controller in single-phase mode. The board is optimized for a 4.5V to 15V input operation to generate a 25A max, 1V output.

**Features**

- Power-Good LED indicator
- Integrated LDO (VCC)
- Droop regulation set by a single resistor

**Specifications**

- Input voltage supply ( $V_{IN}$ ): 4.5V to 15V
- Preset output voltage ( $V_{OUT}$ ): 1V
- Preset switching frequency: 500kHz
- Maximum load current: 25A
- Preset droop regulation

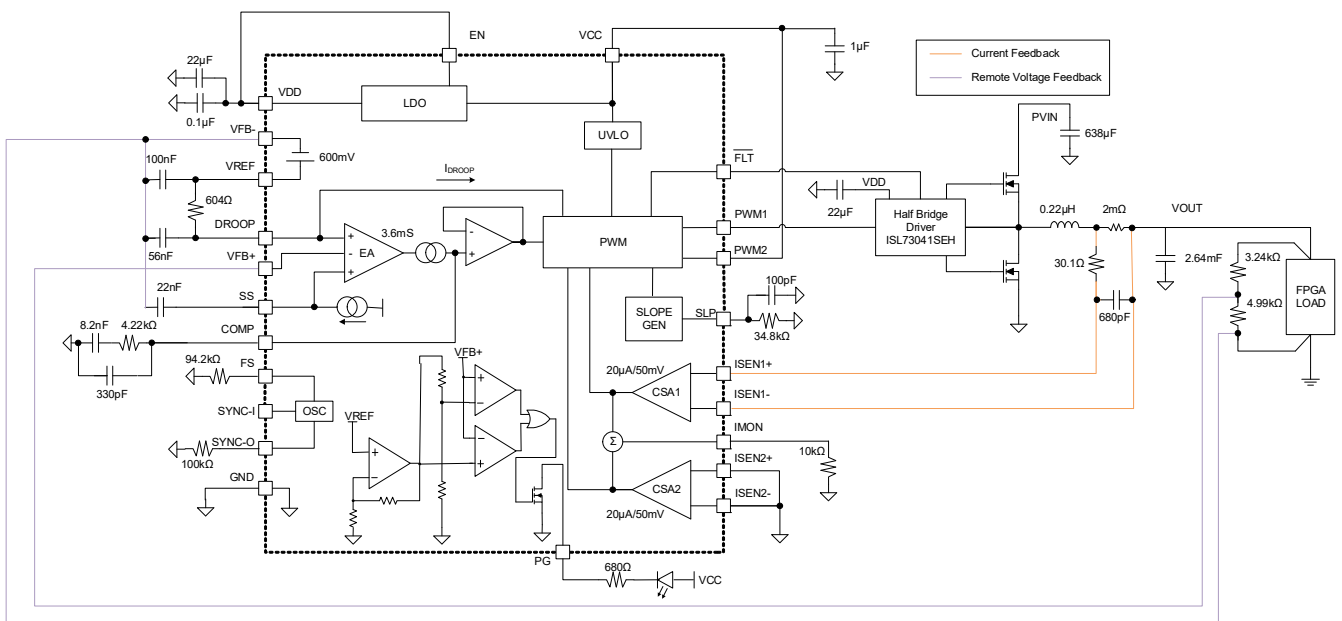


Figure 1. ISL73847MDEMO2Z Block Diagram

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# 1. Functional Description

## 1.1 Operating Range

The ISL73847MDEMO2Z board requires one input supply ( $V_{IN}$ ) to operate properly. This supply powers the ISL73847M controller analog supply input, plus additional supporting circuitry and the on-board buck power supply input. The user can set the  $V_{IN}$  supply from 4.5V to 15V. The buck regulator circuit is preset for a 1V output voltage and a switching frequency of 500kHz with a 0.22 $\mu$ H output inductor and 2.64mF output capacitance.

## 1.2 Before Starting

The board does not come with any connectors. To properly use the board, solder connectors to the  $V_{IN}$ , GND, and  $V_{OUT}$  solder pads.

## 1.3 Quick-Start Guide

1. Apply a 4.5V to 15V voltage to  $V_{IN}$  connectors, as shown in [Figure 2](#). To use 4w sense lines from a power supply or a voltmeter to monitor the input voltage, solder a jumper to TP1.
2. If required, a resistor or electronic load can be connected to the  $V_{OUT}$  connectors, as shown in [Figure 2](#). To use 4w sense lines from an electronic load, solder a jumper to TP2.

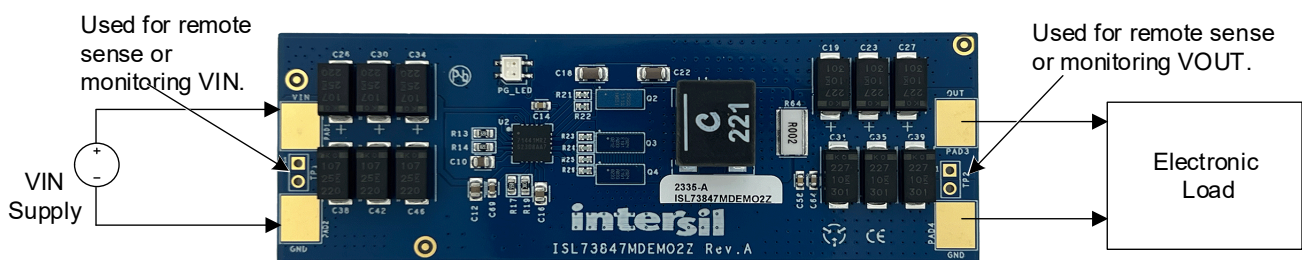


Figure 2. ISL73847MDEMO2Z Board Setup

## 1.4 Changing the Switching Frequency

The ISL73847MDEMO2Z is configured for a 500kHz switching frequency by a 94.2k $\Omega$  pull-down resistor ( $R_2$ ) on the FS pin. The demonstration board includes a 0.22 $\mu$ H inductor and an array of output bypass capacitors for a 2.64mF, which makes up the LC filter. If you need to select a different switching frequency, see [Figure 3](#) for choosing the appropriate  $R_2$  value on FS. For more information about the FS pin, refer to the *ISL73847M Datasheet*.

