EVQ1918-QE-01A

100V Half-Bridge GaN/MOSFET Driver, Evaluation Board, AEC-Q100 Qualified

DESCRIPTION

The EVQ1918-QE-01A is an evaluation board designed to demonstrate the capabilities of the MPQ1918-AEC1, a half-bridge driver that can be used to drive the enhancement mode gallium nitride (GaN) FETs or low gate threshold voltage N-channel MOSFETs in half-bridge or synchronous applications.

The EVQ1918-QE-01A is configured as a buck converter using GaN FETs driven by the MPQ1918-AEC1. It supports open-loop control and can set the output voltage (V_{OUT}) by adjusting the duty cycle of the pulse-width modulation (PWM) signal.

For simplicity, only a single PWM signal is required; the on-board circuitry generates PWML and PWMH signals with proper dead time (DT). In a real system, the controller must take care of the DT adjustment.

The MPQ1918-AEC1 is available in a FCQFN-14 (3mmx3mm) package with wettable flanks.

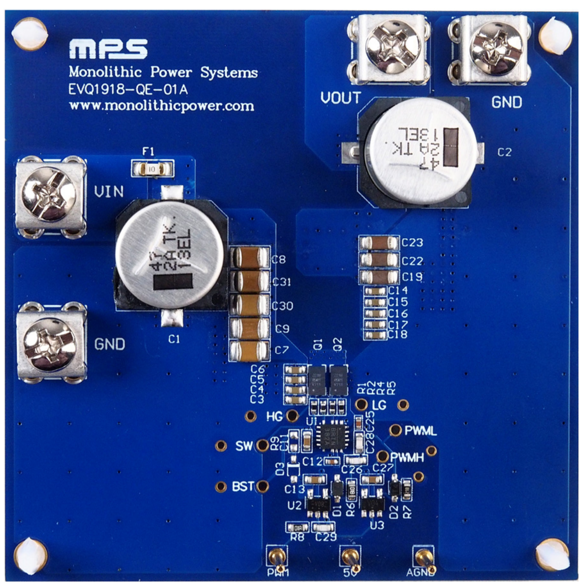
PERFORMANCE SUMMARY

Specifications are at T_A = 25°C, unless otherwise noted.

Parameters	Conditions	Value
Input voltage (V_{IN}) range		0V to 60V
Maximum output current (I_{OUT})	V_{IN} = 36V to 60V, V_{OUT} = 12V, without air cooling	2A
Switching frequency (f_{SW})		1MHz

MPL Optimized Performance with MPS Inductor MPL-AY1265 Series

EVALUATION BOARD



LxWxH (7cmx7cmx2cm)

Board Number	MPS IC Number
EVQ1918-QE-01A	MPQ1918GQE-AEC1

QUICK START GUIDE

1. Prepare the input power supply (V_{IN}), VCC power supply (V_{CC}), and signal generator.
2. Prepare the fan cooling on the GaN devices (Q1 and Q2).
3. Connect the input power supply terminals to:
    a. Positive (+): VIN
    b. Negative (-): GND
4. Connect the load terminals to:
    a. Positive (+): VOUT
    b. Negative (-): GND
5. Set V_{CC} = 5V and set the signal generator to f_{SW} = 1MHz, duty = 0.25.
6. Turn on V_{CC} and the signal generator.
7. Set V_{IN} = 0V and turn V_{IN} on, then gradually increase it to 48V.
8. Increase the output load and monitor the temperature of Q1 and Q2.
9. Gradually increase the duty cycle to V_{OUT} = 12V.
10. To shut down the system, turn off the load, VIN, VCC, and PWM.

