

DESCRIPTION

The EV4700-S-00A is the Evaluation Board designed to demonstrate the capabilities of MP4700 for TV backlighting applications. The MP4700 is a high efficiency step-down converter controller designed for driving the high brightness LEDs.

With a 250-300V input V_{IN} and an 8-18V power supply for MP4700, the EV4700-S-00A can drive a LED string up to 200V, and the LED current is regulated to 250mA. The EVB realizes input UVLO by INUV pin, the PWM dimming can be implemented by applying a PWM dimming signal on PWM pin. The short LED load protection and Over-Voltage protection are included.

ELECTRICAL SPECIFICATION

| Parameter | Symbol | Value | Units |
|-------------------------|---------------|---------|-------|
| Input Voltage | V_{IN} | 250-300 | V |
| IC Power Supply | V_{supply} | 8-18 | V |
| LED Voltage | V_{LED} | 200 | V |
| LED Current | I_{LED} | 250 | mA |
| Over Voltage Protection | $V_{LED-Max}$ | 250 | V |

FEATURES

- 8V-to-18V IC Supply Voltage
- Constant-Current LED Driver
- Power MOSFET Zero-Current Turn-On
- No Freewheeling Diode Reverse Recovery Issues
- High Efficiency and Reliability in Boundary Conduction Mode
- Low 1mA Operation Current
- PWM Dimming Control
- Hiccup Short Circuit Protection
- UVLO for Bus Input Voltage
- Input UVLO, Thermal Shutdown
- Maximum Frequency Limited to 160kHz
- Available in SOIC8 Package

APPLICATIONS

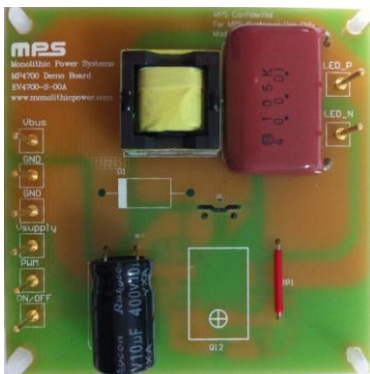
- LED Backlighting for TV and Monitor
- DC/DC or AC/DC LED Driver applications
- General Illumination

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



Warning: Although this board is designed to satisfy safety requirements, the engineering prototype has not been agency approved. Therefore, all testing should be performed using an isolation transformer to provide the AC input to the prototype board.

