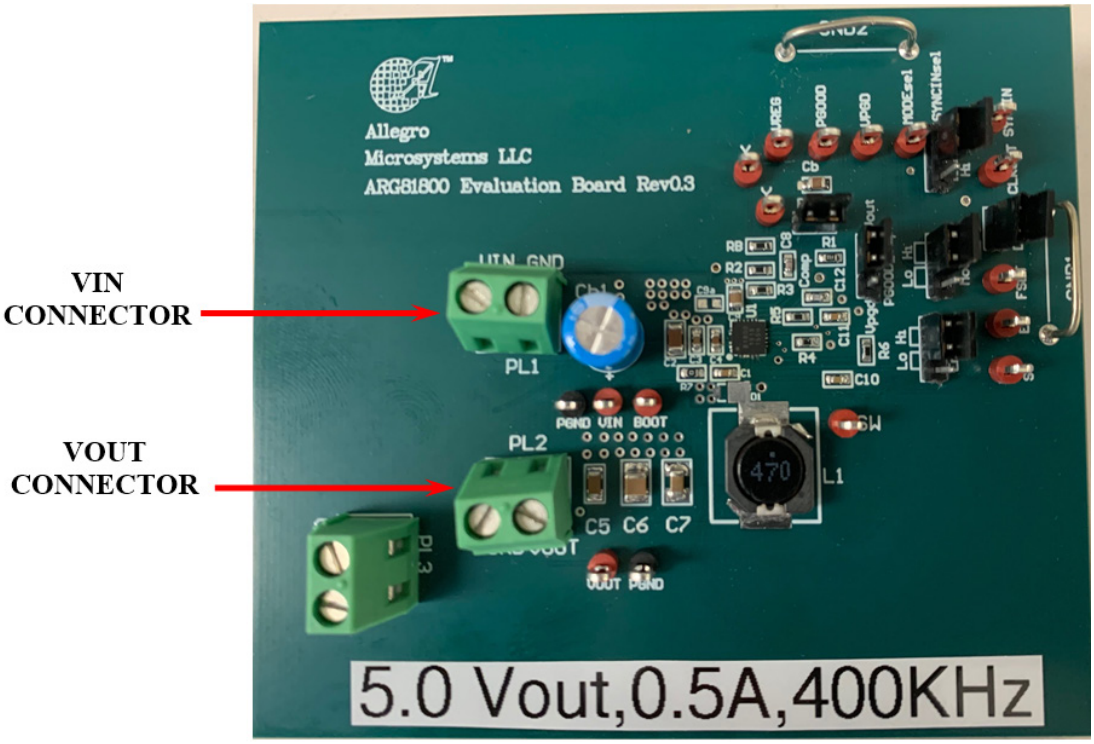
ARG81800-1 Evaluation Board User Manual

Ultra-Low I_Q Synchronous Buck Regulator with $SYNC_{IN}$, CLK_{OUT} and PGOOD

3.5 to 36 V_{IN}, 5.0 V_{OUT}, 0.5 A, 400 kHz

ALLEGRO ARG81800-1 EVALUATION BOARD



GENERAL SPECIFICATIONS

Specification	Min	Nom.	Max.	Units
Absolute Maximum Input Voltage	–0.3	–	40	V
Operating Input Voltage Range	3.5	12	36	V
V_{IN} START Threshold, V_{IN} rising	3.35	3.55	3.80	V
V_{IN} STOP Threshold, V_{IN} falling	3.10	3.30	3.50	V
Output Voltage (FB: 732k/140k, ±1%)	4.85	4.98	5.11	V
Steady-State Output Current (12 V_{IN})	–	0.5	0.6	A
Pulse-by-Pulse Current Limit @ $t_{ON(MIN)}$	0.85	1.0	1.15	A

JUMPER SETTINGS

Enable:

Connect Hi for enabling ARG81800-1

Connect Lo for disabling ARG81800-1

Mode:

Connect Hi to select PWM Mode

Connect Lo to select AUTO Mode

SYNCINsel:

Connect Hi to enable CLKOUT

Connect Lo to disable CLKOUT

Open – For external synchronization. External Sync signal can be applied through SYNCIN test point.

PGOOD_Jmpr:

Connect VOUT to use output voltage as pull-up for PGOOD pin.

Connect VPGD to use external pullup voltage source for PGOOD pin. External voltage can be supplied at VPGD test point.

BIAS:

Closed – To connect output voltage to bias pin

Open – No voltage on bias pin

DITHER:

Closed – To disable dither

Open – To enable dither

OPERATING INSTRUCTIONS

Input Power Connection:

Connect a 12 V power supply from VIN to GND that is capable of at least 1 A. Once operational, VIN can fall as low as 3.55 V_{TYP} (3.8 V_{MAX}) before the ARG81800-1 is reset.

Output Load Connections:

Connect a load from VOUT to GND. The steady-state load current can be as high as 0.5 A. Pulse-by-pulse current limit and/or thermal shutdown will occur if the load is greater than 0.6 A.

