



# EV171A-S-00A

## Small, Universal Input Non-Isolated Off-Line Regulator With Improved EMI Performance Evaluation Board

### DESCRIPTION

The EV171A-S-00A Evaluation Board is designed to demonstrate the capabilities of the MP171A. The MP171A is a primary-side constant voltage regulator, which provides accurate constant voltage (CV) regulation without opto-coupler. It supports Buck, Buck-Boost, Boost and Flyback topologies.

The EV171A-S-00A Evaluation Board is designed as Buck application. It typically drives 5V/50mA load from 85VAC to 265VAC input.

The EV171A-S-00A has an excellent efficiency and meets class3 (2kV) IEC61000-4-5 surge immunity and EN55022 conducted EMI requirements. The radiation emission performance gets improved compared with the MP171. The MP171A features various protections, including thermal shutdown (TSD), VCC under-voltage lockout (UVLO), over-load protection (OLP), short-circuit protection (SCP), and open loop detection.

The MP171A is available in TSOT23-5 and SOIC-8 packages.

### ELECTRICAL SPECIFICATION

| Parameter      | Symbol    | Value     | Units |
|----------------|-----------|-----------|-------|
| Input Voltage  | $V_{IN}$  | 85 to 265 | VAC   |
| Output Voltage | $V_{OUT}$ | 5         | V     |
| Output Current | $I_{OUT}$ | 50        | mA    |

### FEATURES

- Primary-Side Non-Isolated CV Control
- Integrated 700V MOSFET
- <100mW No-Load Power Consumption
- Good EMI Performance
- Limited Maximum Frequency
- Multiple Protections: SCP, OLP, Open Loop Detection, TSD, and VCC UVLO

### APPLICATIONS

- Home Appliances, White Goods, and Consumer Electronics
- Industrial Controls
- Standby Power

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**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.

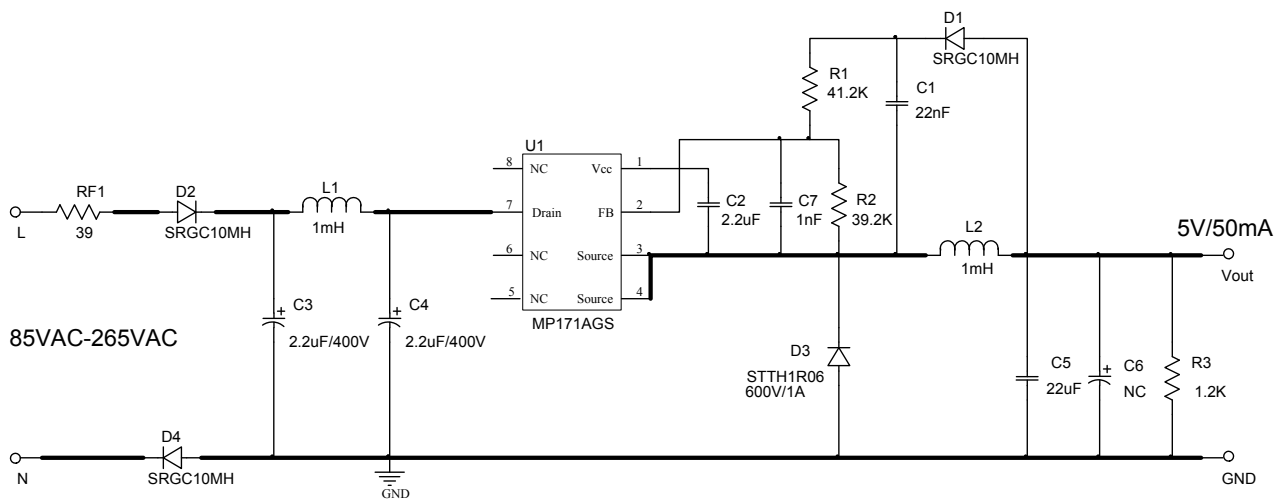
## EV171A-S-00A EVALUATION BOARD



(L x W x H) 17mm x 23mm x 17mm

| Board Number | MPS IC Number |
|--------------|---------------|
| EV171A-S-00A | MP171AGS      |