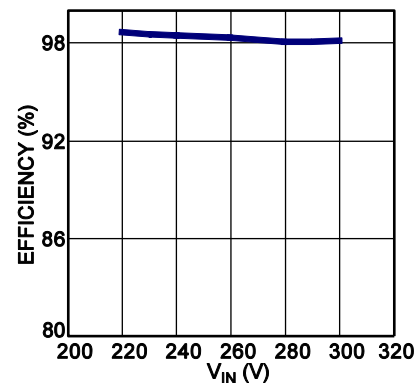
EV4700-S-00A EVALUATION BOARD



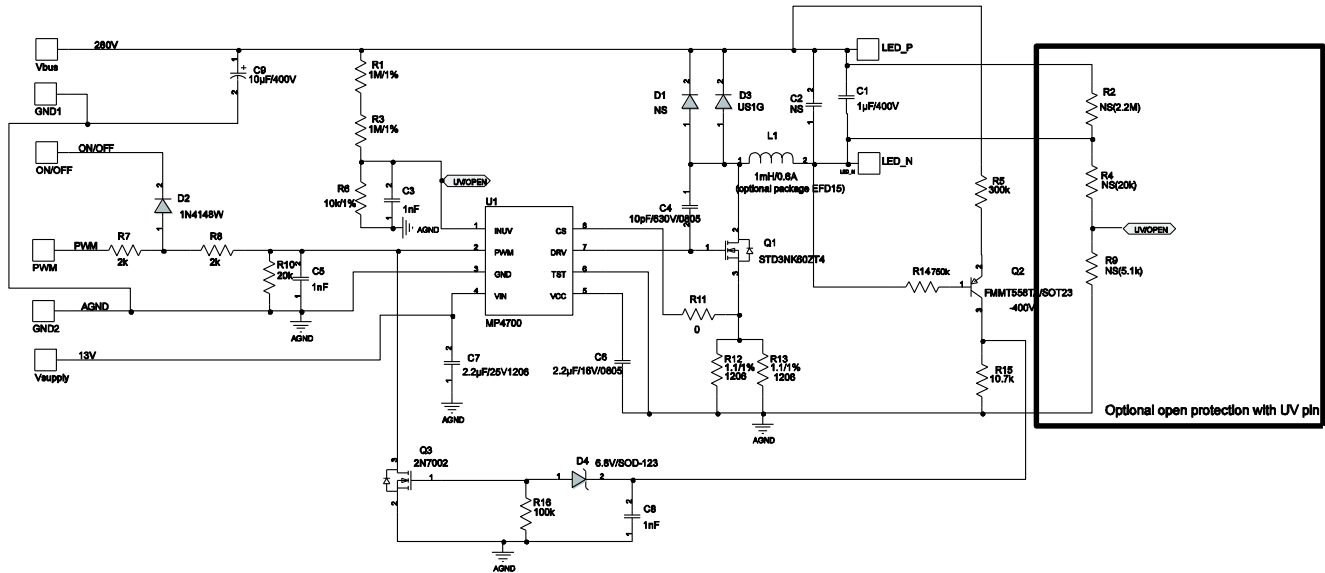
(L x W x H) 6.35cm x 6.35cm x 14mm

| Board Number | MPS IC Number |
|--------------|---------------|
| EV4700-S-00A | MP4700 |