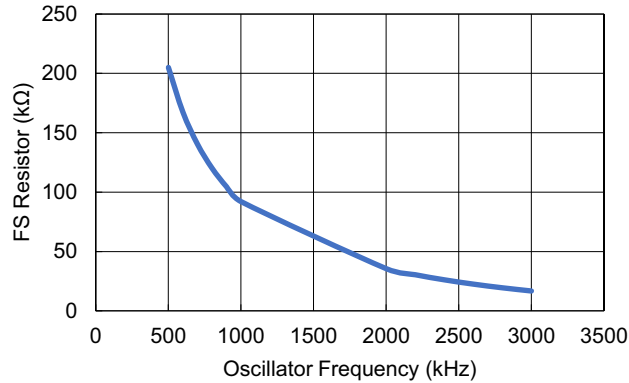


Figure 3.  $R_{FS}$  vs Frequency

## 1.5 Soft-Start Adjustment

The ISL73847MDEMO2Z is configured for a 2ms soft-start (SS) time by a 22nF bypass capacitor ( $C_2$ ) connected to the SS pin. The SS time can be adjusted from 2ms to 200ms by changing the  $C_2$  capacitor. If a different soft-start time is required, use the CSS equation in the *ISL73847M datasheet* to calculate the capacitance given the required soft-start time. For more information on SS, refer to the *ISL73847M datasheet*.

## 1.6 Droop Regulation

The ISL73847MDEMO2Z minimizes peak-to-peak transient response excursions by using a 604 $\Omega$  resistor ( $R_1$ ) connected between the VREF and DROOP pins. If droop regulation is unnecessary, replace the 604 $\Omega$  with a 0 $\Omega$  resistor to short the VREF and DROOP pins together. For more information about the droop regulation, refer to the *ISL73847M datasheet*.

## 1.7 Enabling/Disabling

The ISL73847MDEMO2Z automatically enables when VDD reaches a certain voltage on power-up by a 4.99k $\Omega$  resistor ( $R_6$ ) connected between EN and VDD. For more information about enabling and disabling the controller, refer to the *ISL73847M datasheet*.

## 2. Board Design

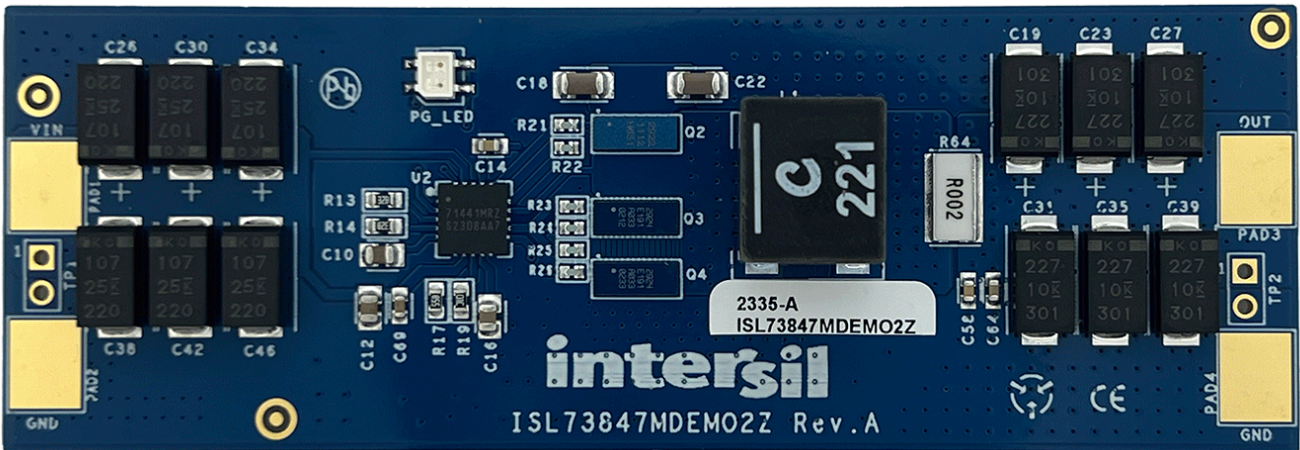


Figure 4. ISL73847MDEMO2Z Evaluation Board (Top)

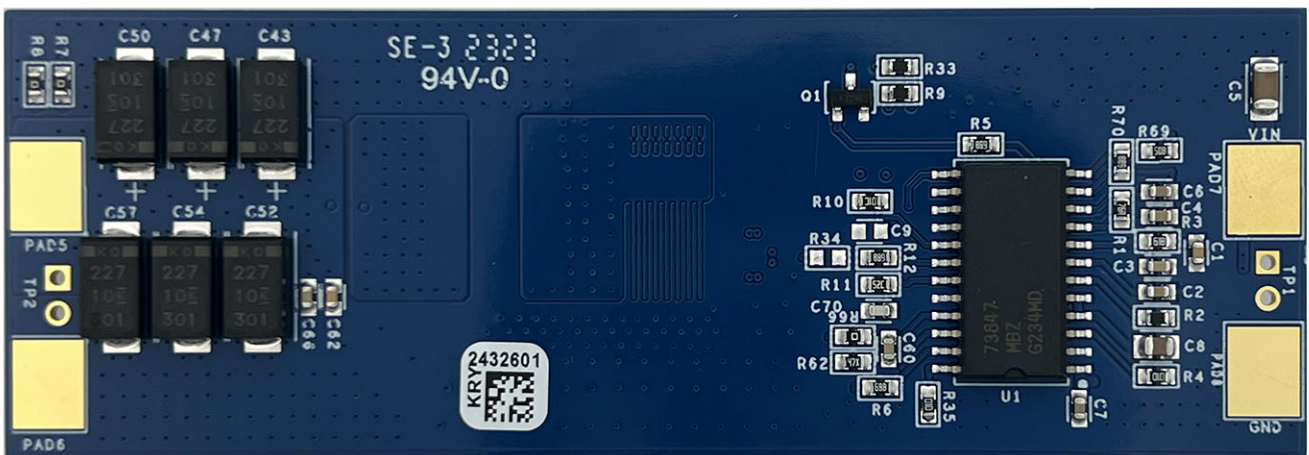


Figure 5. ISL73847MDEMO2Z Evaluation Board (Bottom)

### 2.1 Layout Guidelines

For detailed information about layout guidelines, refer to the *ISL73847M Datasheet*.