## EVALUATION BOARD SCHEMATIC



### Figure 1: Schematic

## PCB LAYOUT (SINGLE-SIDED)

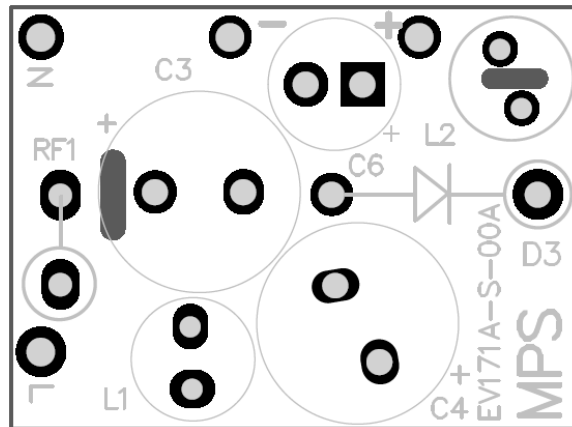


Figure 2: Top Layer

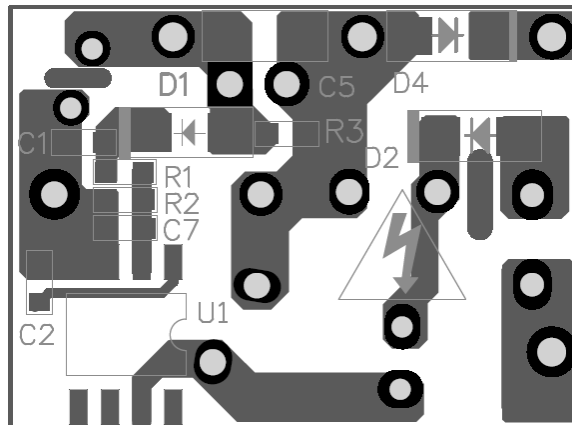


Figure 3: Bottom Layer

**BILL OF MATERIALS**

| Qty | Ref           | Value    | Description                     | Package | Manufacture | Manufacture_PN     |
|-----|---------------|----------|---------------------------------|---------|-------------|--------------------|
| 1   | C1            | 22nF     | Ceramic Capacitor;<br>16V; X7R  | 0603    | muRata      | GRM188R71C223KA01D |
| 1   | C2            | 2.2μF    | Ceramic Capacitor;<br>10V; X7R  | 0603    | muRata      | GRM188R71A225KE15D |
| 2   | C3, C4        | 2.2μF    | Electrolytic Capacitor;<br>400V | DIP     | Rubycon     | 400LLE2R2MEFC      |
| 1   | C5            | 22μF     | Ceramic Capacitor;<br>25V; X5R  | 1206    | muRata      | GRM31CR61E226KE15  |
| 1   | C7            | 1nF      | Ceramic Capacitor;<br>50V; X7R  | 0603    | SUMSUNG     | C10B102KBNC        |
| 3   | D1,<br>D2, D4 | SRGC10MH | Diode; 1000V; 1A                | 1206    | Mexmega     | SRGC10MH           |
| 1   | D3            | STTH1R06 | Diode; 600V; 1A                 | DO-41   | ST          | STTH1R06           |
| 1   | L1            | 1mH      | Inductor; 17.4Ω;<br>100mA       | DIP     | Any         | CKL0410-102        |
| 1   | L2            | 1mH      | Inductor; 6Ω; 250mA             | DIP     | Würth       | 7447462102         |
| 1   | R1            | 41.2K    | Film Resistor; 1%               | 0603    | Yageo       | RC0603FR-0741K2L   |
| 1   | R2            | 39.2K    | Film Resistor; 1%               | 0603    | Yageo       | RC0603FR-0739K2L   |
| 1   | R3            | 1.2K     | Film Resistor; 1%               | 0603    | Yageo       | RC0603FR-071K2L    |
| 1   | RF1           | 39       | Fuse Resistor; 5%; 1W           | DIP     | Yageo       | FKN1WSJT-50-39R    |
| 1   | U1            | MP171A   | Buck Regulator                  | SOIC-8  | MPS         | MP171AGS           |

## **CIRCUIT DESCRIPTION**

The EV171A-S-00A is configured in a buck topology to demonstrate the performance of the MP171A. The MP171A is a primary side regulator which provides accurate constant voltage. It simplifies the schematic and minimizes the BOM cost.