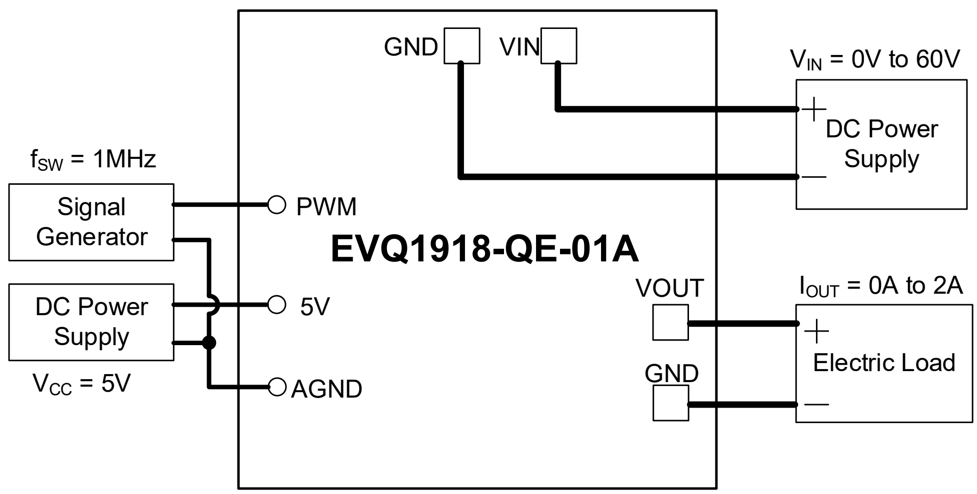


Figure 1: Proper Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

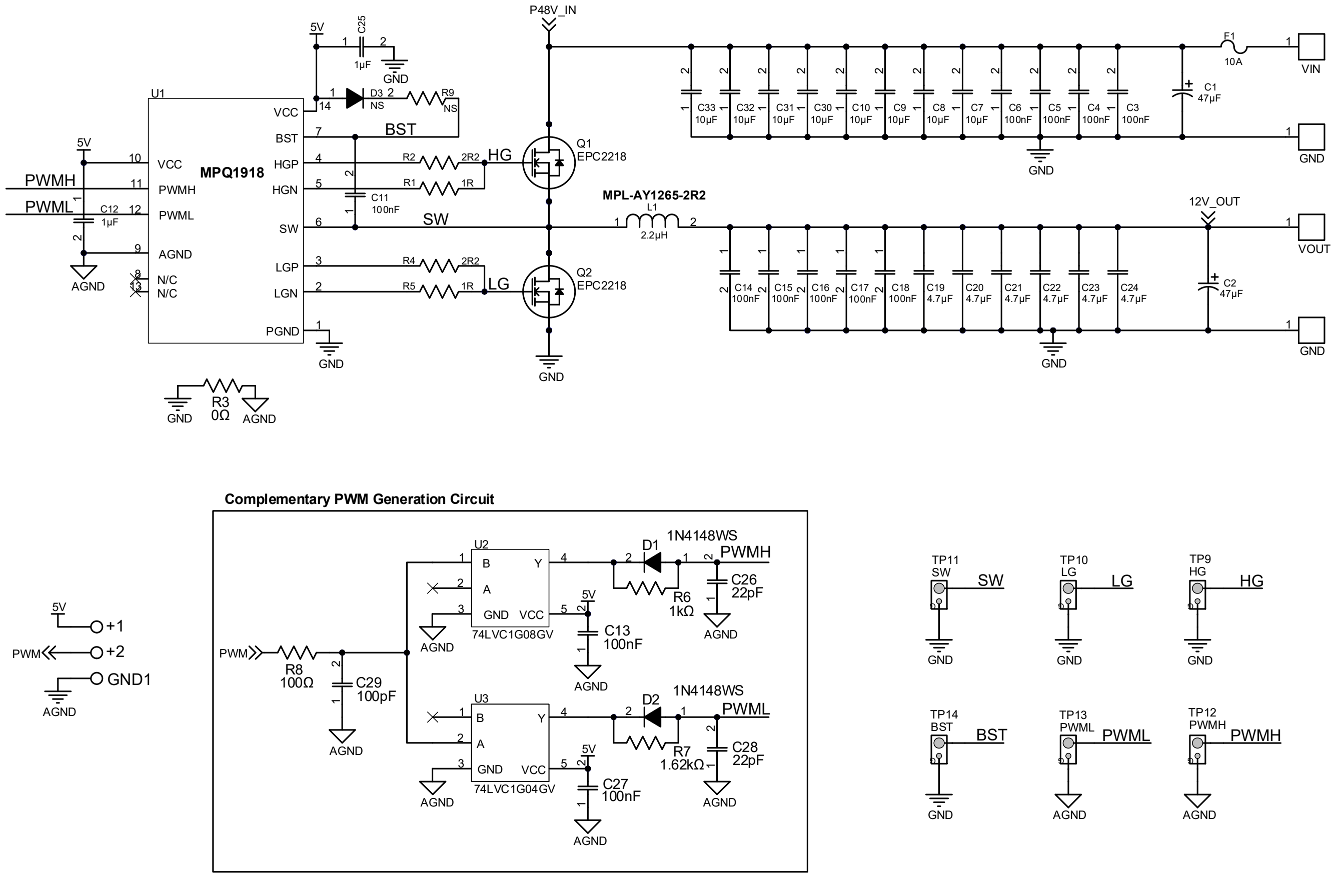


Figure 2: Evaluation Board Schematic

EVQ1918-QE-01A BILL OF MATERIALS

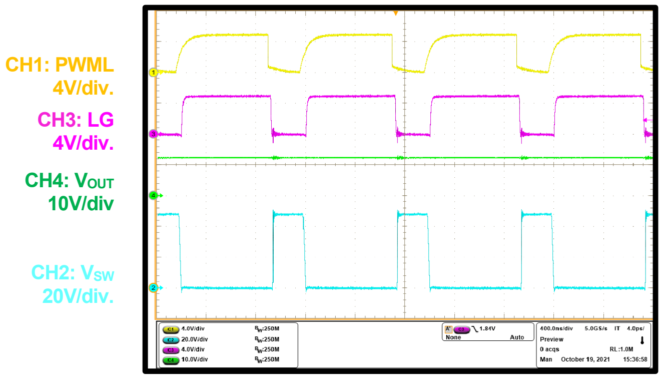
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	C1, C2	47µF	Electrolytic capacitor, 100V	SMD	Panasonic	EEETK2A470AQ
9	C3, C4, C5, C6, C14, C15, C16, C17, C18	100nF	Ceramic capacitor, 100V, X7R	0603	Murata	GRM188R72A104KA35D
8	C7, C8, C9, C10, C30, C31, C32, C33	10µF	Ceramic capacitor, 100V, X7S	1210	Murata	GRM32EC72A106KE05L
3	C11, C13, C27	100nF	Ceramic capacitor, 50V, X7R	0603	Murata	GCM188R71H104KA57D
2	C12, C25	1µF	Ceramic capacitor, 16V, X7R	0402	Murata	GRM155C81C105KE11D
6	C19, C20, C21, C22, C23, C24	4.7µF	Ceramic capacitor, 100V, X7S	1206	Murata	GRM31CC72A475KE11L
2	C26, C28	22pF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM1885C1H220JA01D
1	C29	100pF	Ceramic capacitor, 50V, X7R	0603	Wurth	885012006057