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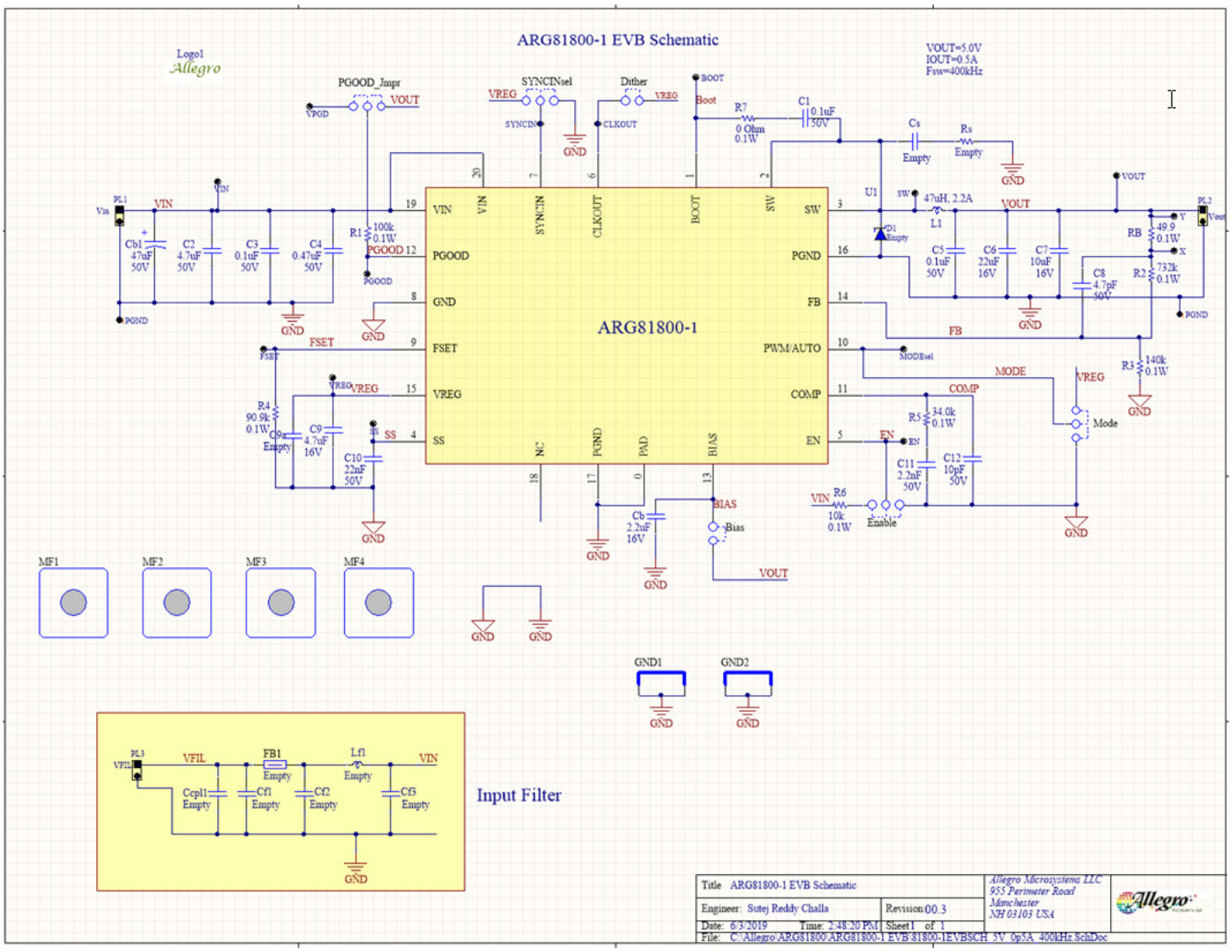
EVALUATION BOARD SCHEMATIC



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BILL OF MATERIALS

Designator	Description	Value	Footprint	Quantity	Manufacturer	Manufacturer P/N	Source	Purchase P/N
C1	Capacitor, X7R	0.1 µF, 50 V	0603	1	Murata	GCM188R71H104KA57D	Digikey	490-4779-2-ND
C2	Capacitor, X7R	4.7 µF, 50 V	1206	1	Murata	GRJ31CR71H475KE11L	Digikey	490-10944-1-ND
C3	Capacitor, X7R	0.1 µF, 50 V	0603	1	Murata	GCM188R71H104KA57D	Digikey	490-4779-2-ND
Cs	Capacitor, C0G (NP0)	DNP	0603	0				
Cb	Capacitor, X7R	2.2 µF, 16 V	0603	1	Taiyo Yuden	EMK107BB7225KA-T	Digikey	587-5835-1-ND
C4	Capacitor, X7R	0.47 µF, 50 V	0603	1	Taiyo Yuden	UMK107B7474KA-TR	Digikey	587-3170-1-ND
C5	Capacitor, X7R	0.1 µF, 50 V	1206	1	Murata	GCM319R71H104KA37J	Digikey	490-14745-2-ND
C6	Capacitor, X7R	22 µF, 16 V	1210	1	Murata	GRM32ER71C226MEA8L	Digikey	490-14539-1-ND
C7	Capacitor, X7R	10 µF, 16 V	1210	1	Murata	GRM32DR71C106KA01L	Digikey	490-1875-2-ND
C8	Capacitor, C0G (NP0)	4.7 pF, 50 V	0603	1	Murata	GCM1885C1H4R7BA16D	Digikey	490-14430-2-ND
C9	Capacitor, X7R	4.7 µF, 16 V	0805	1	Murata	GCJ21BR71C475KA01L	Digikey	490-10557-1-ND
C9a	Capacitor, X7R	DNP	0603	0				
C10	Capacitor,X7R	22 nF, 50 V	0603	1	Murata	GRM188R71H223KA01D	Digikey	490-5851-1-ND
C11	Capacitor, X7R	2.2 nF, 50 V	0603	1	Murata	GCM188R71H222KA37D	Digikey	490-4931-2-ND
C12	Capacitor, C0G (NP0)	10 pF, 50 V	0603	1	Kemet	C0603C100J5GACTU	Digikey	399-1049-1-ND
Cb1	Capacitor : Alu Electrolytic SMT	47 µF, 50 V	6 mm or 8 mm	1	Nichicon	UBT1H470MPD1TD	Digikey	493-4507-1-ND
Ccpl1	Capacitor, X7R	DNP	0805	0				
Cf1	Capacitor, X7R	DNP	1210	0				
Cf2, Cf3	Capacitor, X7R	DNP	1210	0				
Bias, Dither, Enable	Jumper Header : Male 2-pin		0.1" pitch	3	Omron	XJ8B-0211	Mouser	653-XJ8B-0211
Mode, PGOOD_Jmpr, SYNCINsel	Jumper Header : Male 3-pin		0.1" pitch	3	Molex	22-28-5030	Mouser	653-XJ8B-0211
Bias, Dither, Enable, Mode, PGOOD_Jmpr, SYNCINsel	Jumper Shunt: 2 positions		0.1" pitch	6	TE Connectivity	382811-6	Mouser	571-382811-6
BOOT, CLKOUT, EN, FSET, MODEsel, PGOOD, SS, SW, SYNCIN, VIN, VOUT, VPGD, VREG, X, Y	Test Points - Red		0.063", diameter	15	Keystone Electronics	5010	Digikey	36-5010-ND
PGND	Test Points - Black		0.063", diameter	2	Keystone Electronics	5011	Digikey	36-5011-ND
FB1	Ferrite Bead : Chip Impeder	DNP	0805	0				
GND1, GND2	Ground Bar : Tinned Copper Wire		GROUNDBAR_ 15MMP_20SWG	2				
L1	Inductor	47 µH, 2.2 A	10 mm × 10 mm	1	Wurth Electronics	7447714470	Digikey	732-2994-1-ND
Lf1	Inductor	DNP	8.2 mm × 8.2 mm	0				
MF1, MF2, MF3, MF4	Mount Foot : Adhesive Rubber		Clear	4	3M	SJ-5303 (CLEAR)	Digikey	SJ5303-7-ND
PL1, PL2, PL3	Terminal Block		5.08 mm pitch, Vertical, 2 position	3	Phoenix Contact	1715721	Digikey	277-1263-ND
R1	Resistor, 1%,1/10 W	10 kΩ	0603	1	Panasonic	ERJ-3EKF1002V	Digikey	P10.0KHCT-ND
R2	Resistor, 1%,1/10 W	732 kΩ	0603	1	Panasonic	ERJ-3EKF7323V	Digikey	P732KHCT-ND
R3	Resistor, 1%,1/10 W	140 kΩ	0603	1	Panasonic	ERJ-3EKF1403V	Digikey	P140KHCT-ND
R4	Resistor, 1%,1/10 W	90.9 kΩ	0603	1	Panasonic	ERJ-3EKF7152V	Digikey	P71.5KHCT-ND
R5	Resistor, 1%,1/10 W	34.0 kΩ	0603	1	Panasonic	ERJ-3EKF3402V	Digikey	P34.0KHCT-ND
R6	Resistor, 1%,1/10 W	10 kΩ	0603	1	Panasonic	ERJ-3EKF1002V	Digikey	P10.0KHCT-ND
R7	Resistor, 1%,1/10 W	0 Ω	0603	1	Panasonic	ERJ-3GEY0R00V	Digikey	P0.0GCT-ND
RB	Resistor, 1%,1/10 W	49.9 Ω	0603	1	Panasonic	ERJ-3EKF49R9V	Digikey	P49.9HCT-ND
Rs	Resistor, 1%, 0.25 W	DNP	1206	0				
U1	Allegro IC	ARG81800-1	QFN20 4×4	1	Allegro	ARG81800KESJSR-1		
Label:	5.0 Vout, 0.5 A, 400 kHz							

