EV020A-5-S-01B

85VAC~265VAC/50Hz, 12V/0.65A，5V/50mA
Off-line Primary-Side-Regulator
Home Appliances Evaluation Board

DESCRIPTION

The EV020A-5-S-01B Evaluation Board is designed to demonstrate the capabilities of MP020A-5. The MP020A-5 is a primary-side-control offline regulator which can eliminates secondary feedback components.

The EV020A-5-S-01B is typically designed for small home appliances which output 12V/0.65A and 5V/50mA load from 85VAC to 265VAC, 50HZ/60HZ.

The EV020A-5-S-01B has an excellent efficiency and meets IEC61000-4-5 surge immunity and EN55022 conducted EMI requirements. It has multi-protection function as open circuit protection, short-circuit protection, cycle by cycle current limit and over-temperature protection, etc.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	85 to 265	VAC
Output Voltage 1	V_{OUT1}	12	V
Output Current 1	I_{OUT1}	0.65	A
Output Voltage 2	V_{OUT2}	5	V
Output Current 2	I_{OUT2}	0.05	A
Output Power	P_{OUT}	8.05	W
Efficiency (full load)	η	>80	%

FEATURES

- Primary-Side–Control without Opto-Coupler or Secondary Feedback Circuit
- Precise Constant Current and Constant Voltage Control (CC/CV)
- Integrated 700V MOSFET with Minimal External Components
- Variable, Off-Time, Peak-Current Control
- 550μA High-Voltage Current Source
- 100mW No-Load Power Consumption
- Programmable Cable Compensation
- Multiple Protections: OVP, OCP, OCkP, OTP, and VCC UVLO
- Natural Spectrum Shaping for Improved EMI Signature
- Low Cost and Simple External circuit

APPLICATIONS

- Small Home Appliances
- Cell Phone Chargers
- Adapters for Handheld Electronics
- Stand-By and Auxiliary Power Supplies
- Small Appliances

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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.

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EV020A-5-S-01B EVALUATION BOARD