RF1 is used to protect circuit from component failure or some excessive short events. It can also restrain the inrush current.

C3, L1 and C4 compose CLC filter to meet the conducted EMI standard EN55022. C3 and C4 are also used for energy storage and protecting against line surge.

With RF1, C3 and C4, the EV171A-S-00A meets calss3 (2kV) IEC61000-4-5 surge immunity standard.

C1 is the sample-hold capacitor used for reflecting output voltage. R1 and R2 are resistor divider for detecting output voltage by sampling voltage on C1.

D3 is the freewheeling diode. For universal voltage applications, use a diode with a 600V reverse block voltage. Fast recovery diode or ultra fast diode is recommended for better efficiency and reliable operation.

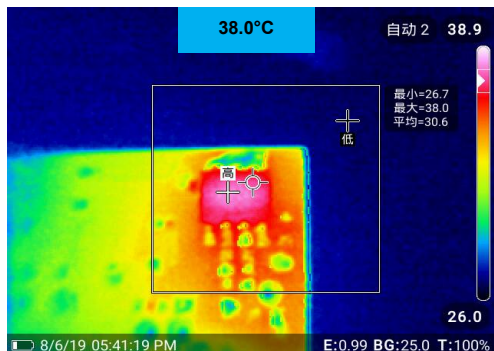
C5 is the output capacitors for 5V output. R3 is dummy load to lower the output voltage of 5V rail at no load condition.

## EVB TEST RESULTS

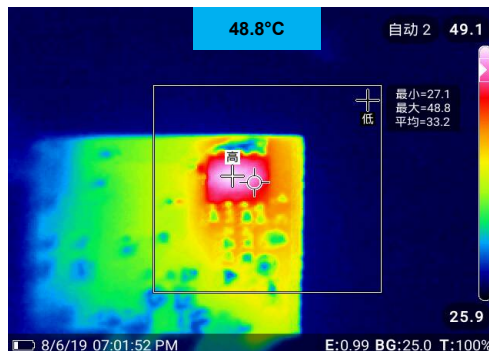
Performance waveforms are tested on the evaluation board.

$V_{IN}=230V_{AC}$ ,  $V_{OUT}=5V$ ,  $I_{OUT}=50mA$ ,  $T_A=26^{\circ}C$ , unless otherwise noted.