DNP - Do Not Populate

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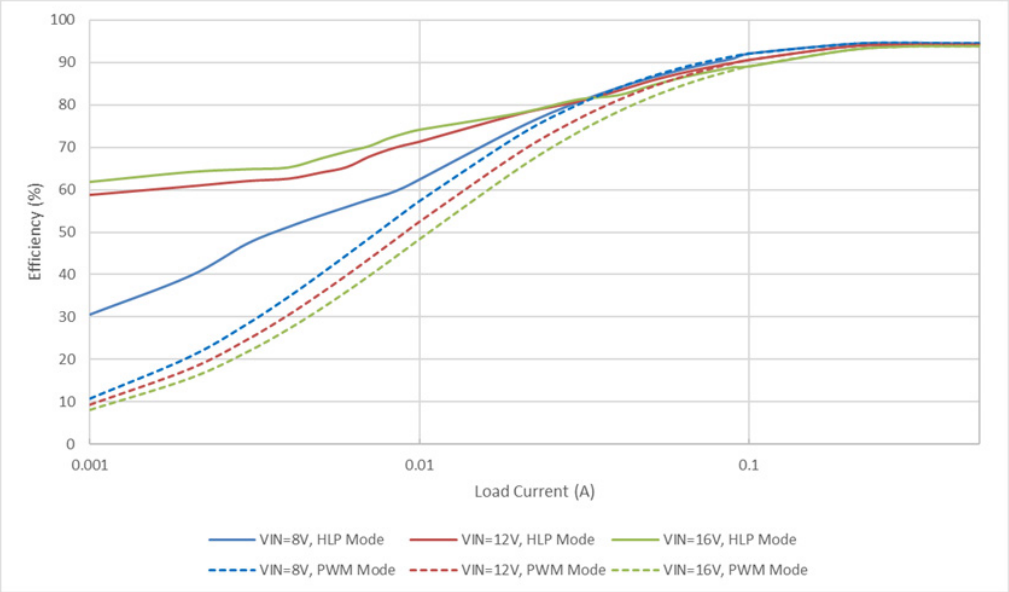
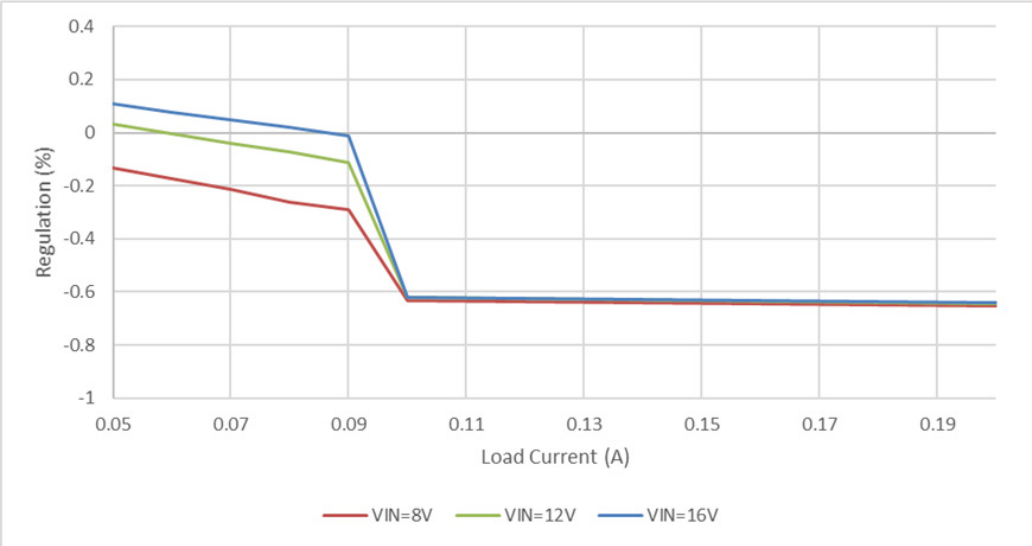
EVALUATION BOARD PERFORMANCE