Efficiency vs. V_{IN}



EVALUATION BOARD SCHEMATIC



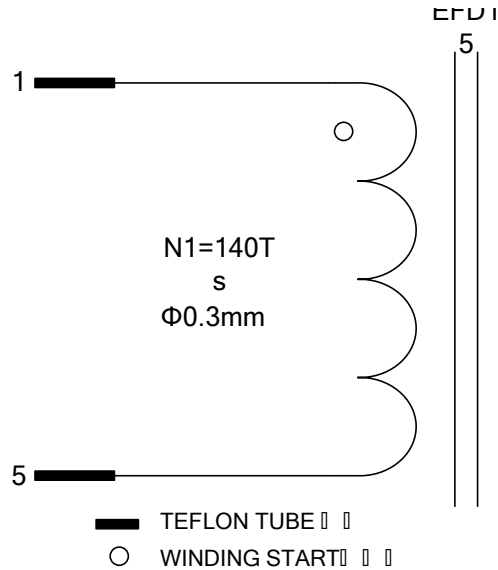
EV4700-S-00A BILL OF MATERIALS

| Qty | Ref | Value | Description | Package | Manufacture | Manufacture_PN |
|-----|------------|----------------------|--|---------|---------------|--------------------|
| 1 | C1 | 1 μ F | Capacitor;400V;CBB | DIP | Panasonic | ECQE4105KF |
| | C2 | NS | | | | |
| 3 | C3, C5, C8 | 1nF | Ceramic Capacitor;50V;X7R;0603; | 0603 | TDK | C1608X7R1H102K |
| 1 | C4 | 10pF | Capacitor;630V;X7R | 0805 | HQ | C0805C100KBRCTU |
| 1 | C6 | 2.2 μ F/16V/0805 | Ceramic Capacitor;16V;X7R;0805 | 0805 | TDK | C2012X7R1C225K |
| 1 | C7 | 2.2 μ F/25V1206 | Ceramic Capacitor;25V;X7R;1206 | 1206 | muRata | GRM31MR71E225KA93L |
| 1 | C9 | 10 μ F | Electrolytic Capacitor;400V;Electrolytic | DIP | 江海 | CD11H-400V10 |
| | D1 | NS | | | | |
| 1 | D2 | 1N4148W | Diode;75V;0.15A; | SOD-123 | Diodes | 1N4148W |
| 1 | D3 | US1G | Diode;400V;1A; | SMA | MULTICOMP/Mic | US1G |
| 1 | D4 | BZT52C6V8 | Zener Diode;6.8V;5mA/500mW; | SOD-123 | Diodes | BZT52C6V8-7 |
| 1 | L1 | 1mH/0.6A | Inductor;1mH;EFD15, 140turns | DIP | E-MEI | FX330 |
| 1 | Q1 | STD3NK60ZT4 | N-MOS/TO-252/DPAK | DPAK | ST | STD3NK60ZT4 |
| 1 | Q2 | FMMT558TA | Transistor;-400V;-150mA;500mW; | SOT-23 | Zetex | FMMT558TA |
| 1 | Q3 | 2N7002-F | N-Channel Mosfet;60V;7500;115m | SOT-23 | Diodes | 2N7002-F |
| 2 | R1, R3 | 1M/1% | Film Resistor;1% | 1206 | Yageo | RC1206FR-071ML |
| | R2, R4, R9 | NS | | | | |
| 1 | R5 | 300k | Resistor;1%;1/4W | 1206 | Yageo | RC1206FR-07300KL |
| 1 | R6 | 10k/1% | Film Resistor;1%;1/10W | 0603 | Yageo | RC0603FR-0710KL |
| 2 | R7, R8 | 2k | Film Resistor;5%;1/10W | 0603 | LIZ | CR0603JA0202G |
| 1 | R10 | 20k | Film Resistor;1%;1/10W; | 0603 | Yageo | RC0603FR-0720KL |
| 1 | R11 | 0 | Film Resistor;5%; | 0603 | Yageo | RC0603JR-070RL |
| 2 | R12, R13 | 1.1/1% | Film Resistor;1% | 1206 | Yageo | RC1206FR-071R1L |
| 1 | R14 | 750k | Film Resistor;1% | 0603 | Yageo | RC0603FR-07750KL |
| 1 | R15 | 10.7k | Film Resistor;1%; | 0603 | Yageo | RC0603FR-0710K7L |
| 1 | R16 | 100k | Film Resistor;1%; | 0603 | Yageo | RC0603FR-07100KL |
| 1 | U1 | MP4700GS | LED Driver | SO8 | MPS | MP4700GS |

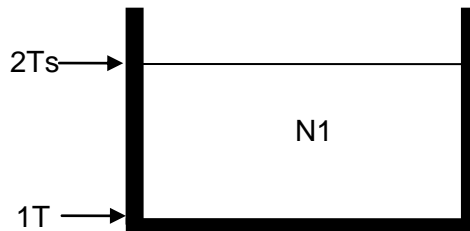
MAGNETIC COMPONENTS

A. FX330, Inductor (L1)

Electrical Diagram:



Winding Diagram



Winding Order

| 胶带圈数 (Tape Layer Number) | 绕组顺序 (Winding No.) | 始末脚位 (Start & End) | 线径 ϕ (Magnet Wire) | 圈数 (Turns) |
|-----------------------------|-----------------------|-----------------------|----------------------------|---------------|
| 1 | | | | |
| 2 | N1 | 4—8 | 0.3mm*1 | 140 |