2	D1, D2	75V	Diode, 0.15A	SOD-323	Diodes, Inc.	1N4148WS-7-F
1	F1	10A	Surface mount fuse	1206	Littelfuse, Inc.	0458010.DR
2	Q1, Q2	3.2mΩ	GaN MOSFET, 100V	3.5mmx 1.95mm	EPC	EPC2218
2	R1, R5	1Ω	Thick film resolution, 1%, 1/16W	0402	Yageo	RC0402FR-071RL
2	R2, R4	0Ω	Thick film resolution, 1%, 1/16W	0402	Yageo	RC0402FR-070RL
1	R3	0Ω	Thick film resolution, 5%, 1/10W	0603	Yageo	RC0603JR-070RL
1	R6	1kΩ	Thick film resolution, 1%, 1/10W	0603	Yageo	RC0603FR-071KL
1	R7	1.62kΩ	Thick film resolution, 1%, 1/10W	0603	Yageo	RC0603FR-071K62L
1	R8	100Ω	Thick film resolution, 1%, 1/10W	0603	Yageo	RC0603FR-07100RL
1	U2	3mmx 1.5mm	Single, 2-input AND gate	SOT-753	NXP	74LVC1G08GV
1	U3	3mmx 1.5mm	Inverter gate	SOT-753	NXP	74LVC1G04GV
3	PWM, 5V, GND	1mm	Connector	TH	Any	
4	VIN, GND, VOUT, GND	7mmx 8mm	Connector	TH	Any	
1	L1	2.2µH	Inductor, 17A, 3.7mΩ	SMD	MPS	MPL-AY1265-2R2
1	U1	MPQ1918-AEC1	100V, half-bridge GaN/MOSFET driver	FCQFN-14 (3mmx3mm)	MPS	MPQ1918GQE-AEC1

EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board, f_{SW} =1MHz, L = 2.2µH, T_A = 25°C, unless otherwise noted.

Steady State

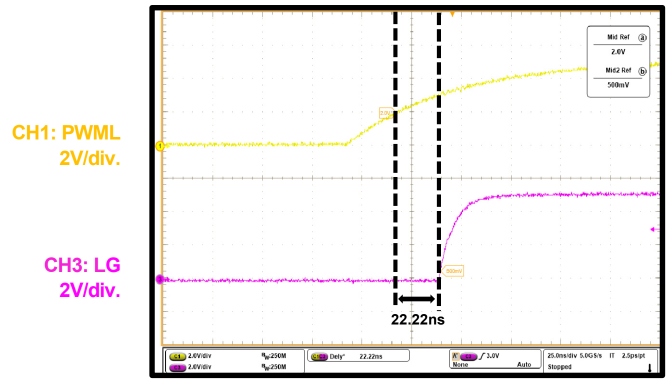
V_{IN} = 48V, V_{OUT} = 12V, I_{OUT} = 2A



400ns/div.

LG Start-Up Propagation Delay

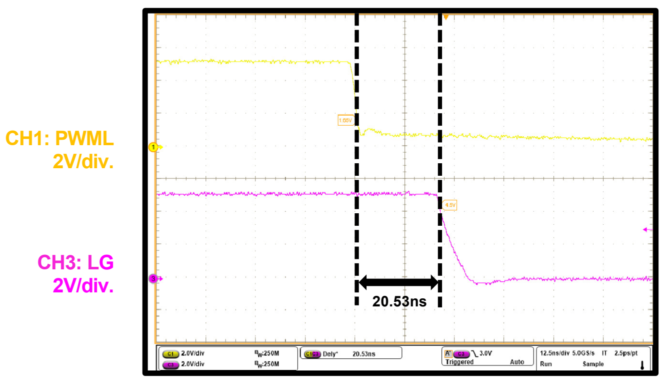
V_{IN} = 0V, V_{CC} = 5V



25ns/div.

LG Shutdown Propagation Delay

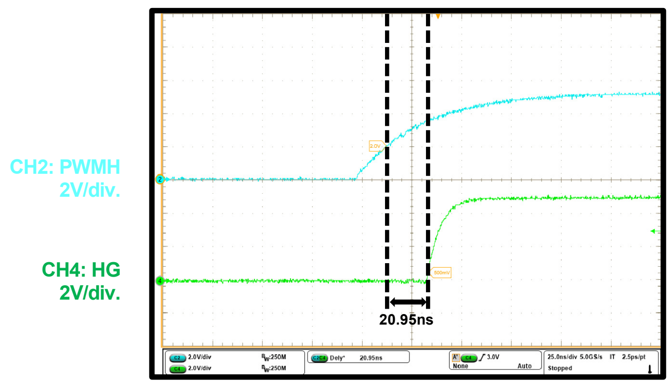
V_{IN} = 0V, V_{CC} = 5V



12.5ns/div.

HG Start-Up Propagation Delay

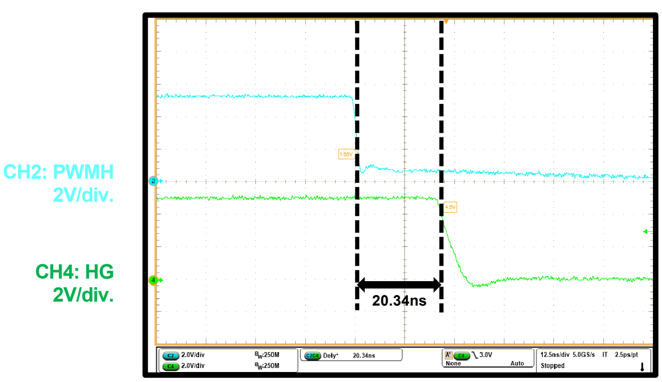
V_{IN} = 0V, V_{CC} = 5V



25ns/div.