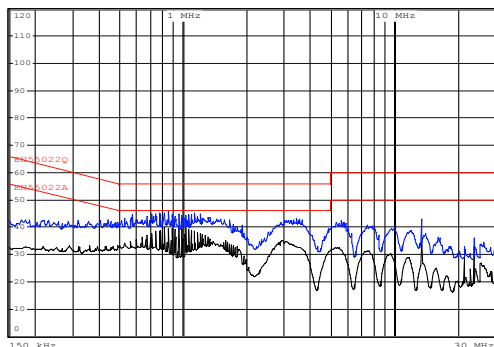
**Thermal**  
 $V_{IN}=85V_{AC}$



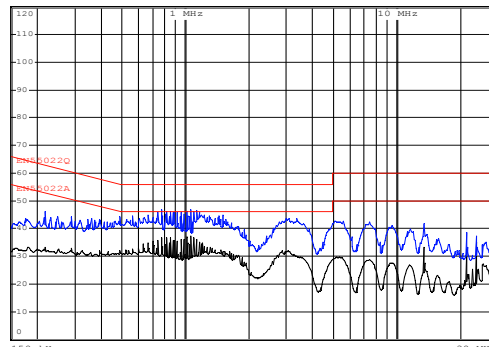
**Thermal**  
 $V_{IN}=265V_{AC}$



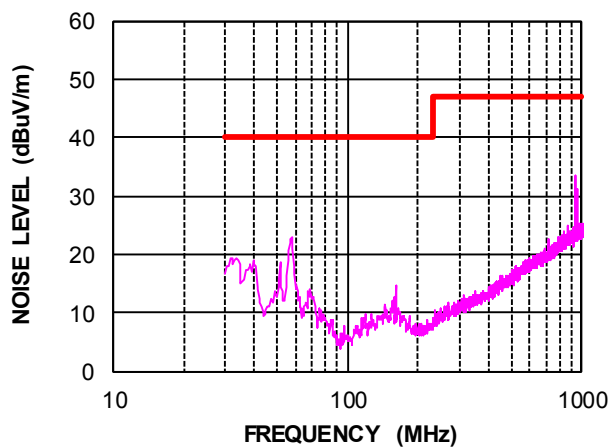
**CE Performance- L Line**



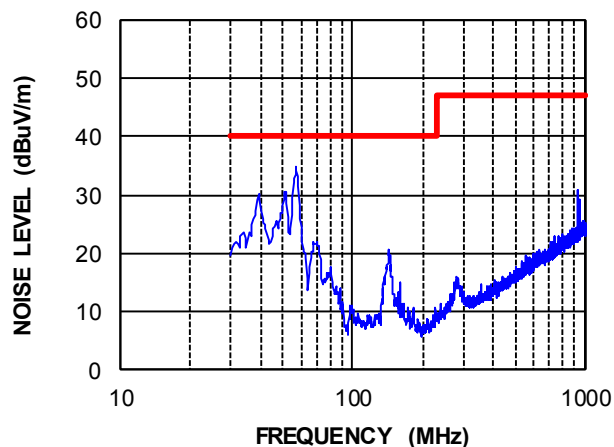
**CE Performance- N Line**



**RE Performance- Horizontal (Peak)**



**RE Performance- Vertical (Peak)**

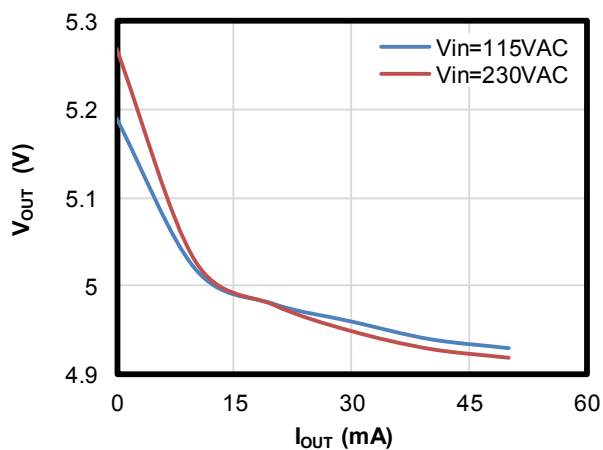


## EVB TEST RESULTS *(continued)*

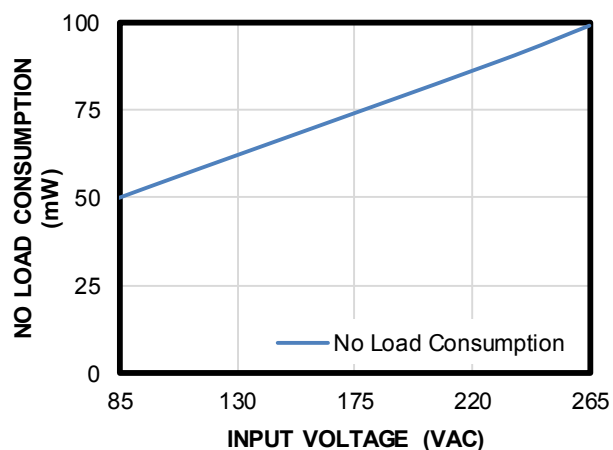
Performance waveforms are tested on the evaluation board.