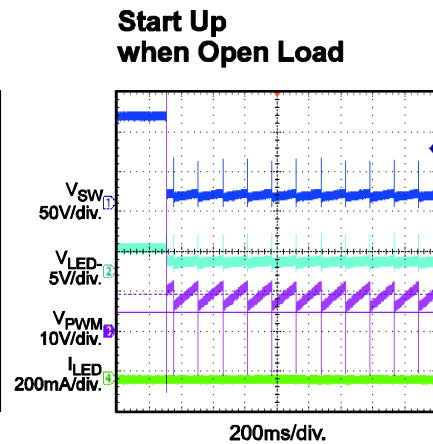
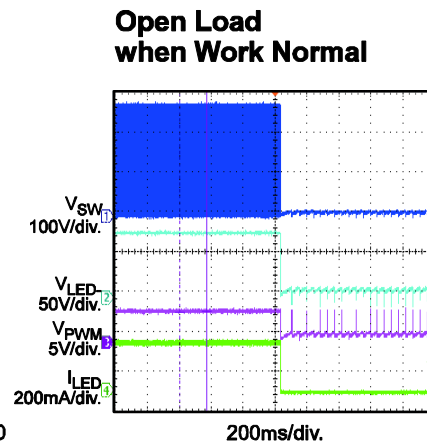
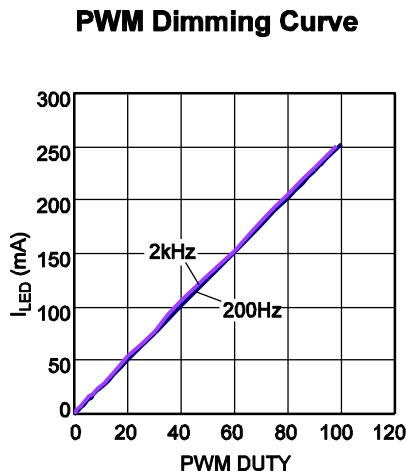
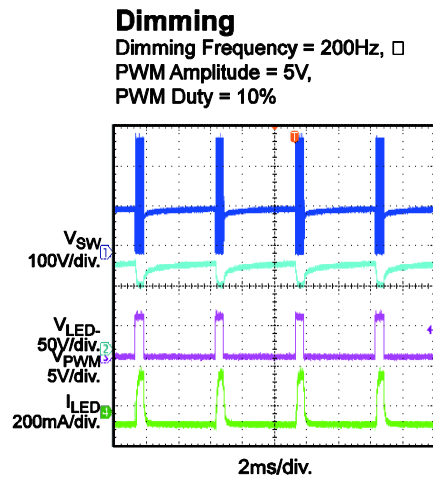
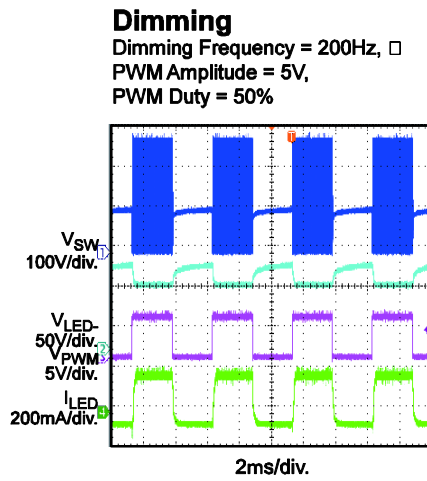
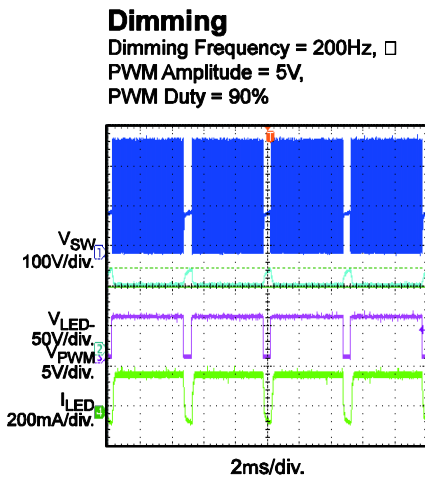
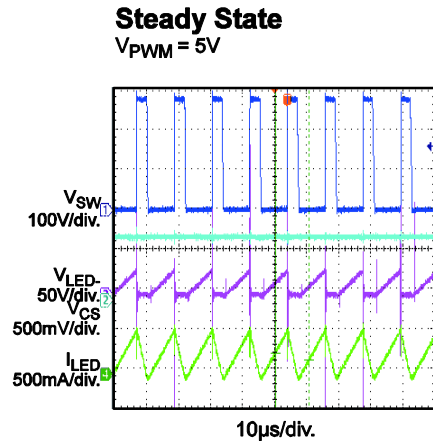
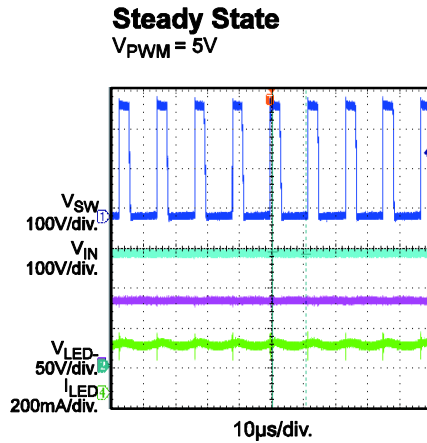
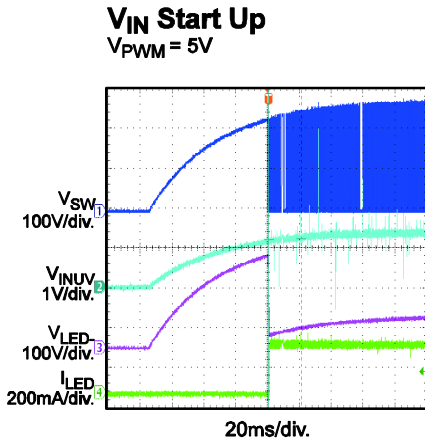
Electric Characteristics

