EV4603-S-00A

Buck-Boost White LED Driver For TV Backlighting Applications

The Future of Analog IC Technology

DESCRIPTION

The EV4603-S-00A Evaluation Board is designed to demonstrate the capabilities of MPS' MP4603ES for TV backlighting applications. MP4603 is an integrated Buck-Boost white LED driver which is suitable for TV and big panel backlighting applications with MPS patented pending technology.

With a 12V input VIN and a high voltage source V_{INH}, EV4603-S-00A can deliver a regulated voltage (V_{INH} to V_{INH}+63V) to drive a LED string over 350V. The LED current is regulated to about 120mA. The EV4603-S-00A can be synchronized. Several EV4603-S-00As can be used together to drive a TV panel

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	VIN	12±10%	V
LED Current	I_{LED}	120	mA
Switching Frequency	fs	200	kHz
Over Voltage Protection	V_{OVP}	-63	V

FEATURES

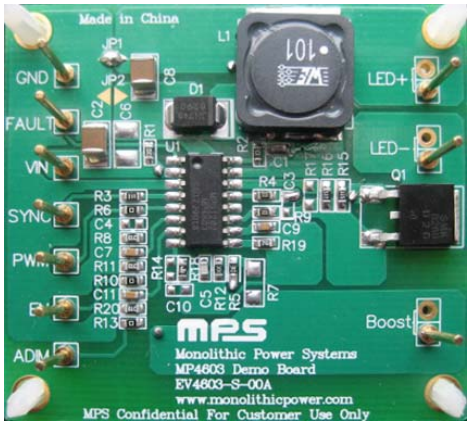
- Novel Power Leverage Control Technology
- Unique Step-up/down Operation
- Up to 99.5% Efficiency
- 0.5Ω Internal Power MOSFET Switch
- Switching Frequency Synchronization
- Over 1:1000 Dimming Ratio
- Separated Analog and PWM Dimming
- ±5% 200mV Reference Voltage
- 10μA Shutdown Mode
- Cycle-by-Cycle Over Current Protection
- Thermal Shutdown Protection
- LED String Open and Short Protection
- FAULT Output at LED Protection
- Output Short Circuit Protection

APPLICATIONS

- TV Backlighting
- Large LCD Panels Backlighting

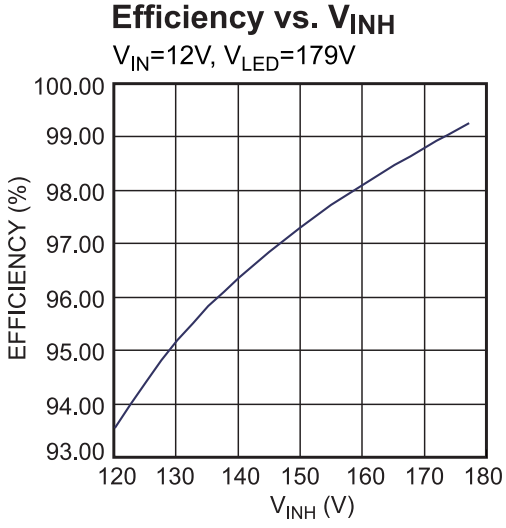
All MPS parts are lead-free and adhere to the RoHS directive. For MPS green status, please visit MPS website under Products, Quality Assurance page "MPS" and "The Future of Analog IC Technology", are Registered Trademarks of Monolithic Power Systems, Inc.