HG Shutdown Propagation Delay

V_{IN} = 0V, V_{CC} = 5V



12.5ns/div.

PCB LAYOUT

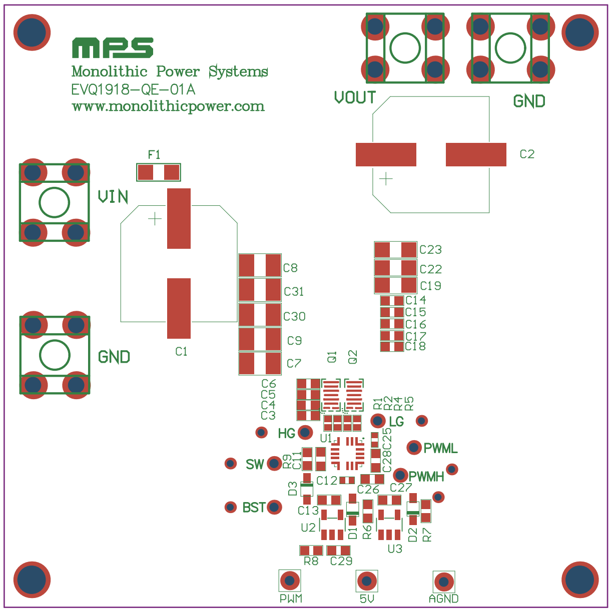


Figure 3: Top Silk

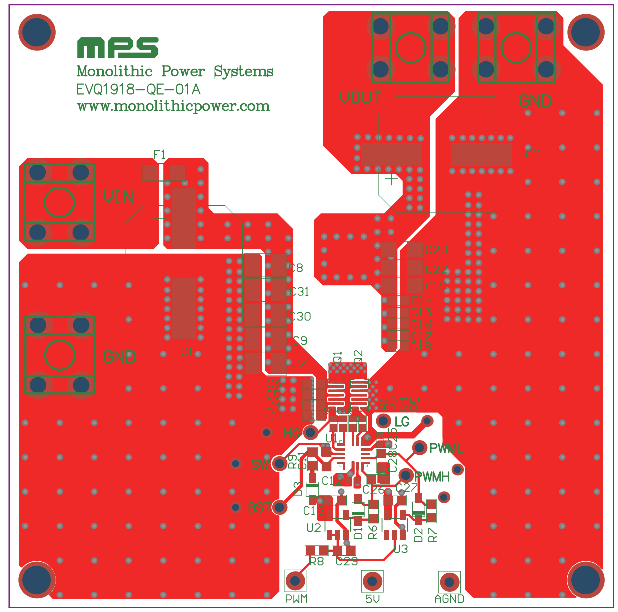


Figure 4: Top Layer

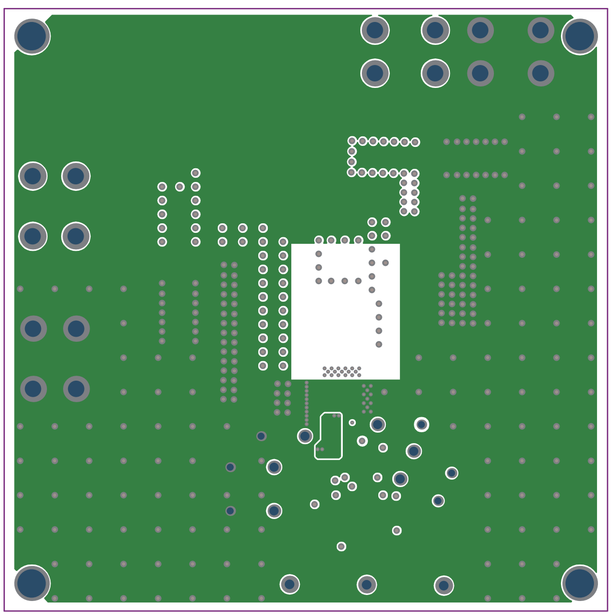


Figure 5: Mid-Layer 1