TOP VIEW

BOTTOM VIEW

(L x W x H) 50mm x 30mm x 18mm

Board Number	MPS IC Number
EV020A-5-S-01B	MP020A-5GS

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EVALUATION BOARD SCHEMATIC

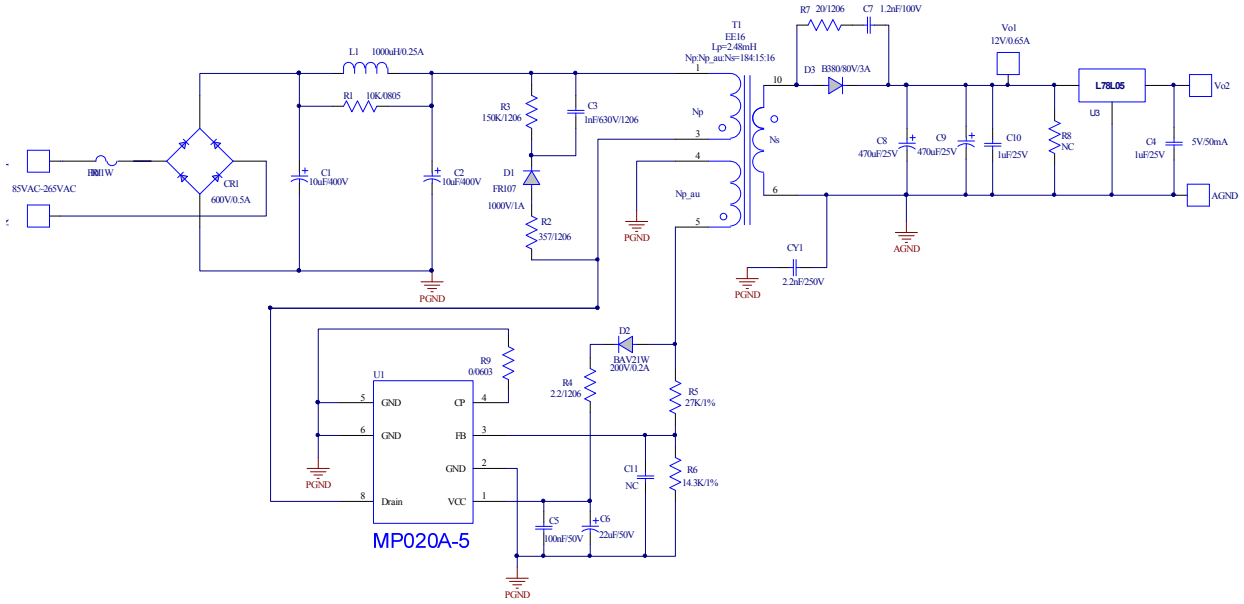

Figure 1—Schematic

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PCB LAYOUT (SINGLE-SIDED)