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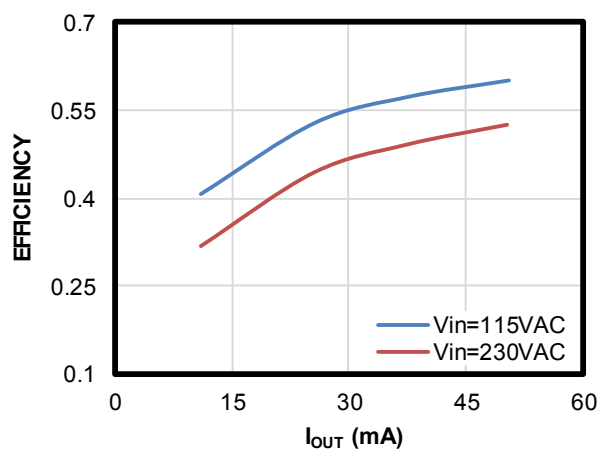
**Load Regulation**



**No Load Consumption**



**Efficiency**

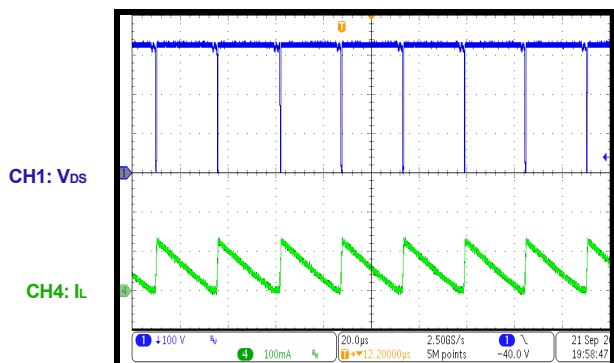


## EVB TEST RESULTS (continued)

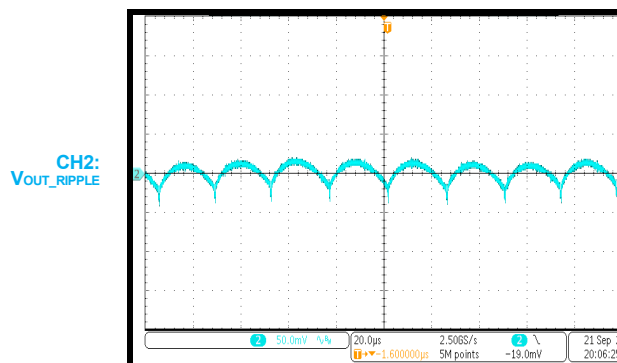
Performance waveforms are tested on the evaluation board.

$V_{IN}=230V_{AC}$ ,  $V_{OUT}=5V$ ,  $I_{OUT}=50mA$ ,  $T_A=26^{\circ}C$ , unless otherwise noted.