EV4603-S-00A EVALUATION BOARD



(L x W x H) 5cm x 4.6cm x 4.5mm

Board Number	MPS IC Number
EV4603ES-00A	MP4603ES



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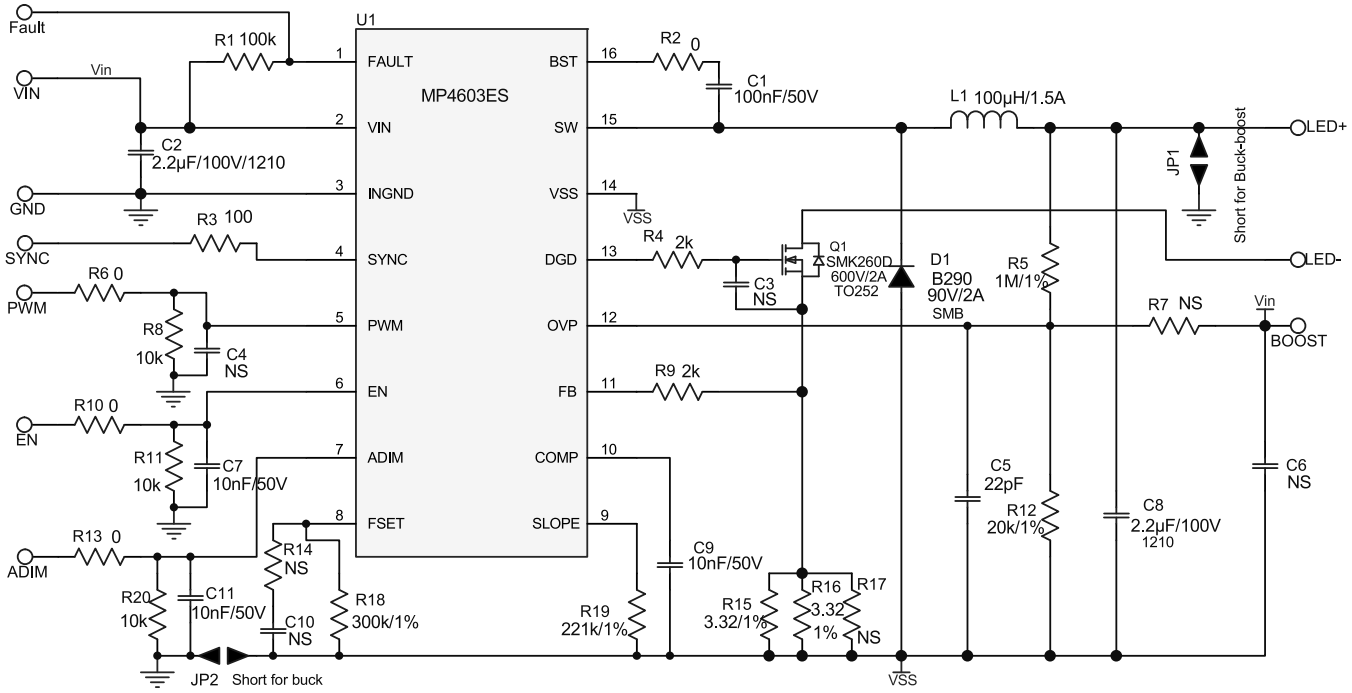
EVALUATION BOARD SCHEMATIC



EV4603-S-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Part Number
1	C1	100nF	Ceramic Capacitor;50V;X7R;0603	0603	muRata	GRM188R71H103KA01D
2	C2, C8	2.2µF	Ceramic Capacitor;100V;X7R;1210	1210	muRata	GRM32ER72A225KA35L
4	C3, C4, C6, C10	NS				
1	C5	22pF	Ceramic Capacitor;50V;COG;0603	0603	muRata	GRM1885C1H220JA01D
3	C7, C9, C11	10nF	Ceramic Capacitor;50V;X7R;0603	0603	muRata	GRM188R71H104KA93D
1	D1	B290	Schottky Diode;90V;2A	SMB	Diodes	B290
3	JP3, JP4, JP5	Jump Wire	Jump Wire			Jump Wire
1	L1	100µH	Inductor;100uH;250mOhm ;1.5A	SMD	Wurth	7447715101
1	Q1	SMK0260D	N-Channel Mosfet;600V, 2A	DPAK(TO-252)	AUK	SMK0260D
1	R1	100k	Film Resistor;1%	0603	Yageo	RC0603FR-07100KL
4	R2, R6, R10, R13	0	Film Resistor;5%	0603	Yageo	RC0603JR-070RL