| | | | | |
|---|-------------------------------|-----------------------|---------------|---------|
| 1 | 电感量 (Primary Inductance) | $L_p(4-8)$ | 1mH \pm 10% | 100kHz |
| 2 | 匝比 (Turn Ratio) | N1 | 140 | |
| 3 | 抗电强度 (Electrical Strength) | Pri. Side ~ Sec. Side | AC: 3000V | 1s, 1mA |
| | | Pri. Side ~ Core | AC: 2000V | |
| | | Sec. Side ~ Core | AC: 2000V | |

EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.

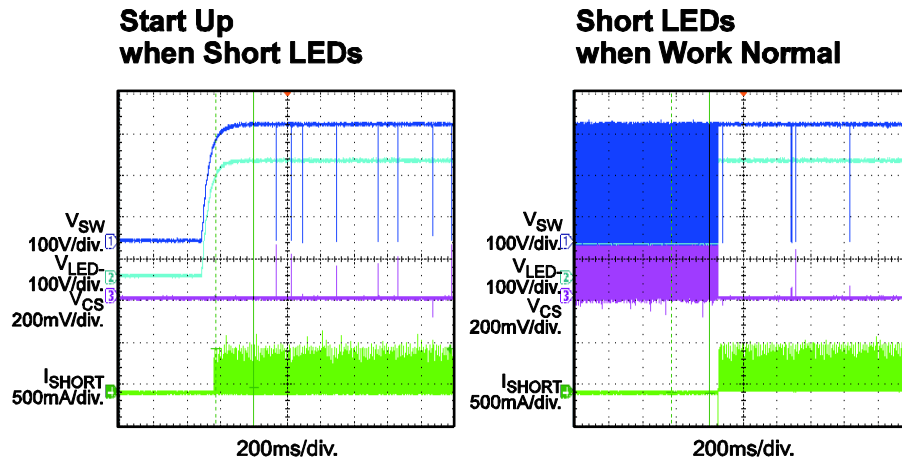
$V_{IN} = 280V$, $V_{SUPPLY} = 13V$, $V_{LED} = 200V$, $I_{LED} = 250mA$, $T_A = 20^\circ C$, unless otherwise noted.



EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

$V_{IN} = 280V$, $V_{SUPPLY} = 13V$, $V_{LED} = 200V$, $I_{LED} = 250mA$, $T_A = 20^{\circ}C$, unless otherwise noted.