Efficiency



Load Regulation in LP Mode



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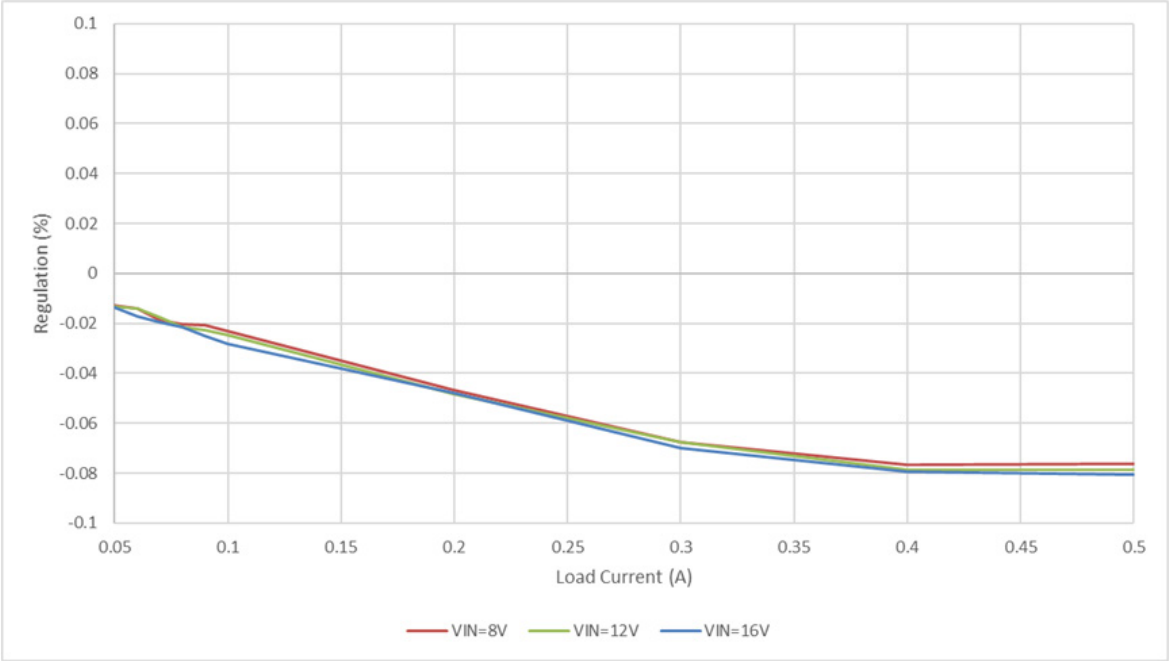
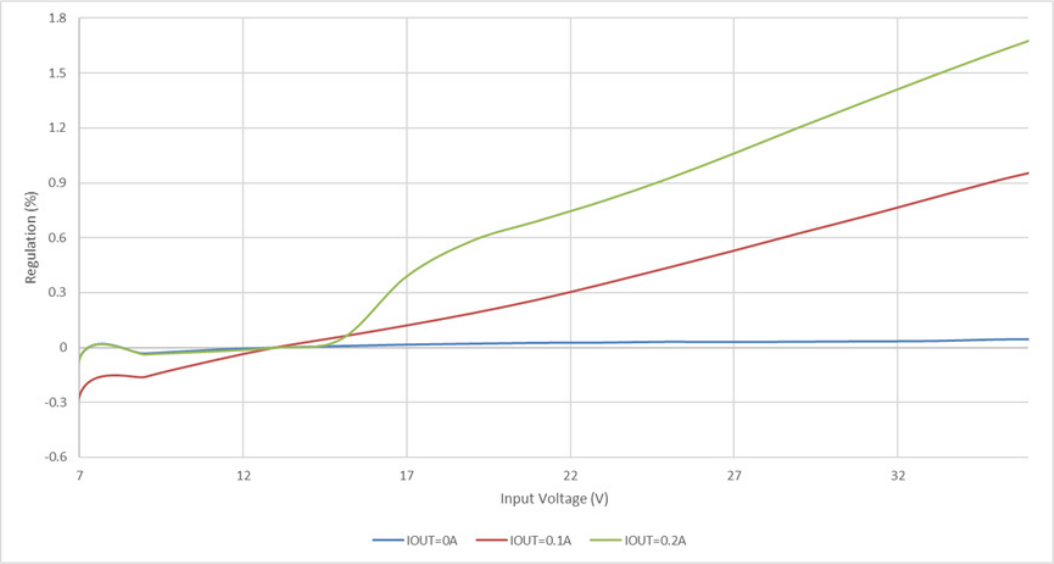
EVALUATION BOARD PERFORMANCE (continued)

Load Regulation in PWM Mode



Line Regulation in LP Mode



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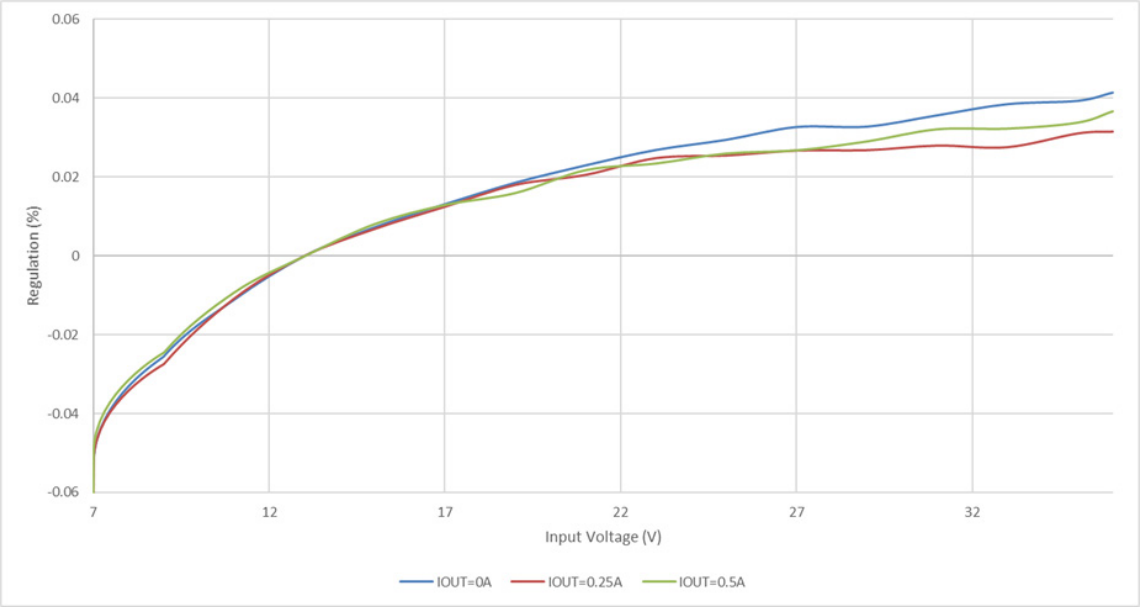
EVALUATION BOARD PERFORMANCE (continued)