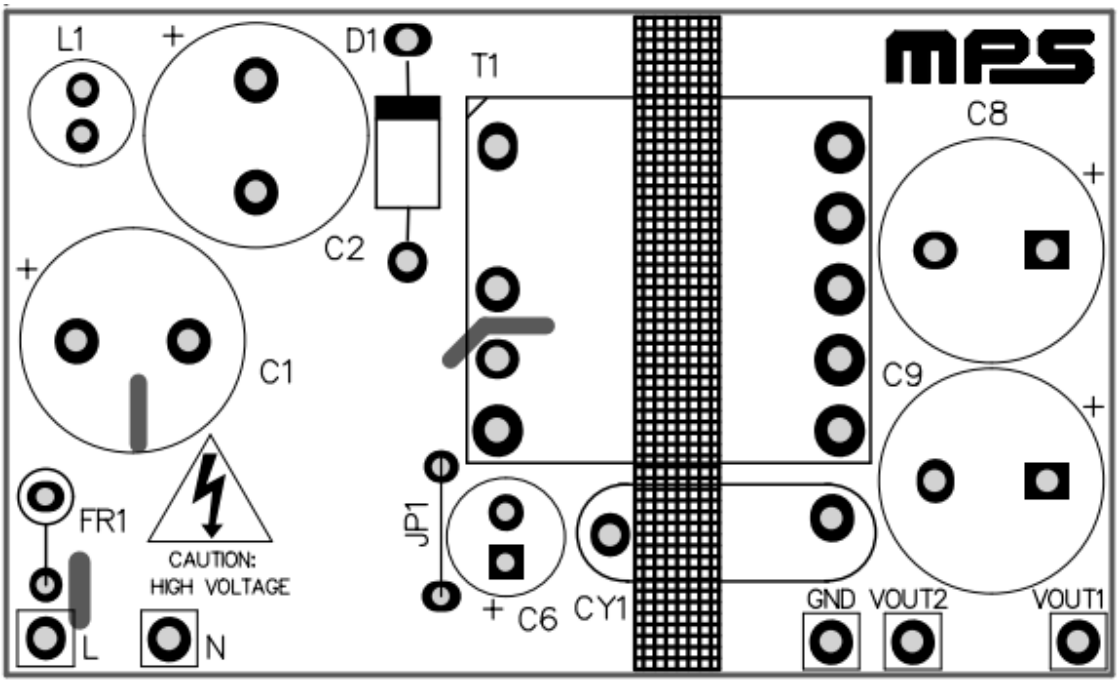

Figure 2—Top Layer

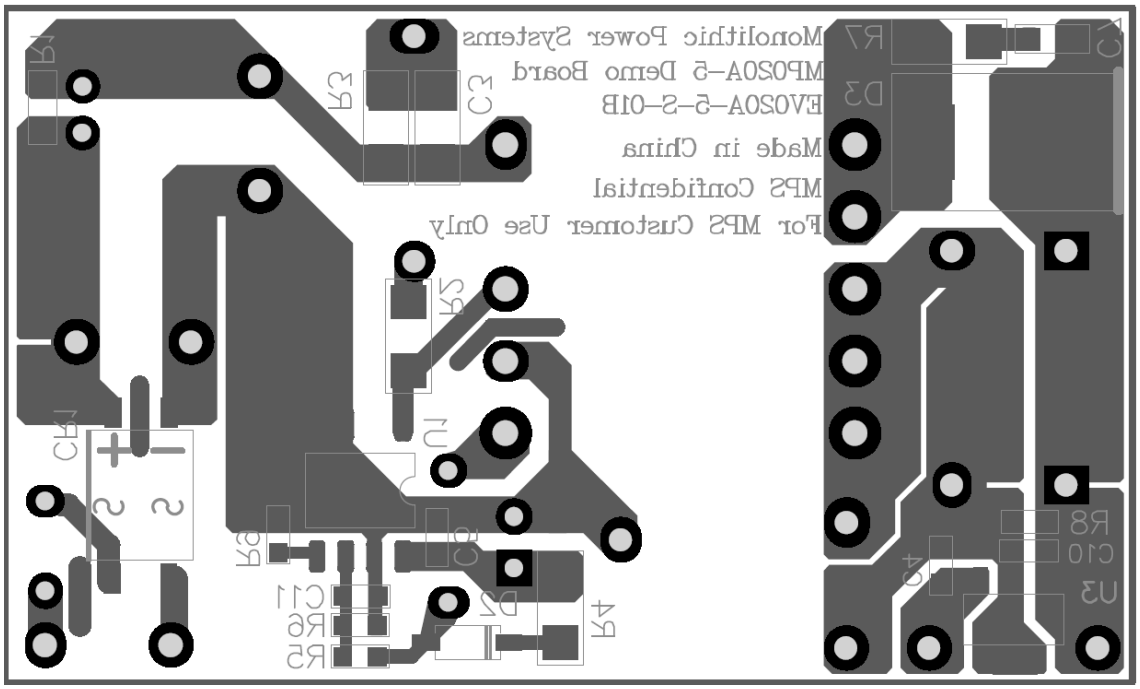

Figure 3—Bottom Layer

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CIRCUIT DESCRIPTION

The EV020A-5-S-01B is configured in a single-stage Flyback topology, it uses primary-side-control which can mostly simplify the schematic and get a cost effective BOM. It can also achieve accurate constant voltage and constant current.

FR1 and CR1 compose the input stage. FR1 is used to protect for the component failure or some excessive short events, also it can restrain the inrush current.

C1, L1 and C2 compose π filter to guarantee the conducted EMI meet standard EN55022. R2, R3, D1 and C3 compose the snubber circuit to reduce drain-source voltage spike.

R4, C5, C6 and D2 are used as Vcc power supply.

R5 and R6 are resistor divider for detecting output voltage by sampling voltage on primary auxiliary winding.

CY1 is Y capacitor lowering common mode noise to make sure there is enough EMI margin. T1 is power transformer, the structure of which is also very important to pass EMI test.

D3, C8, C9, and C10 compose the 12V output circuit. D3 is schottky diode for better efficiency. C10 is ceramic capacitor for lower output voltage ripple. U3 is a LDO for 5V output.

R7 and C7 are used to depress the spike of schottky.