PRINTED CIRCUIT BOARD LAYOUT

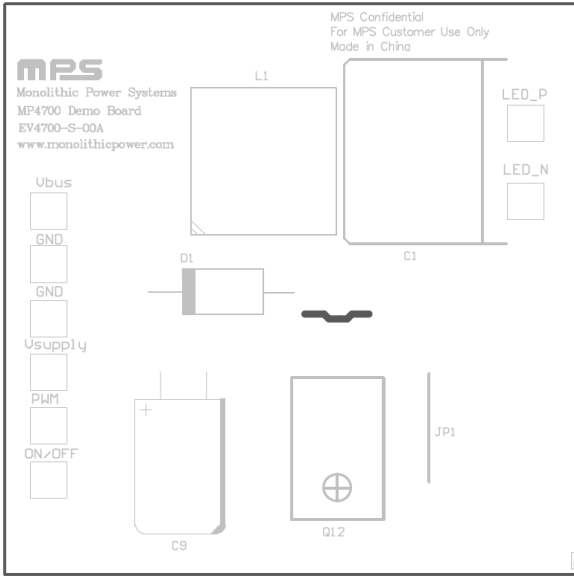


Figure 1—Top Silk Layer

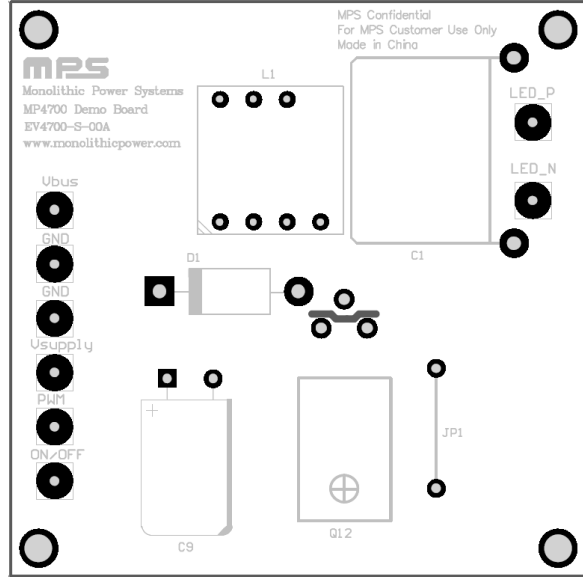


Figure 2—Top Layer

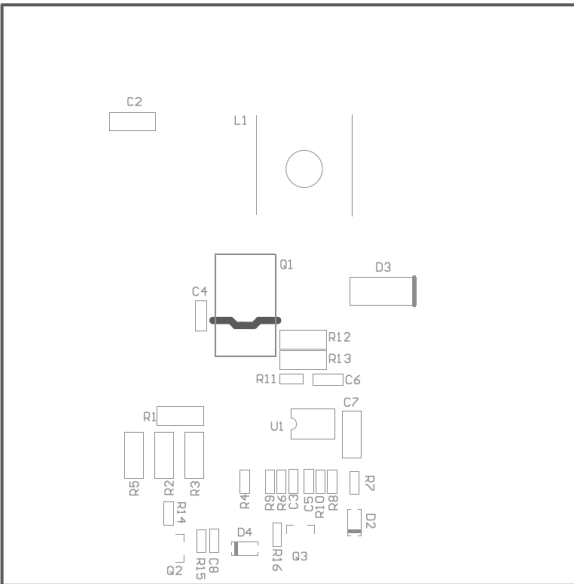


Figure 3—Bottom Silk Layer

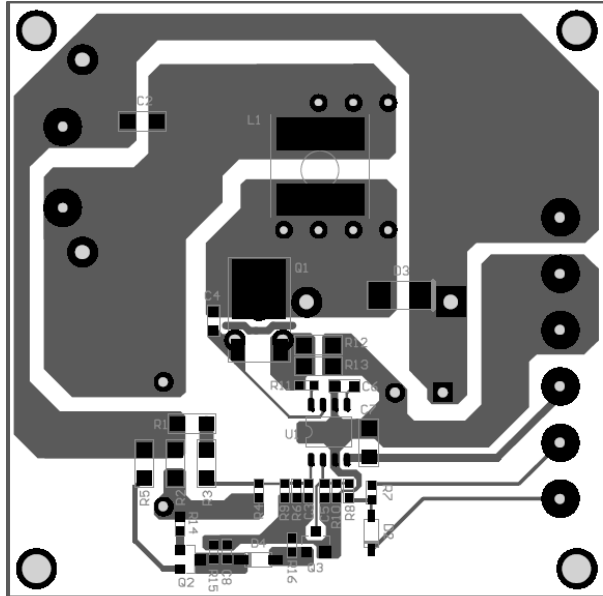


Figure 4—Bottom Layer

QUICK START GUIDE

1. Preset the VIN power supply to 250V-300V, turn off VIN power supply, and connect VIN power supply to “VIN” connector.
2. Preset the IC power supply to 8-18V, turn off the power supply, and connect the IC power supply to “Vsupply” connector.
3. Preset the PWM dimming signal to 5V; turn off the signal, and connect the signal to “PWM” connector.
4. Preset the ON/OFF signal to 2-5V; turn off the signal, and connect the signal to “ON/OFF” connector.
5. Preset the LED string to 200V; connect the anode of LED string to “LED+” and the cathode of LED string to “LED-”.
6. Turn on the VIN power supply.
7. Turn on the IC power supply.
8. Turn on the PWM dimming signal.
9. Turn on the ON/OFF signal, the LED string should be ignited.
10. To demo the PWM dimming performance; set the square wave with amplitude 2-5V, and low level 0V as PWM dimming signal. The duty of LED current will follow the duty of PWM dimming signal.

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