Line Regulation in PWM Mode



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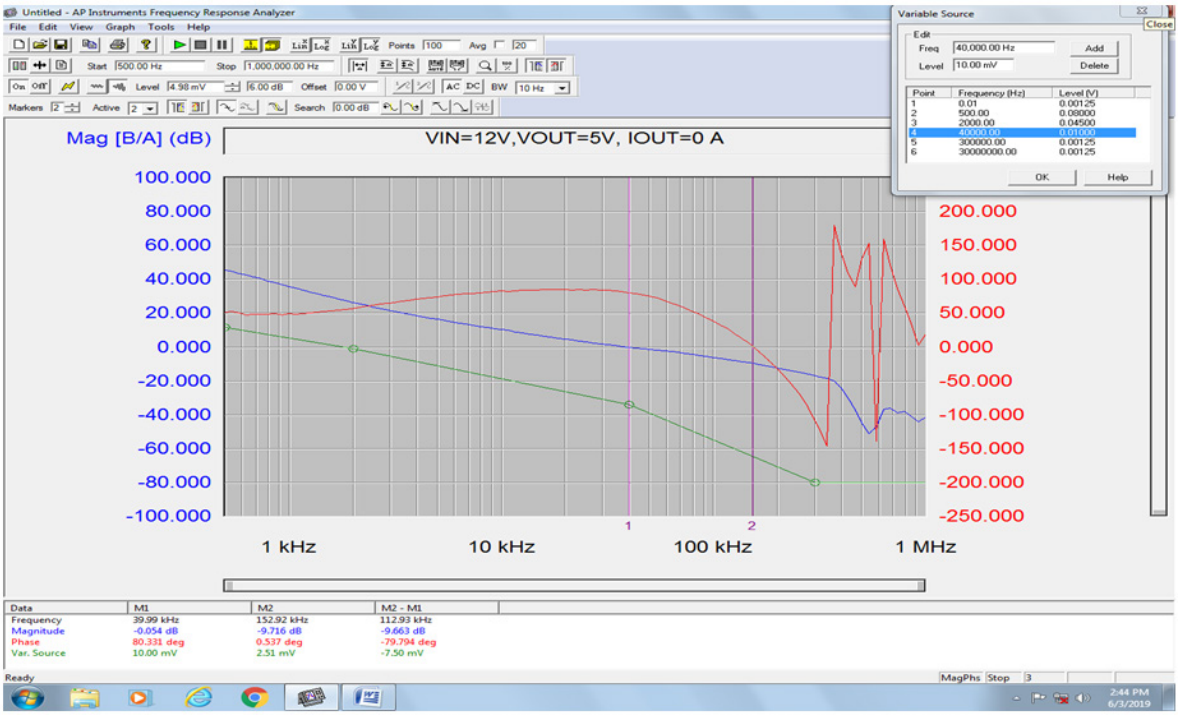
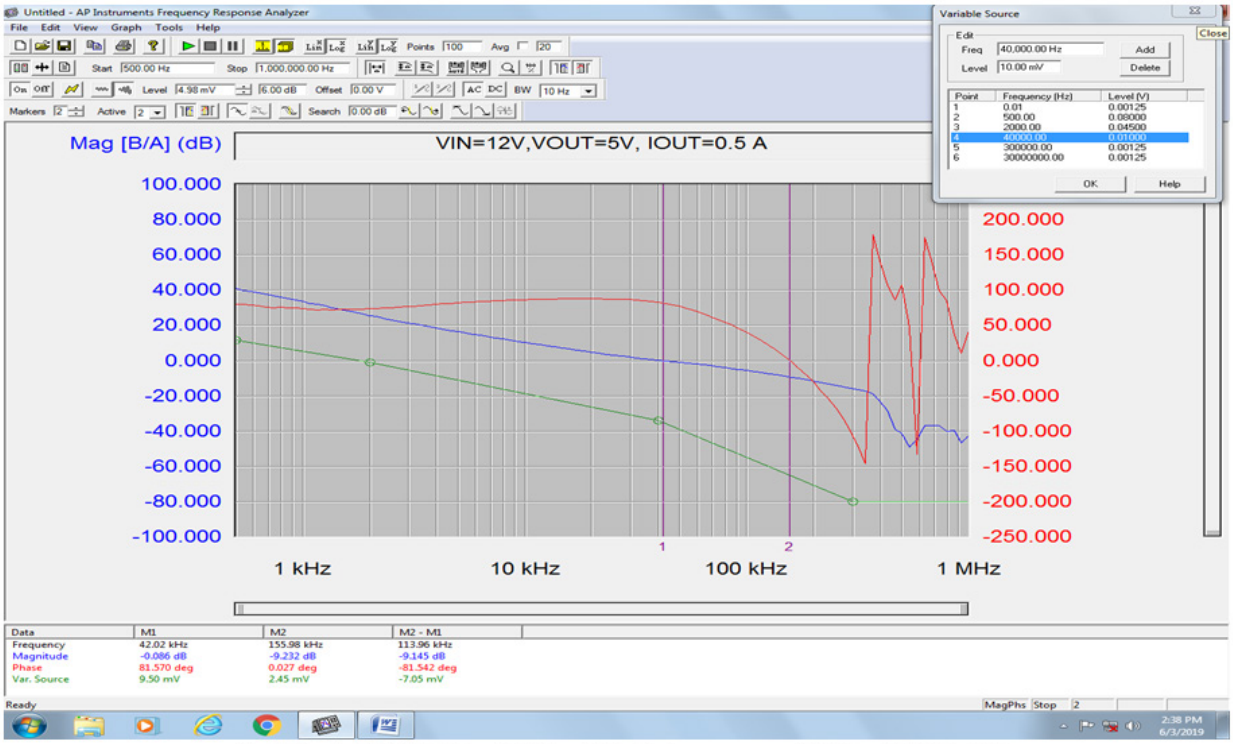
EVALUATION BOARD PERFORMANCE (continued)