### Steady State

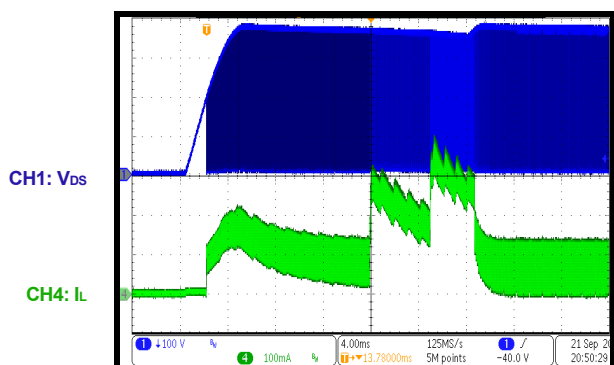


### Output Ripple

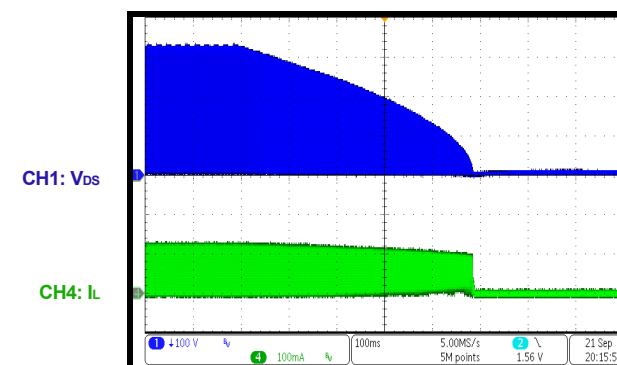


### Start-up

$V_{IN}=265V_{AC}$ ,  $C_{OUT}=470\mu F$

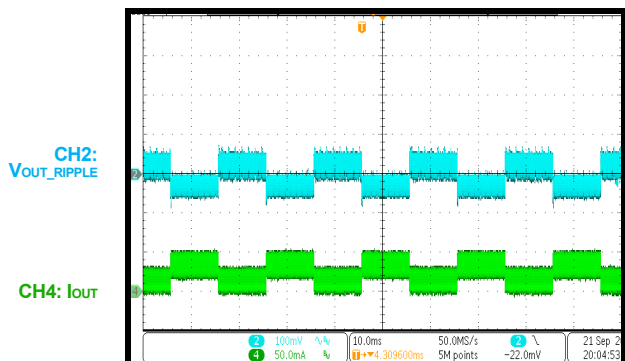


### Shut-down

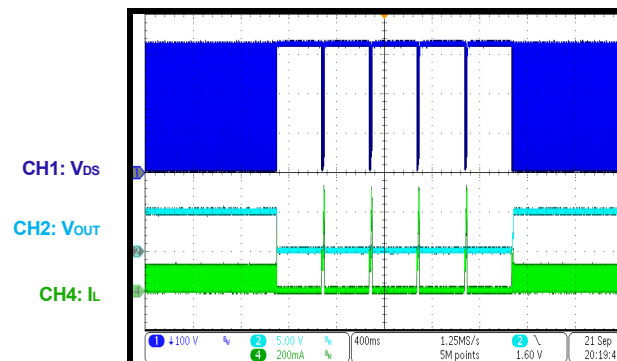


### Load Transient

1/2 Load to Full Load



### SCP Entry & Recovery

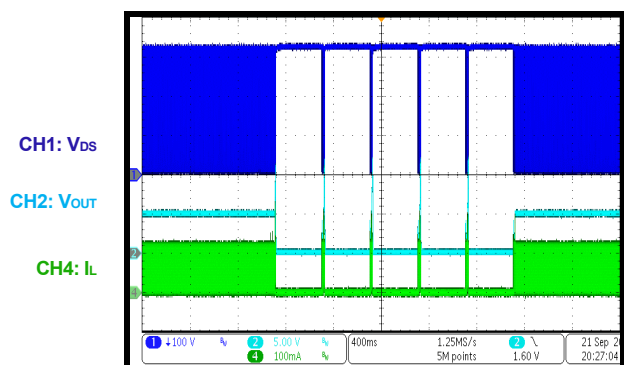


## EVB TEST RESULTS *(continued)*

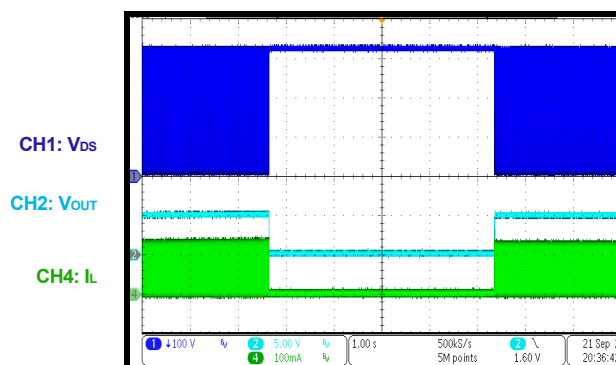
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Open Loop Entry & Recovery



OTP Entry & Recovery



## QUICK START GUIDE

1. Preset power supply to  $85\text{VAC} \leq V_{\text{IN}} \leq 265\text{VAC}$ .
2. Turn power supply off.
3. Connect the Line and Neutral terminals of the power supply to L and N port.
4. Connect load positive and negative terminals to corresponding + and - outputs.
5. Turn power supply on after making connections.

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