## 2.2 Schematic Diagrams

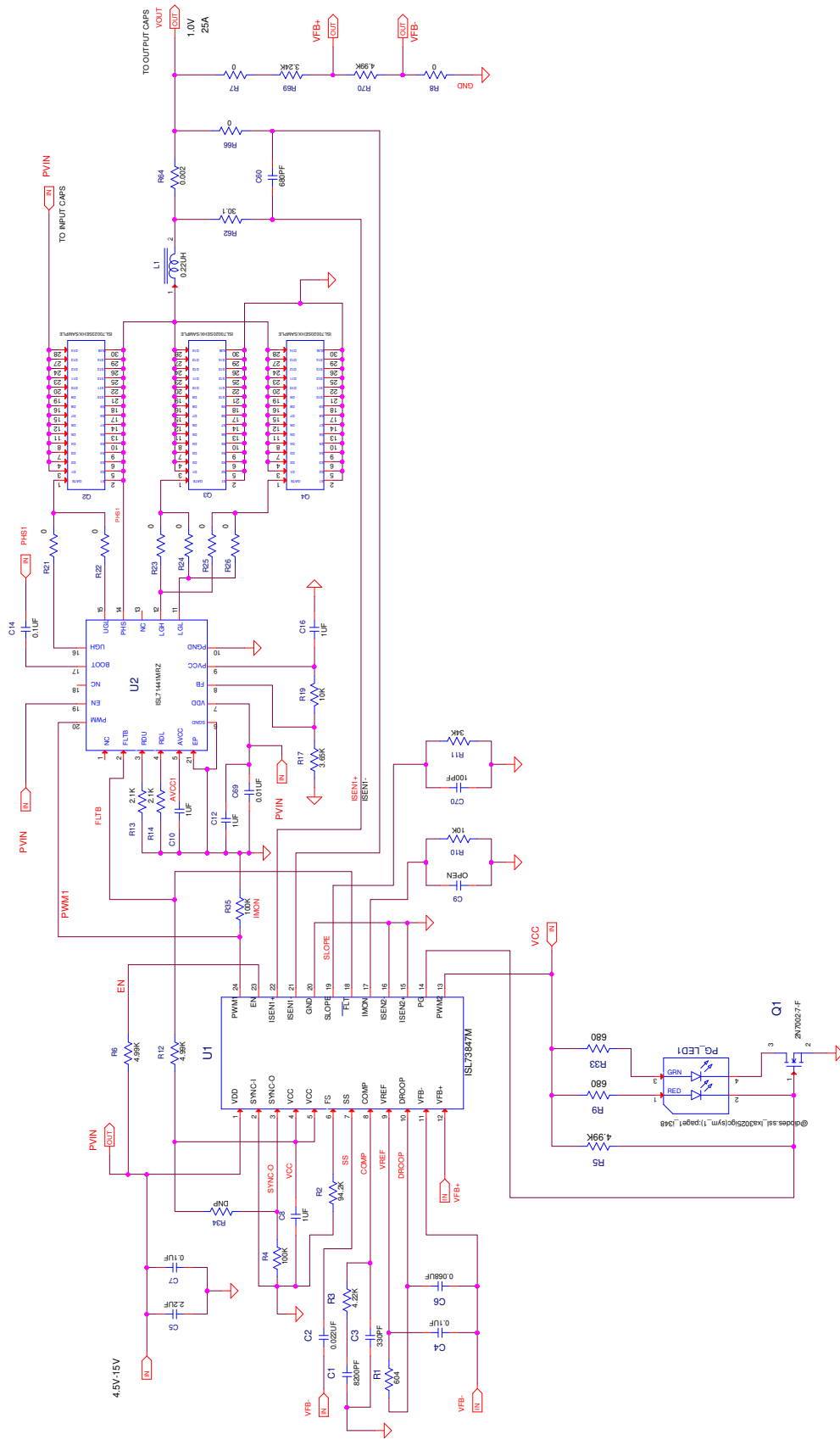


Figure 6. ISL73847MDEMO2Z Schematic (Page 1)

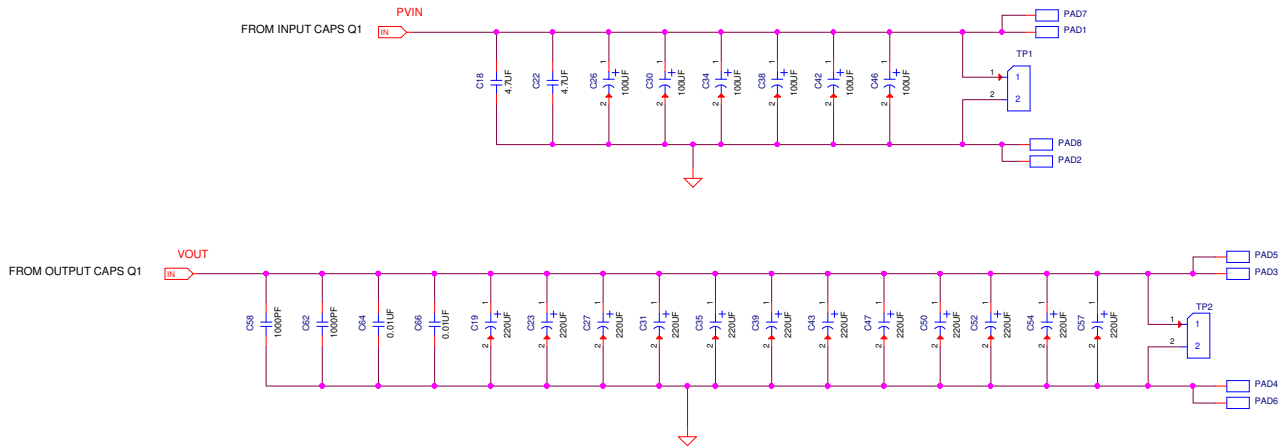


Figure 7. ISL73847MDEMO2Z Schematic (Page 2)