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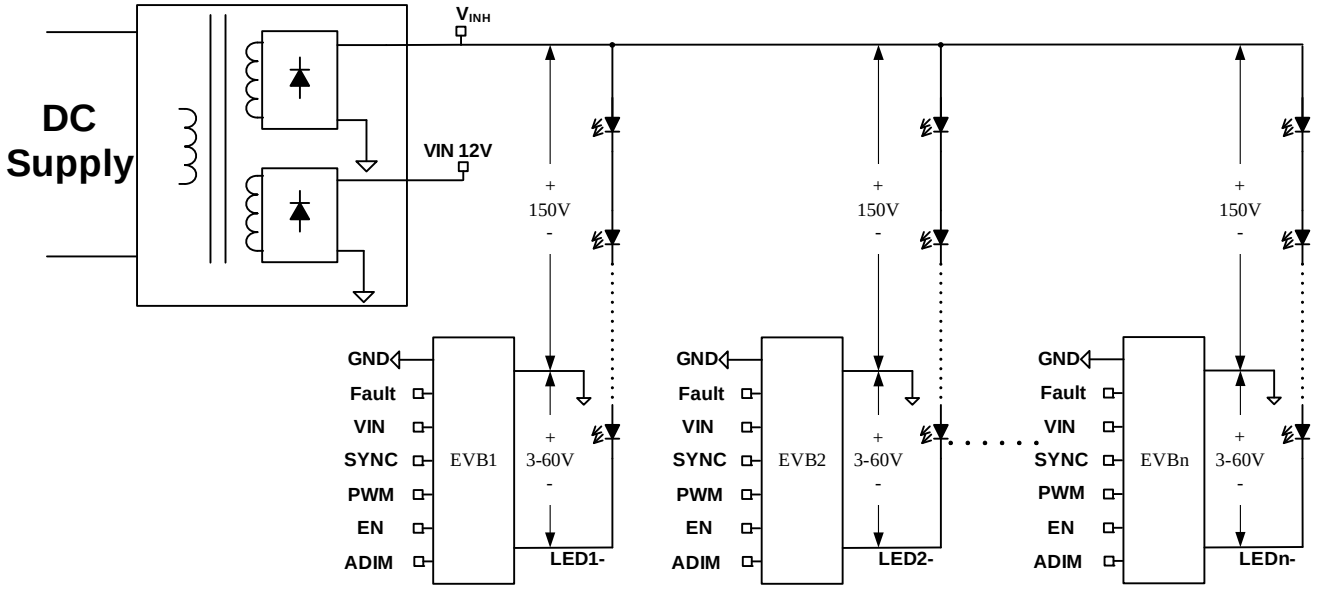
EV4603ES-00A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Part Number
1	R3	100	Film Resistor;1%	0603	Yageo	RC0603FR-07100RL
2	R4, R9	2k	Film Resistor;1%	0603	Yageo	RC0603FR-072KL
1	R5	1M	Film Resistor;1%	0603	Yageo	RC0603FR-071ML
3	R7, R14, R17	NS				
4	R8, R11, R20	10k	Film Resistor;1%	0603	Yageo	RC0603FR-0710KL
1	R12	20k	Film Resistor;1%	0603	Yageo	RC0603FR-0720KL
2	R15, R16	3.32	Film Resistor;1%	0603	Yageo	RC0603FR-073R32L
1	R18	300k	Film Resistor;1%	0603	Yageo	RC0603FR-07300KL
1	R19	221k	Film Resistor;1%	0603	Yageo	RC0603FR-07221KL
1	U1	MP4603ES	MP4603ES	SOIC16	MPS	MP4603ES

EXAMPLE OF TV BACKLIGHT DRIVE WITH SEVERAL EV4603-S-00A



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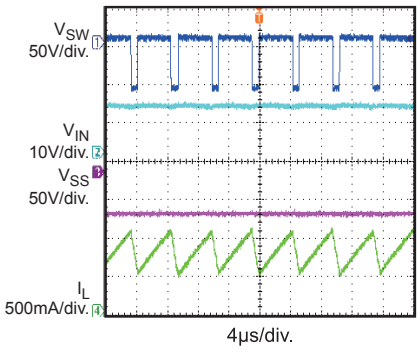
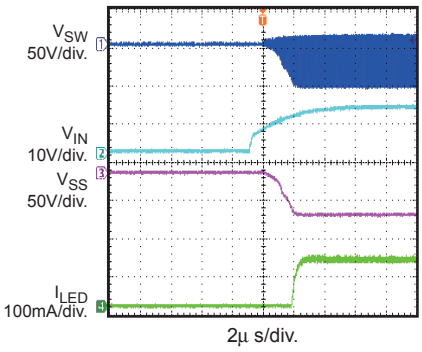
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board (JP1 Short, JP2 Open).
VIN = 12V, V_{INH}=125V, VLED=180V, ILED = 120mA, T_A = 20ºC, unless otherwise noted.