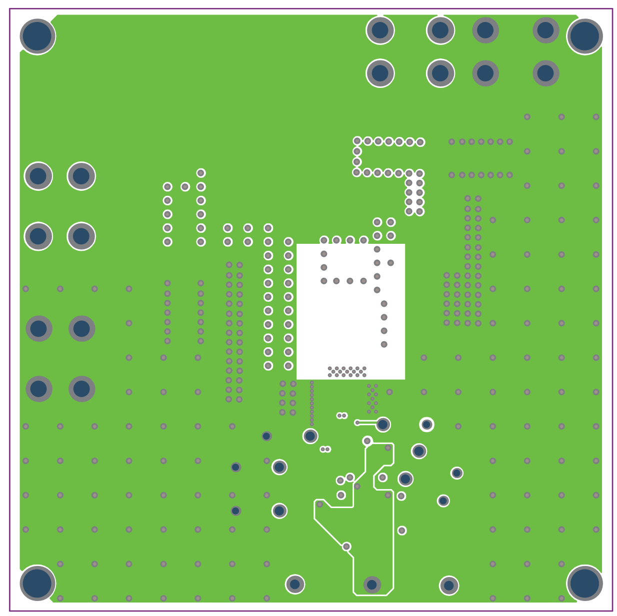


Figure 6: Mid-Layer 2

PCB LAYOUT *(continued)*

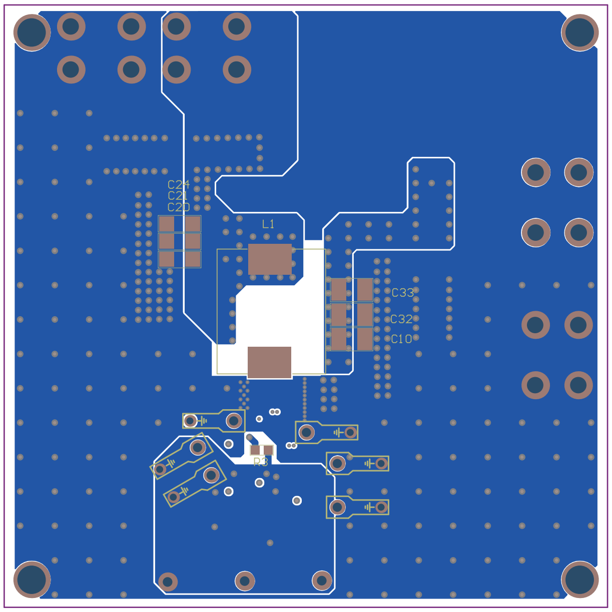


Figure 7: Bottom Layer

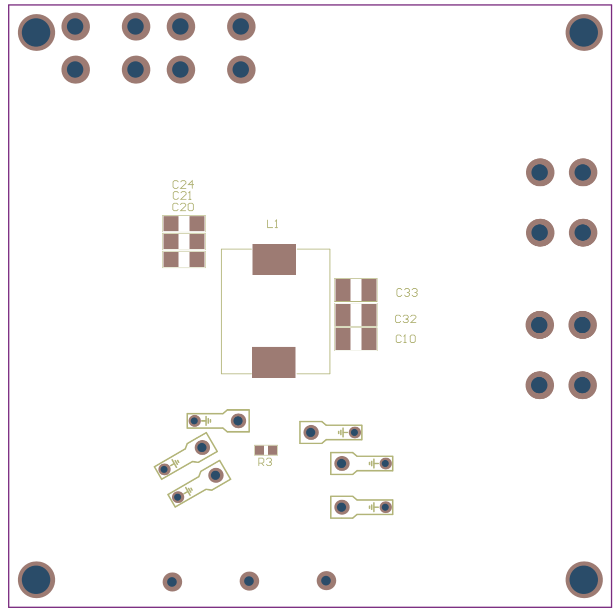


Figure 8: Bottom Silk

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	1/26/2022	Initial Release	-