### 2.3 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1	-	PWB-PCB, ISL73847MDEMO2Z, REVA, ROHS	Imagineering Inc	ISL73847MDEMO2ZREVAPCB
2	C58, C62	CAP, SMD, 0603, 1000pF, 16V, 10%, X7R, ROHS	AVX	0603YC102KAT2A
2	C8, C10	CAP, SMD, 0805, 1.0µF, 25V, 10%, X7R, ROHS	TDK	C2012X7R1E105K125AB
2	C18, C22	CAP, SMD, 1206, 4.7µF, 25V, 10%, X7R, ROHS	TDK	C3216X7R1E475K
2	C64, C66	CAP, SMD, 0603, 0.01µF, 16V, 10%, X7R, ROHS	Yageo	CC0603KRX7R7BB103
1	C2	CAP, SMD, 0603, 0.022µF, 16V, 10%, X7R, ROHS	Yageo	CC0603KRX7R7BB223
1	C70	CAP, SMD, 0603, 100pF, 25V, 10%, X7R, ROHS	Yageo	CC0603KRX7R8BB101
2	C4, C14	CAP, SMD, 0603, 0.1µF, 25V, 10%, X7R, ROHS	Yageo	CC0603KRX7R8BB104
1	C7	CAP, SMD, 0603, 0.1µF, 50V, 10%, X7R, ROHS	Yageo	CC0603KRX7R9BB104
1	C3	CAP, SMD, 0603, 330pF, 50V, 10%, X7R, ROHS	Yageo	CC0603KRX7R9BB331
1	C60	CAP, SMD, 0603, 680pF, 50V, 10%, X7R, ROHS	Yageo	CC0603KRX7R9BB681
1	C6	CAP, SMD, 0603, 0.068µF, 50V, 10%, X7R, ROHS	Yageo	CC0603KRX7R9BB683
2	C12, C16	CAP, SMD, 0805, 1.0µF, 25V, 10%, X7R, ROHS	Samsung	CL21B105KAFNNNE
1	C5	CAP-AEC-Q200, SMD, 1206, 2.2µF, 25V, 10%, X7R, ROHS	Murata	GCJ31MR71E225KA12L

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Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1	C69	CAP, SMD, 0603, 0.01 $\mu$ F, 25V, 10%, X7R, ROHS	Murata	GRM188R71E103KA01D
0	C9	CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS		
6	C26, C30, C34, C38, C42, C46	CAP-TANT, SMD, 7.3 $\times$ 4.3mm, 100 $\mu$ F, 25V, 20%, 30m $\Omega$ at 100MHz, ROHS	Kemet	T521X107M025ATE030
12	C19, C23, C27, C31, C35, C39, C43, C47, C50, C52, C54, C57	CAP-TANT, SMD, 7.3 $\times$ 4.3 $\times$ 2.8, 220 $\mu$ F, 10V, 20%, 6m $\Omega$ , ROHS	Kemet	T530D227M010ATE006
1	C1	CAP, SMD, 0603, 8200pF, 50V, 5%, X7R, ROHS	Vishay/Vitramon	VJ0603Y822JXACW1BC
1	L1	COIL-PWR INDUCT, AEC-Q200, SMD, 11.3 $\times$ 10mm, 0.22 $\mu$ H, 20%, 98.8A, ROHS	Coilcraft	XAL1010-221MEB
1	PG_LED	LED, SMD, 3 $\times$ 2.5mm, 4P, RED/GREEN, 12/20MCD, 2V	Lumex	SSL-LXA3025IGC-TR
2	Q3, Q4	IC-SAMPLE DIE, RAD HARD, 40V GAN FET, ROHS	Renesas Electronics America	ISL70020SEHX/SAMPLE
1	Q2	IC-SAMPLE DIE, RAD HARD, 100V GAN FET, ROHS	Renesas Electronics America	ISL70023SEHX/SAMPLE
1	U2	IC-GAN FET DRIVER, HALF-BRIDGE, 20P, QFN, ROHS	Renesas Electronics America	ISL71441MRZ
1	U1	IC-20V DUAL PHASE CONTROLLER, SMD, 24P, WSOIC, ROHS	Renesas Electronics America	ISL73847MBZ
1	Q1	TRANSISTOR, N-CHANNEL, 3LD, SOT-23, 60V, 115mA, ROHS	Diodes, Inc.	2N7002-7-F
2	R9, R33	RES-AEC-Q200, SMD, 0603, 680 $\Omega$ , 1/10W, 1%, TF, ROHS	Vishay/dale	CRCW0603680RFKEA
0	R34	RES, SMD, 0603, DNP-PLACE HOLDER, ROHS		
1	R64	RES-AEC-Q200, SMD, 2512W, 0.002 $\Omega$ , 3W, 2%, MF, ROHS	Susumu Co., LTD	KRL6432E-M-R002-G-T1
6	R21, R22, R23, R24, R25, R26	RES, SMD, 0402, 0 $\Omega$ , 1/16W, 1%, THINFILM, ANTI-SULFER, ROHS	Vishay/BC Components	MCS04020Z0000ZE000
2	R4, R35	RES, SMD, 0603, 100K, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-07100KL
2	R10, R19	RES, SMD, 0603, 10K, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-0710KL

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
2	R13, R14	RES, SMD, 0603, 2.1K, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-072K1L
1	R62	RES, SMD, 0603, 30.1Ω, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-0730R1L
1	R11	RES, SMD, 0603, 34K, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-0734KL
1	R69	RES, SMD, 0603, 3.24K, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-073K24L
1	R17	RES, SMD, 0603, 3.65K, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-073K65L
1	R3	RES, SMD, 0603, 4.22K, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-074K22L
4	R5, R6, R12, R70	RES, SMD, 0603, 4.99K, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-074K99L
1	R1	RES, SMD, 0603, 604Ω, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-07604RL
3	R7, R8, R66	RES, SMD, 0603, 0Ω, 1/10W, TF, ROHS	Yageo	RC0603JR-070RL
1	R2	RES, SMD, 0603, 94.2K, 1/10W, 0.1%, THINFILM, ROHS	Yageo	RT0603BRD0794K2L
0	PAD1-PAD8	DO NOT POPULATE OR PURCHASE	-	-
0	TP1, TP2	DO NOT POPULATE OR PURCHASE	-	-