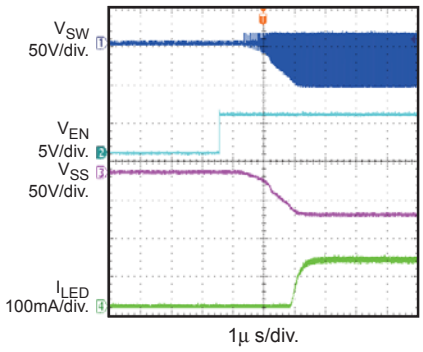
Steady State



VIN Start

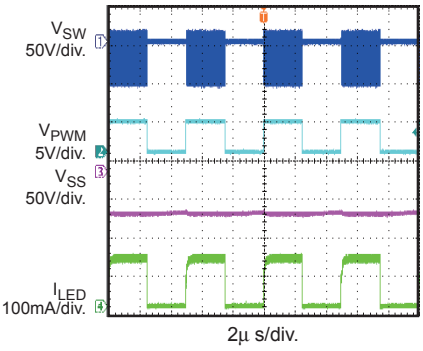


EN Start

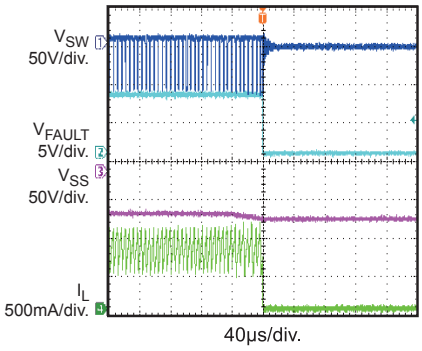


PWM Dimming

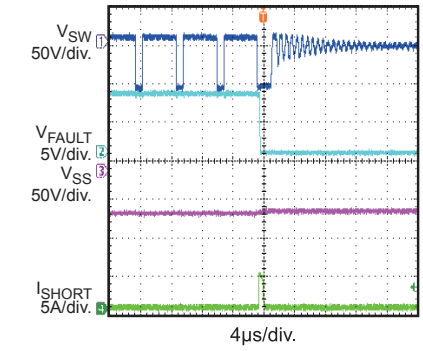
F_{PWM}=200Hz, D_{PWM}=50%



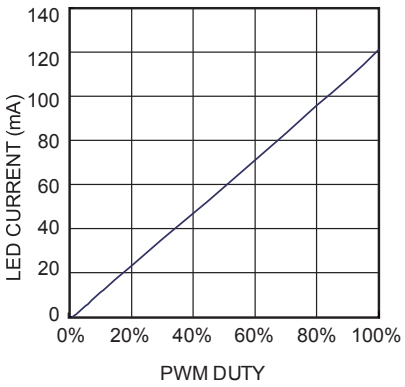
Open LED Load @ Working



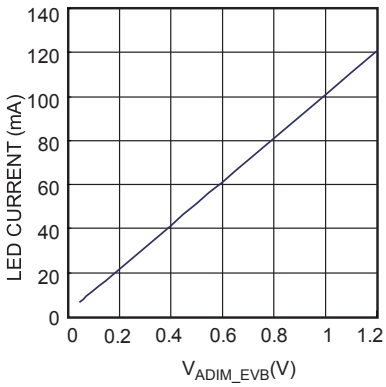
Short LED- to GND @ Working



PWM Dimming Curve



Analog Dimming Curve



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PRINTED CIRCUIT BOARD LAYOUT