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EV020A-5-S-00B BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer_P/N
2	C1,C2	10μF	Capacitor;400V;20%	DIP	Ltec	TY 10uF/400V
1	C3	1nF	Ceramic Capacitor;630V;X7R	1206	Murata	GRM31A7U2J102JW31D
1	C5	100nF	Ceramic Capacitor;50V;X7R;	0603	Murata	GCJ188R71H104KA12D
1	C6	22μF	Electrolytic Capacitor;50V	DIP	Jianghai	CD281L-50V22
1	C7	1.2nF	Ceramic Capacitor;100V;X7R	0603	muRata	GRM188R72A122KA01D
2	C8,C9	470μF	Electrolytic Capacitor;25V,Low ESR	DIP	Rubycon	25ZLF470MEFC10X12.5
2	C10,C4	1μF	Ceramic Capacitor;25V;X7R	0603	Murata	GRM188R71E105KA12D
0	C11	NC				
1	CY1	2.2nF	Y Capacitor; 250V	DIP	Hongke	JNK12E222ML02N
1	CR1	MB6F	Diode;600V;0.5A	SOP-4	Diodes	MB6F
1	D1	FR107	Diode;1000V;1A	DO-41	Diodes	FR107
1	D2	BAV21W	Diode;200V;0.2A;	SOD-123	Diodes	BAV21W-7-F
1	D3	B380	Schottky Diode;80V;3A	SMC	Diodes	B380
1	FR1	10Ω	Fusible Resistor, 1 W, 5%	Yageo	DIP	FKN1WSJT-52-10R
1	L1	1000μH	Inductor;1000uH;6 Ohm;0.25A	DIP	Wurth	7447462102
1	R1	10kΩ	Film Resistor;5%	0805	Yageo	RC0805JR-0710KL
1	R2	357Ω	Film Resistor;1%;1/4W	1206	Yageo	RC1206FR-07357RL
1	R3	150kΩ	Film Resistor; 1%,1/4W	1206	Yageo	RC1206FR-07150KL
1	R4	2.2Ω	Film Resistor;5%;1/4W	1206	Royalohm	1206F220KT5E
1	R5	27kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-0727KL
1	R6	14.3kΩ	Film Resistor;1%	0603	Yageo	RC0603FR-0714K3L
1	R7	20Ω	Film Resistor;5%;1/4W	1206	Royalohm	1206J020A0T5E
0	R8	NC				
1	R9	0Ω	Film Resistor;5%	0603	Yageo	RC0603JR-070RL
1	U1	MP020A-5	Primary side regulator	SOIC8-7A	MPS	MP020A-5GS
1	U3	L78L05ACUTR	LDO, 5V, 100mA	SOT89	ANY	L78L05ACUTR
1	T1		Transformer;2.48mH; N_P:N_{P_AU}:N_S=184:15:16	EE16	Wurth(1)	7508110328
					Emei(2)	FX0303
Notes:		(1) Wurth transformer sample request please login on website: www.we-online.com				
		(2) Emei transformer sample request please login on website: www.emeigroup.com				

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TRANSFORMER SPECIFICATION

Electrical Diagram

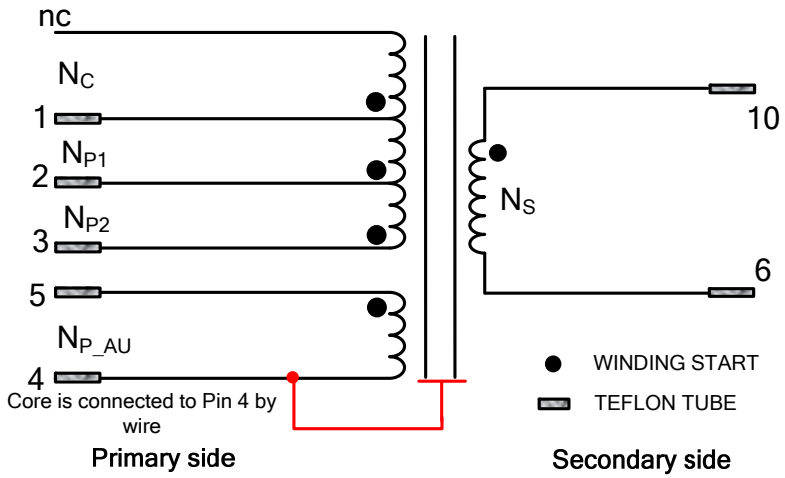

Figure 4—Transformer Electrical Diagram

Notes:

1) Core is connected with Pin 4 with naked wire.
2) N_S is with Triple Insulation Wire.