## 2.4 Board Layout

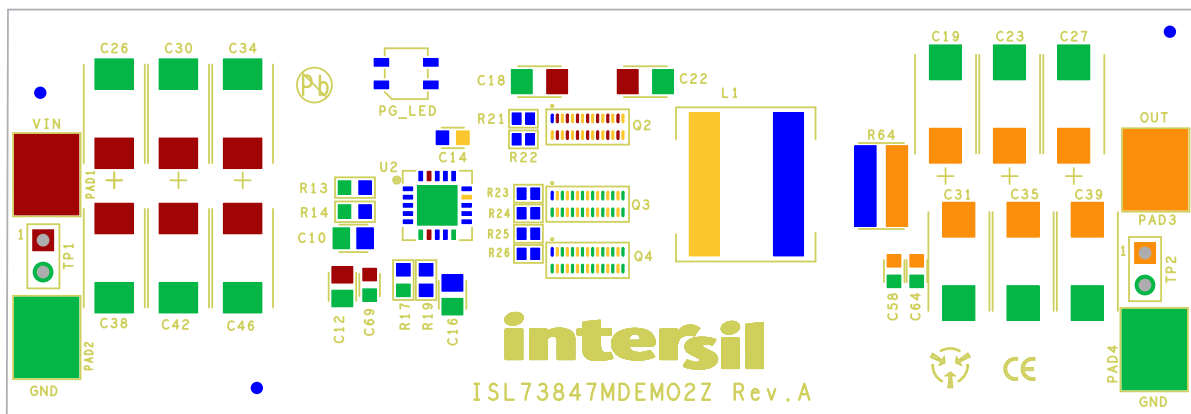


Figure 8. Silkscreen Top Layer

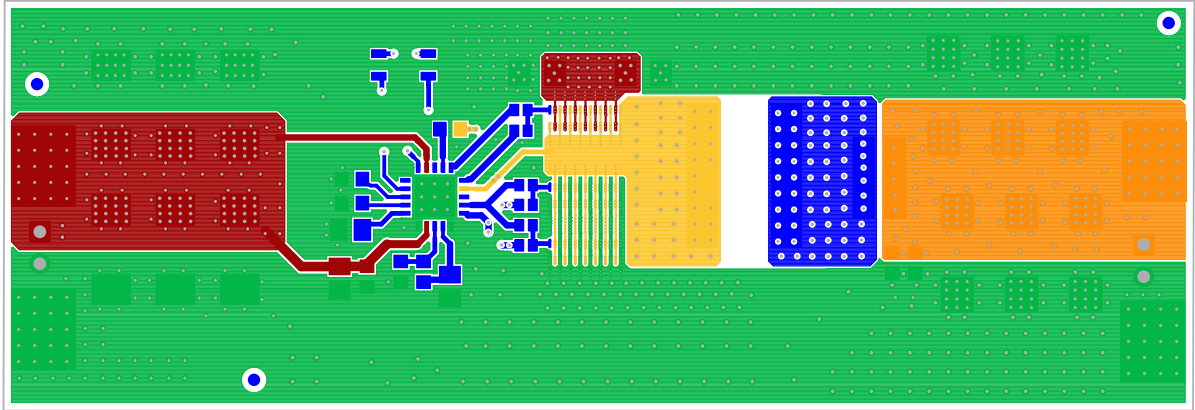


Figure 9. Top Layer

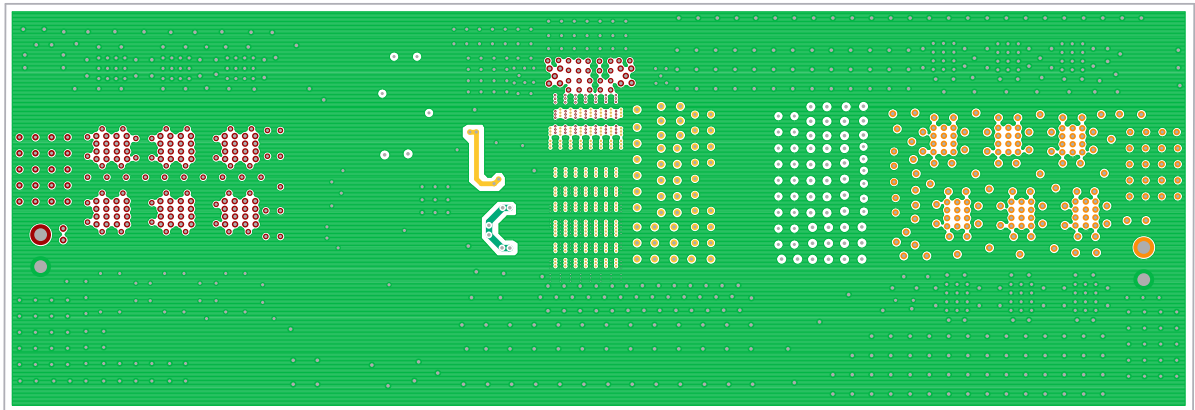


Figure 10. Layer 2

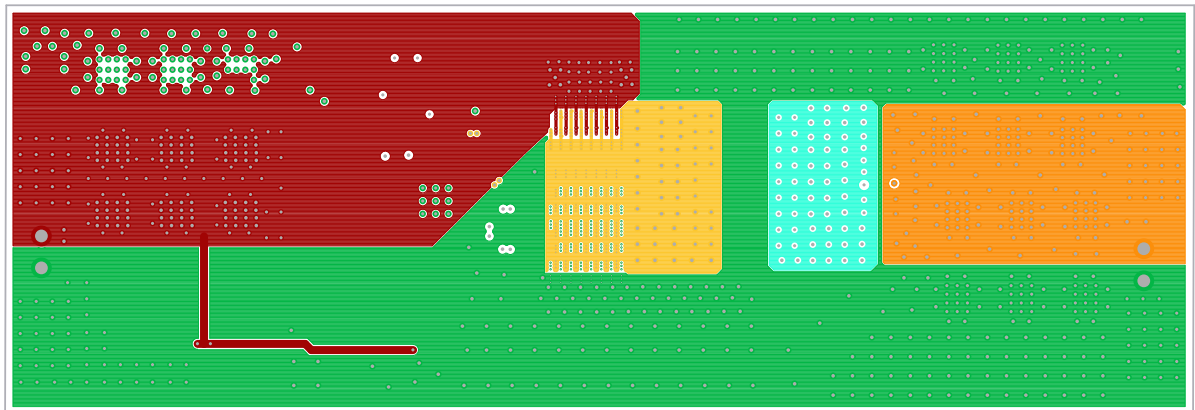


Figure 11. Layer 3

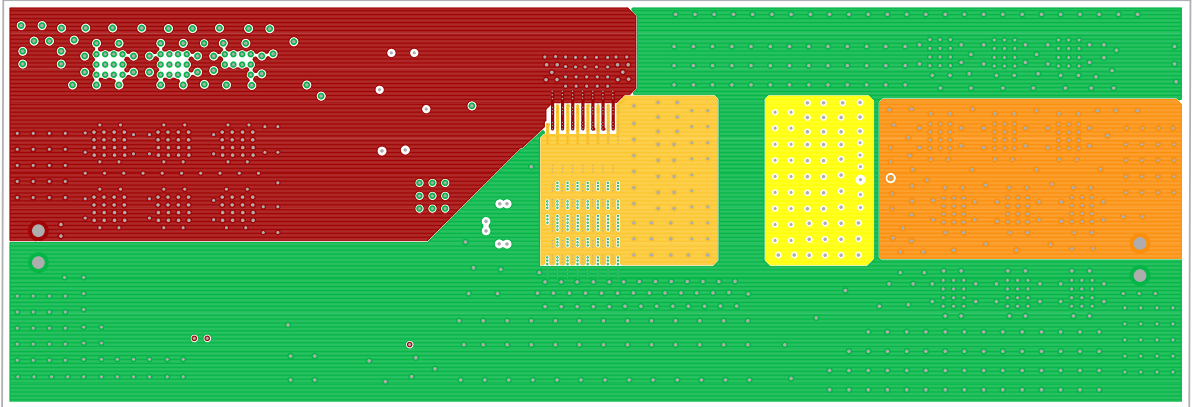


Figure 12. Layer 4

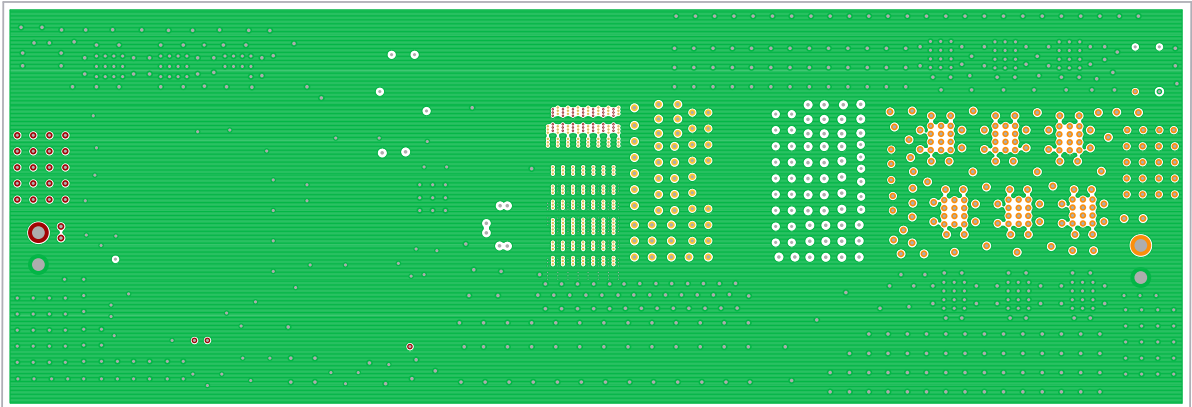


Figure 13. Layer 5

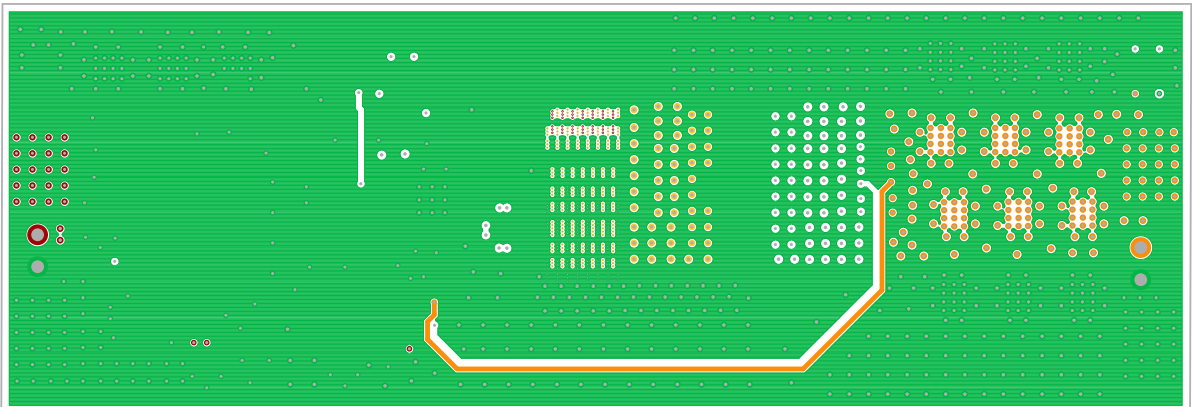


Figure 14. Layer 6