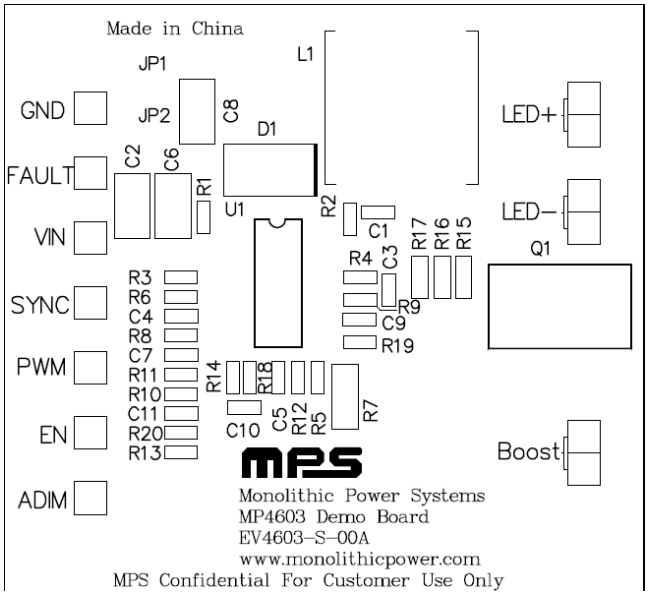

Figure 1—Top Silk Layer

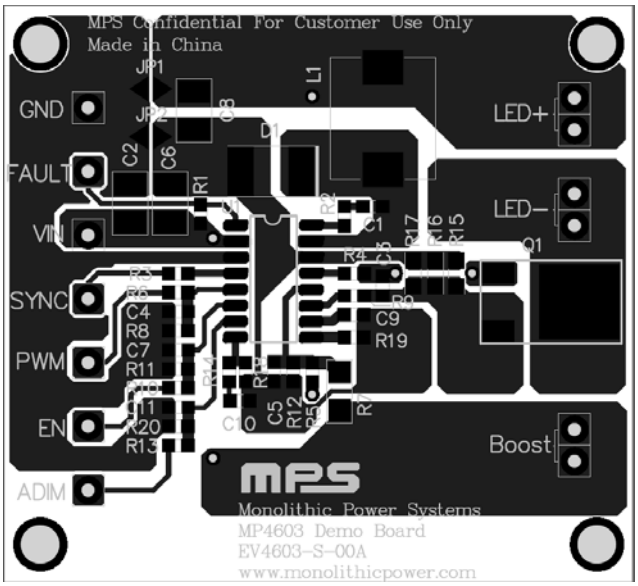

Figure 2—Top Layer

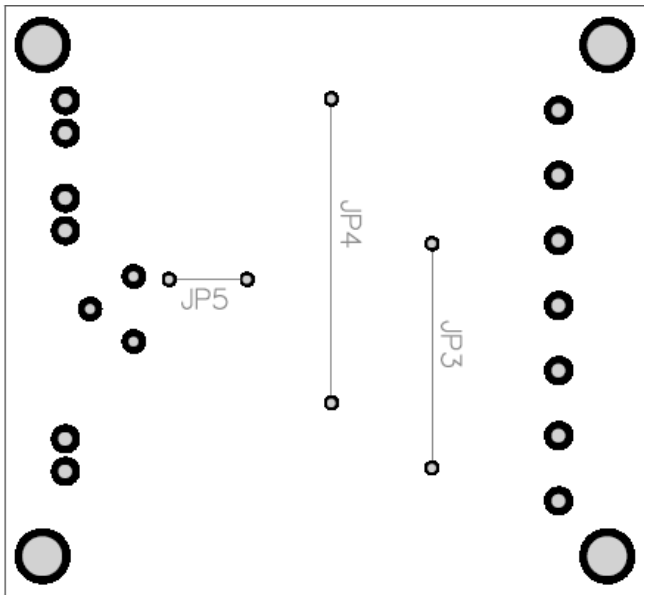

Figure 3—Bottom Layer

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QUICK START GUIDE

1. Check the LED string voltage and preset the high voltage power supply's output. For example, 60 LED string needs 180V. Set the high voltage power supply output V_{INH} as 150V.
2. Set a second power supply VIN to 12V as the input of all the EVBs. Set a third power supply to 5V as the EN input to all the EVBs, Set a fourth power supply to 5V as the ADIM input of all EVBs. Set another power supply to 5V as the PWM input of all EVBs.
3. Turn-off all power supplies.
4. Connect the positive terminal of the high voltage power supply to all the anodes of the LED strings, and the negative terminal to all the EVB 'GND' connector.
5. Connect each LED string cathode to the 'LED-' connector on one EVB individually (one EVB for one LED string).
6. Connect VIN (12V) the positive terminal to all the EVB 'VIN' connectors and the negative terminal to all the EVB GND connectors.
7. Connect the 5V PWM power supply positive terminal to all the EVB 'PWM' connectors, and negative terminal to all the EVB 'GND' connectors.
8. Connect the 5V 'ADIM' power supply positive terminal to all the EVB 'ADIM' connectors, and negative terminal to all the EVB 'GND' connectors.
9. Connect the 5V EN power supply positive terminal to all the EVB 'EN' connectors, and negative terminal to all the EVB 'GND' connectors.
10. Connect all 'SYNC' pin of all EVBs together for synchronization if necessary.
11. Turn on the high voltage power supply.
12. Turn on the 12V power supply.
13. Turn on the 5V PWM power supply.
14. Turn on the 5V ADIM power supply.
15. Turn on the 5V EN power supply. All the LED strings should be lighted.
16. To demo the dimming function: replace the 5V PWM power supply with a function generator. Set the PWM signal amplitude from 2.5V to 5V and the frequency within 100Hz to 20kHz range.
17. For analog dimming, adjust the power supply on 'ADIM' connector from 0V to 1.2V
18. To demo the EVB in Boost mode, connect the LED load as follow: Anode to 'BOOST' and Cathode to 'LED-'
19. To demo the EVB in Buck mode, open 'JP1' and short 'JP2'. The anode and cathode of the LED string are connected to "LED+" and "LED-" separately.

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