0 dB at 40.00 kHz, PM = 80.3 degrees, GM = 9.71 dB



0 dB at 42.0 kHz, PM = 81.5 degrees, GM = 9.23 dB

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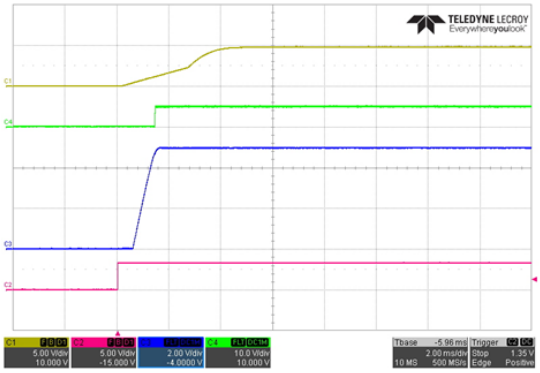
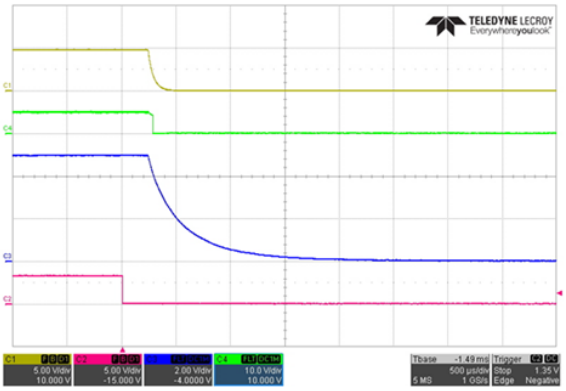
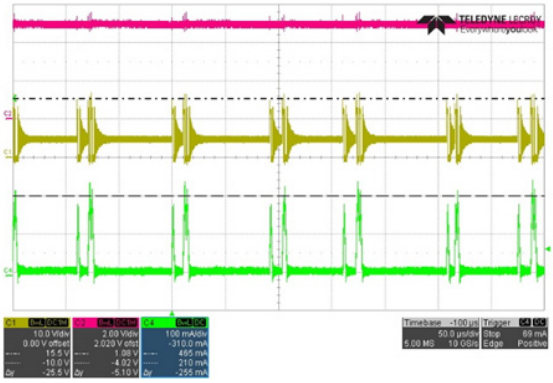
EVALUATION BOARD PERFORMANCE (continued)



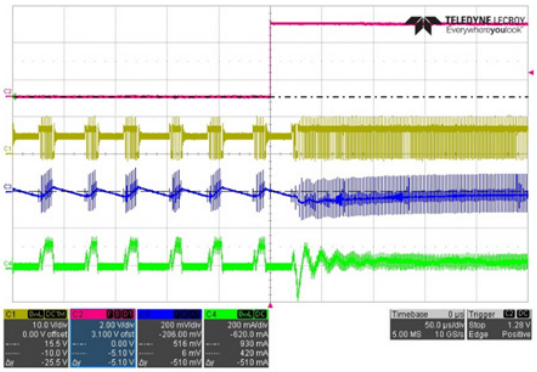
Startup with EN Rising
V_{OUT} = 5.0 V, I_{OUT} = 0.5 A, PWM Mode
C1: SS, C2: EN, C3: VOUT, C4: PGOOD



Shutdown with EN Falling
V_{OUT} = 5.0 V, I_{OUT} = 0.5 A, PWM Mode
C1: SS, C2: EN, C3: VOUT, C4: PGOOD



Steady State Performance
V_{OUT} = 5.0 V, I_{OUT} = 10 mA, LP Mode
C1: SW, C2: VOUT, C4: IL



AUTO Mode Transition
V_{OUT} = 5.0 V, I_{OUT} = 10 mA
C1: SW, C2: Mode, C3: VOUT (AC) C4:

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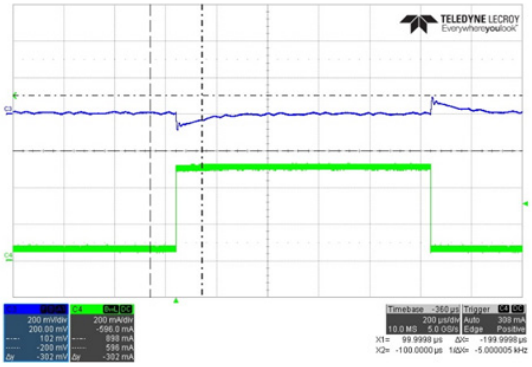
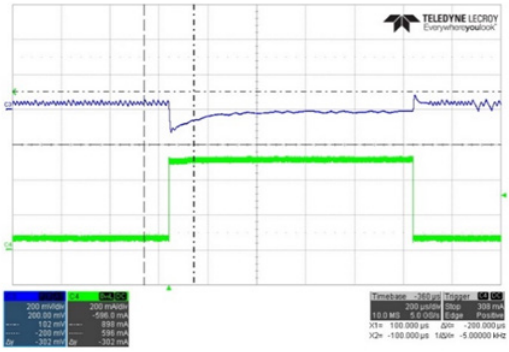
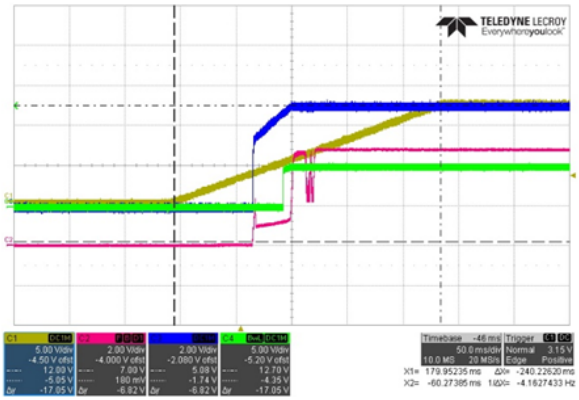
EVALUATION BOARD PERFORMANCE (continued)