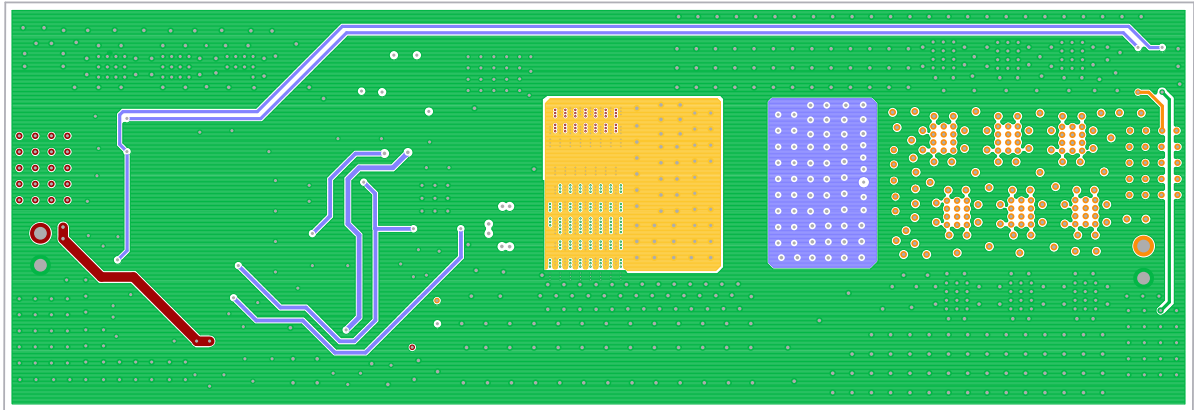


Figure 15. Layer 7

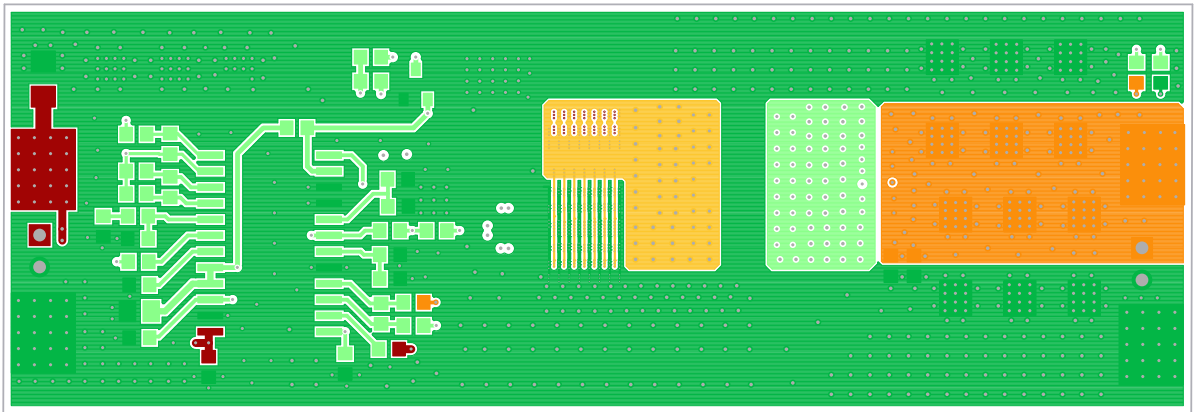


Figure 16. Bottom Layer

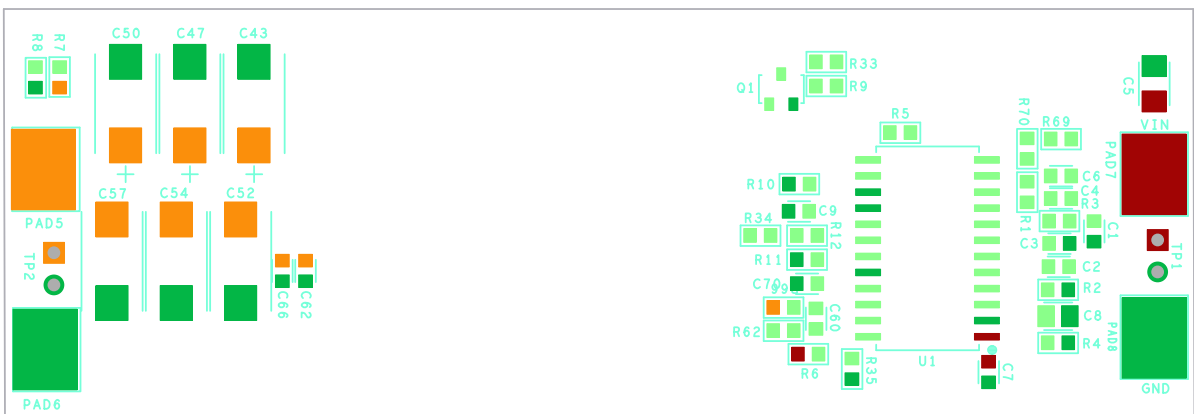


Figure 17. Silkscreen Bottom Layer

### 3. Typical Performance Graphs

Unless otherwise noted,  $V_{OUT} = 1V$ ;  $L_{OUT} = 220nH$ ,  $C_{OUT} = 2.64mF$ ,  $C_{DROOP} = 56nF$ ,  $C_{VREF} = 100nF$ ,  $R_{DROOP} = 604\Omega$ ,  $R_{FS} = 94.2k\Omega$ ,  $C_{SS} = 22nF$ ,  $C_{COMP} = 8.2nF$ ,  $R_{COMP} = 