Winding Diagram

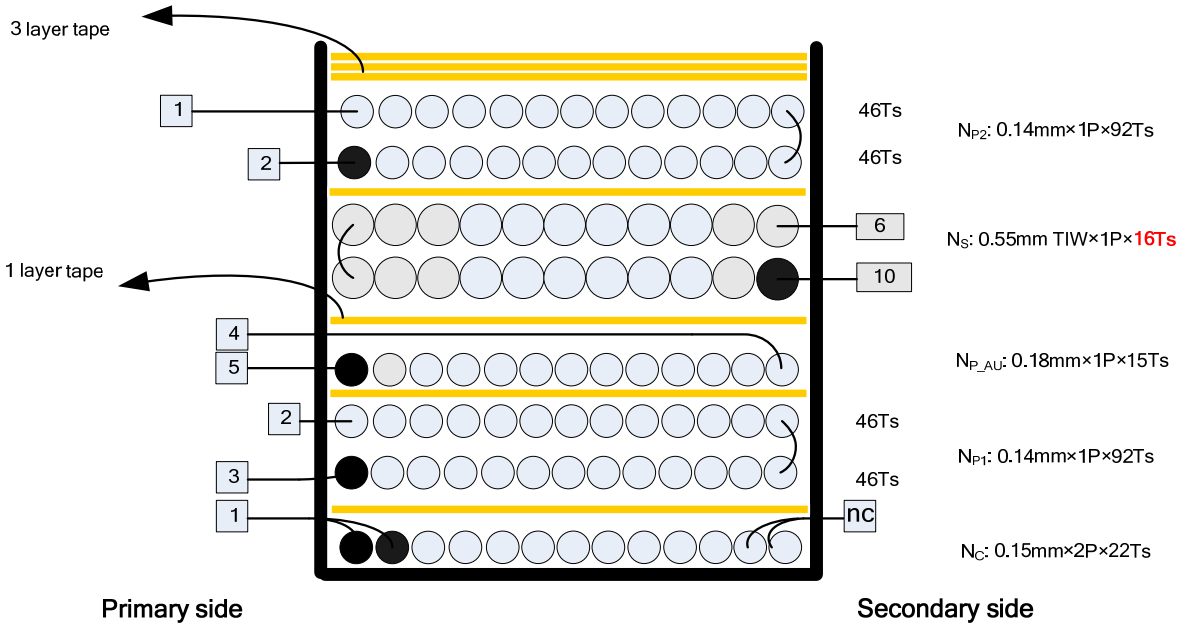

Figure 5—Winding Diagram

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Winding Order

Winding No.	Tape Layer Number	Start & End	Magnet WireΦ(mm)	Turns
N_C	1	1→nc	0.15mm * 2	22
N_{P1}	1	3→2	0.14mm * 1	92
N_{P_AU}	1	5→4	0.18mm * 1	15
N_S	1	10→6	0.55mm * 1 TIW	16
N_{P2}	1	2→1	0.14mm * 1	92

Electrical Specifications

Electrical Strength	60 second, 60Hz, from PRI. to SEC.	3000VAC
	60 second, 60Hz, from PRI. to CORE.	500VAC
	60 second, 60Hz, from SEC. to CORE.	3000VAC
Primary Inductance	Pins 1 - 3, all other windings open, measured at 50kHz, 0.1 VRMS	2.48mH±10%
Primary Leakage Inductance	Pins 1 - 3 with all other pins shorted, measured at 50kHz. 0.1 VRMS	60μH±10%

Materials

Item	Description
1	Core: EE16, UI=2300±25%, AL=73.2.4nH/N^2±3% GAPPED, or equivalent
2	Bobbin: EE16, 5+5PIN 1 SECT TH, UL94V-0
3	Wire:Φ0.14mm,, 2UEW, Class B
4	Wire:Φ0.15mm,, 2UEW, Class B
5	Wire:Φ0.18mm,, 2UEW, Class B
6	Triple Insulation Wire: Φ0.55mm TIW
7	Tape: 8.0mm(W)×0.06mm(TH)
8	Varnish: JOHN C. DOLPH CO, BC-346A or equivalent

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QUICK START GUIDE

1. Preset Power Supply to 85VAC ≤ V_{IN} ≤ 265VAC.
2. Turn Power Supply off.
3. Connect the Line and Neutral terminals of the power supply output to L and N port. For three-wire input application, make OUTPUT GND connected to Earth.
4. Connect Load to:
    a. Positive (+): VOUT
    b. Negative (–): GND
5. Turn Power Supply on after making connections.

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