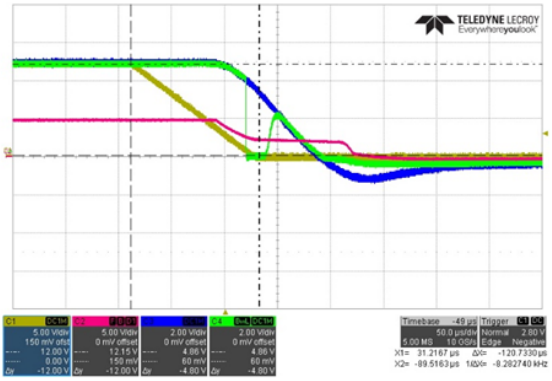
Transient Response at 12 V_{IN}
V_{OUT} = 5.0 V, PWM Mode
C3: VOUT (AC) C4: IL



Transient Response at 12 V_{IN}
V_{OUT} = 5.0 V, LP Mode
C3: VOUT (AC) C4: IL



Startup with Rising V_{IN}
V_{OUT} = 5.0 V, I_{OUT} = 0.5 A, PWM Mode
C1: VIN, C2: SS, C3: VOUT, C4: PGOOD



Shutdown with Falling V_{IN}
V_{OUT} = 5.0 V, I_{OUT} = 0.5 A, PWM Mode
C1: VIN, C2: SS, C3: VOUT, C4: PGOOD

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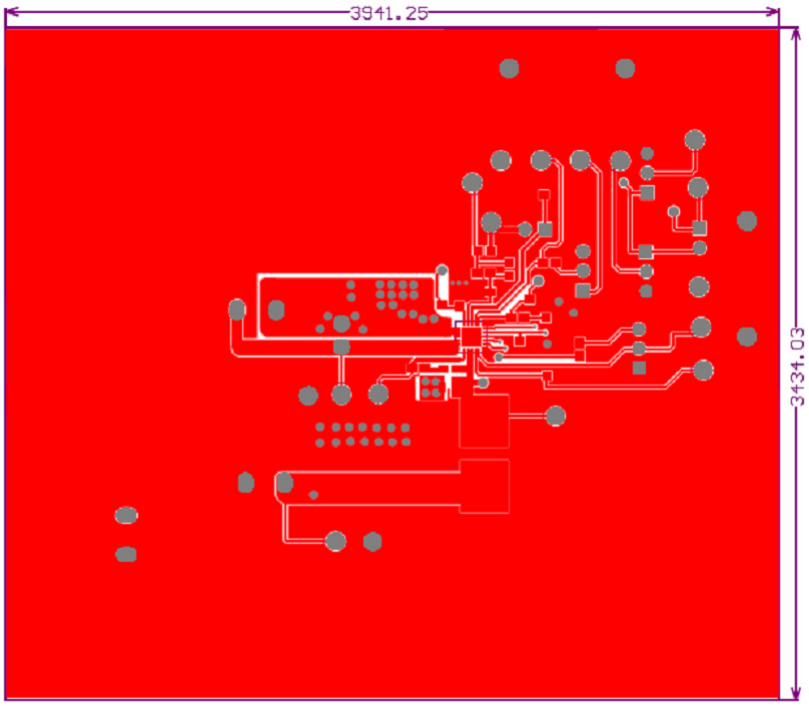
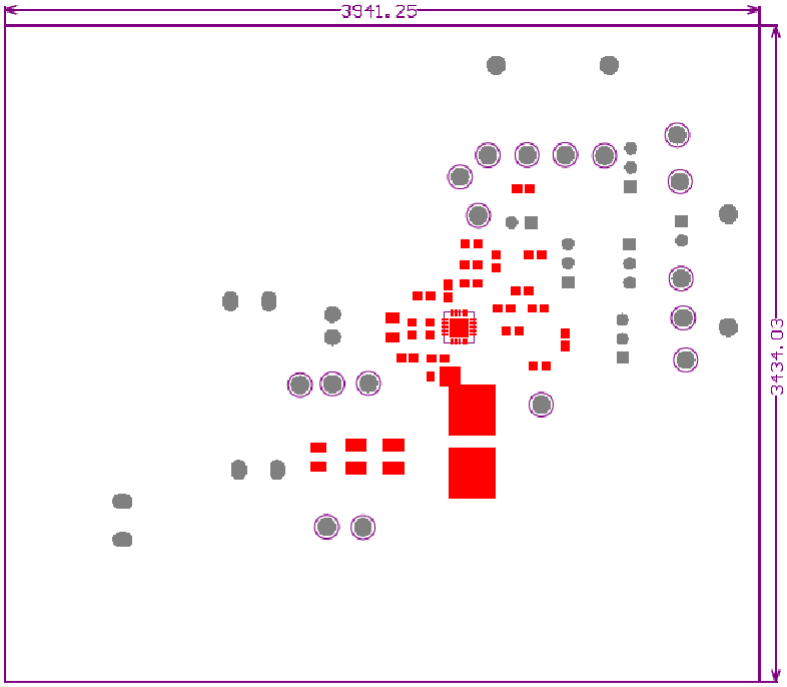
PCB LAYOUT