4.22k\Omega$ ,  $C_{POLE} = 330pF$ ,  $C_{VCC} = 1\mu F$ ,  $R_{SLP} = 34.8k\Omega$ ,  $C_{SLP} = 100pF$ ,  $T_A = +25^\circ C$

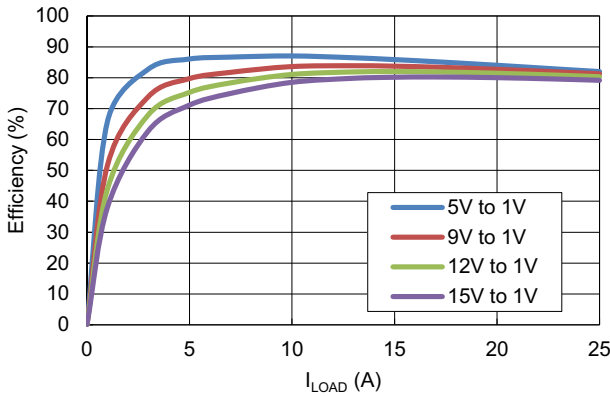


Figure 18. Conversion Efficiency for Various  $V_{IN}$  ( $f_{SW} = 500kHz$ )

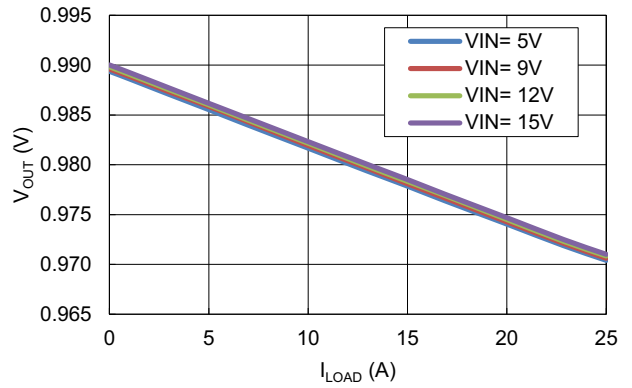


Figure 19. Droop Regulation for Various  $V_{IN}$

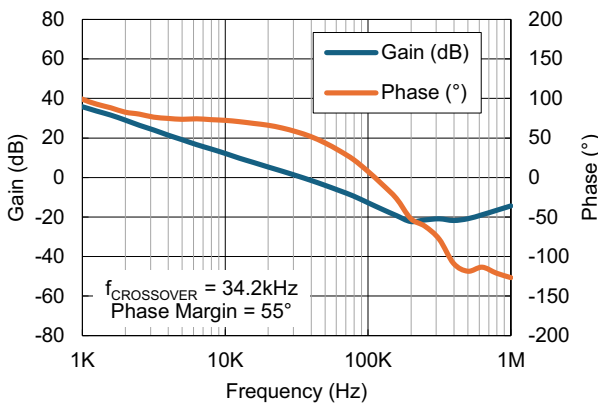


Figure 20. Gain and Phase vs Frequency ( $V_{IN} = 5V$ ,  $I_{LOAD} = 0A$ ,  $f_{SW} = 500kHz$ )