Top Layer



Top Silk

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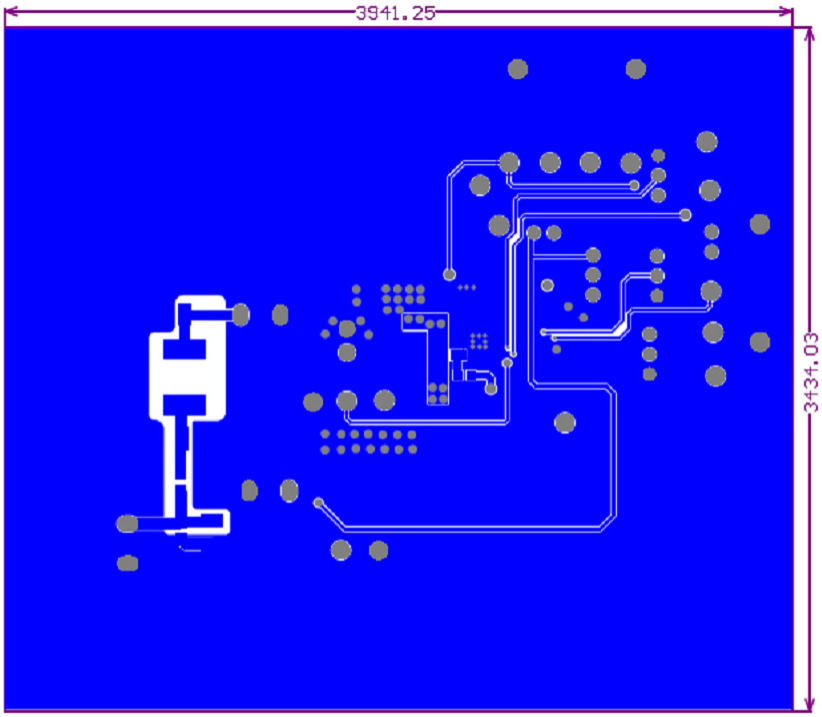
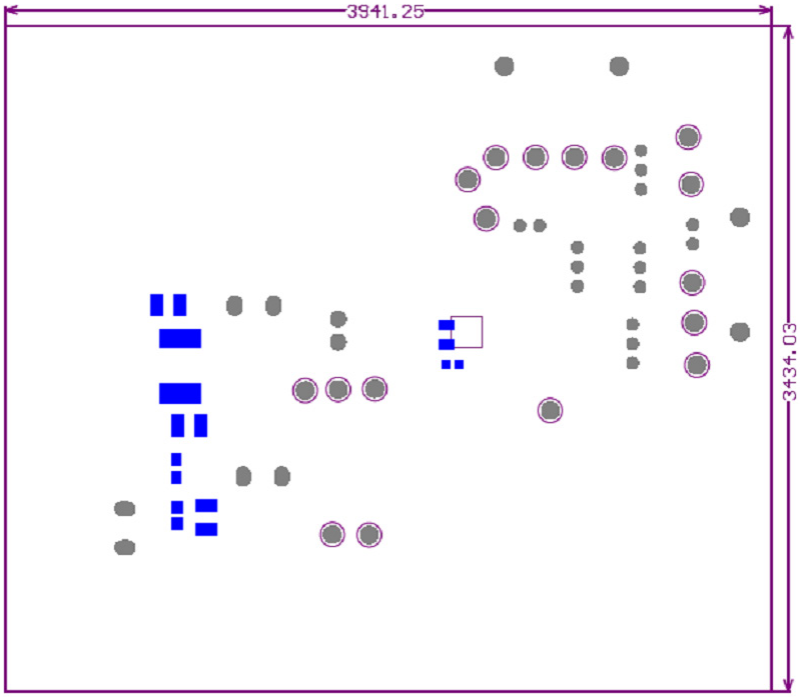
PCB LAYOUT (continued)



Bottom Layer



Bottom Copper

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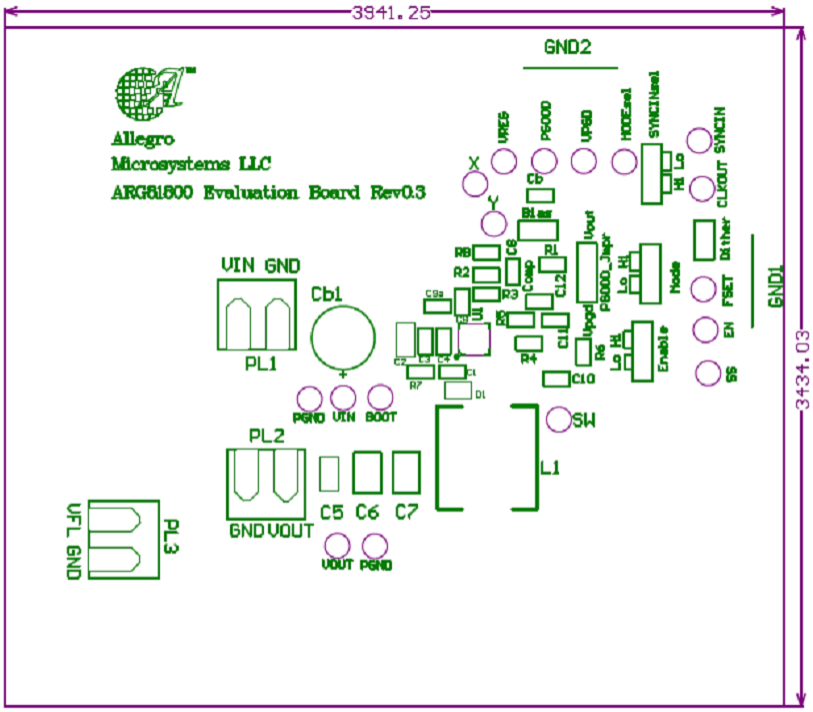
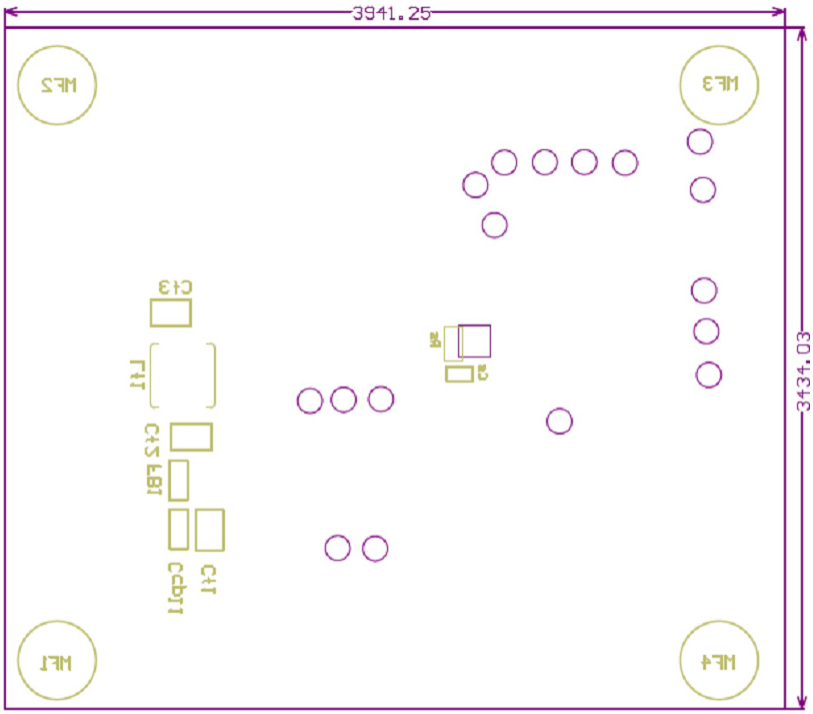
PCB LAYOUT (continued)



Top Silk



Bottom Silk

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Revision History

Number	Date	Description
–	December 16, 2019	Initial Release
1	December 2, 2022	Minor editorial updates

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