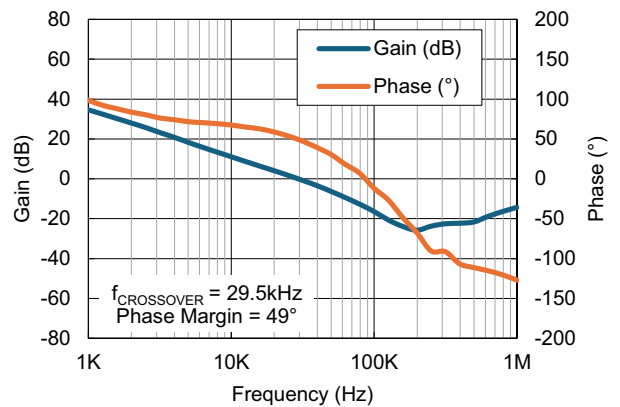


Figure 21. Gain and Phase vs Frequency ( $V_{IN} = 12V$ ,  $I_{LOAD} = 0A$ ,  $f_{SW} = 500kHz$ )

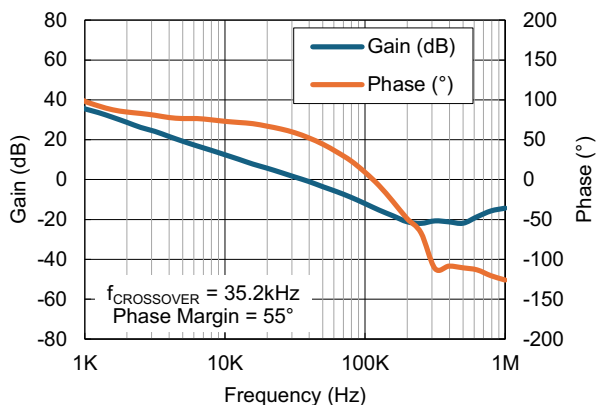


Figure 22. Gain and Phase vs Frequency ( $V_{IN} = 5V$ ,  $I_{LOAD} = 12.5A$ ,  $f_{SW} = 500kHz$ )

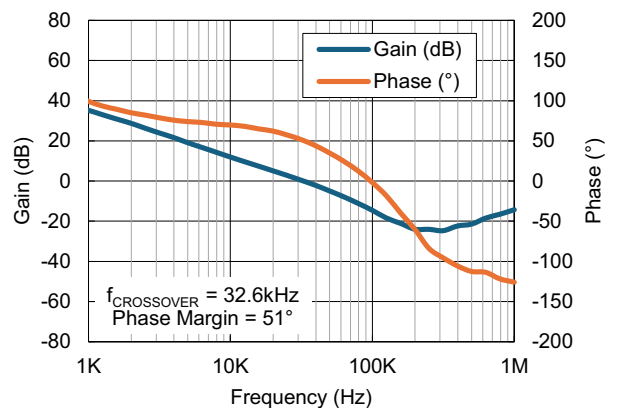


Figure 23. Gain and Phase vs Frequency ( $V_{IN} = 12V$ ,  $I_{LOAD} = 12.5A$ ,  $f_{SW} = 500kHz$ )

Unless otherwise noted,  $V_{OUT} = 1V$ ;  $L_{OUT} = 220nH$ ,  $C_{OUT} = 2.64mF$ ,  $C_{DROOP} = 56nF$ ,  $C_{VREF} = 100nF$ ,  $R_{DROOP} = 604\Omega$ ,  $R_{FS} = 94.2k\Omega$ ,  $C_{SS} = 22nF$ ,  $C_{COMP} = 8.2nF$ ,  $R_{COMP} = 4.22k\Omega$ ,  $C_{POLE} = 330pF$ ,  $C_{VCC} = 1\mu F$ ,  $R_{SLP} = 34.8k\Omega$ ,  $C_{SLP} = 100pF$ ,  $T_A = +25^\circ C$

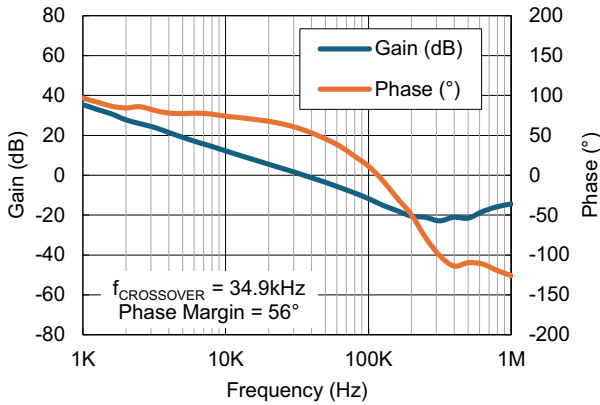


Figure 24. Gain and Phase vs Frequency ( $V_{IN} = 5V$ ,  $I_{LOAD} = 25A$ ,  $f_{SW} = 500kHz$ )

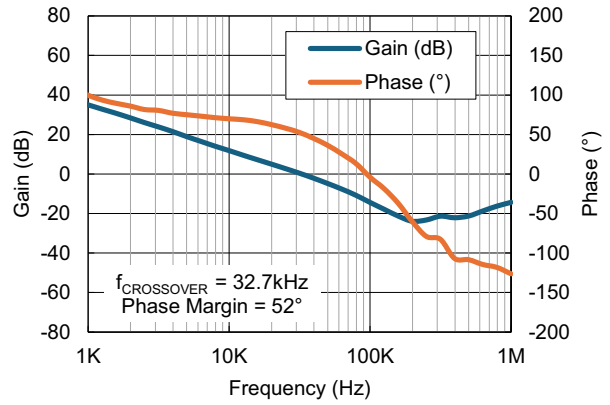


Figure 25. Gain and Phase vs Frequency ( $V_{IN} = 12V$ ,  $I_{LOAD} = 25A$ ,  $f_{SW} = 500kHz$ )

## 4. Ordering Information

Part Number	Description
ISL73847MDEMO2Z	ISL73847M demonstration board

## 5. Revision History

Revision	Date	Description
1.01	May 13, 2024	Added Figures 20 through 25.
1.00	Sep 27, 2023	Initial release

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