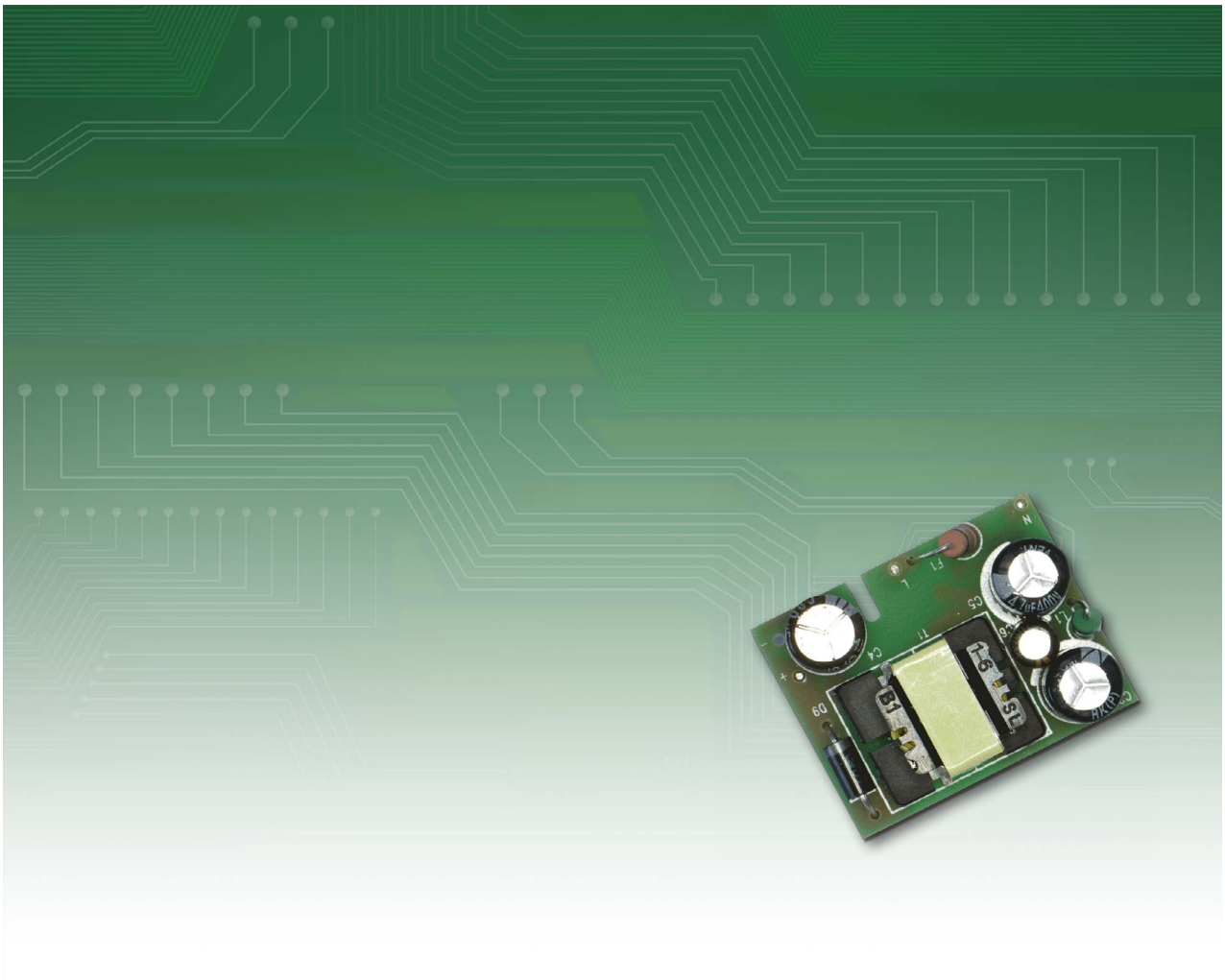
Reference Design

EBC10013

iWatt
Power Management Simplified Digitally™



iW1810-00 For 5V 600mA AC-DC SMPS Design

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(AC Input 90–264V_{AC}, Output 5V 600mA)
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1.0 Introduction

This document provides a reference design for a universal input, 5V 600mA isolated flyback switched-mode power supply. For this design the iW1810-00 is used. This document contains the complete specification of the power supply, a detailed circuit diagram, an entire bill of materials required to build the power supply, a drawing of the power transformer, and test data of the most important performance.

Figure 1.1 PCB Top View

Figure 1.3 Side View

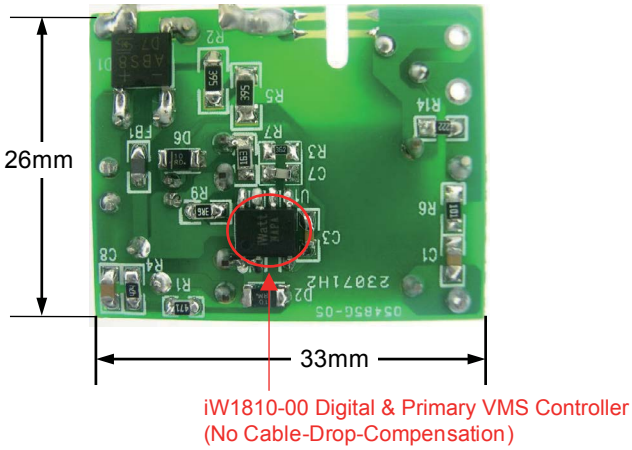


Figure 1.2 PCB Bottom View

2.0 Design Features

- AC input range 90-264V_{AC}
- DC output 5V 600-800mA
- Meet “100mW” no-load standby power consumption requirement
- Meet *“EPA 2.0”* requirement
- Max ripple <150mV_{P_P}

3.0 Power Supply Design Specification

The information in the table below represents the minimum acceptable performance of the design.

Description		Symbol	Min	Typ	Max	Units	Comment
Input							
Voltage		V_{IN}	90		264	V_{AC}	2 wire
Frequency		f_{LINE}	47	50/60	63	Hz	
No-load input power ($230V_{AC}$)					100	mW	
Output							
Constant voltage	Output voltage	V_{OUT_CV}	4.75	5.00	5.25	V	Measured at end of PCB
	Output current	I_{OUT_CV}	0		0.60	A	
Constant current	Output voltage	V_{OUT_CC}	2.5	Depending on battery voltage		V	Min V_{OUT} is dependent on V_{CC} supply voltage
	Output current	I_{OUT_CC}	0.60		0.80	A	
Output ripple voltage		V_{RIPPLE}			150	mV_{P_P}	Measured at end of PCB I_{OUT}=0.6A @T_A=25°C 20MHz bandwidth
Total Output Power							
Continuous output power		P_{OUT}		3		W	
Over-current protection		I_{OUT_MAX}			0.80	A	Auto-restart
Active mode efficiency (meet EPA2.0)		η	64.4			%	Measured at end of PCB, V_{IN}=115V_{AC} and 230V_{AC} (T_{AMB}=25°C)
Environmental							
Conducted EMI			Meets CISPR22B/EN55022B				
Safety			Designed to meet IEC950, UL1950 Class II				
Ambient temperature		T_{AMB}	0		40	°C	Free convection, sea level

4.0 Schematic

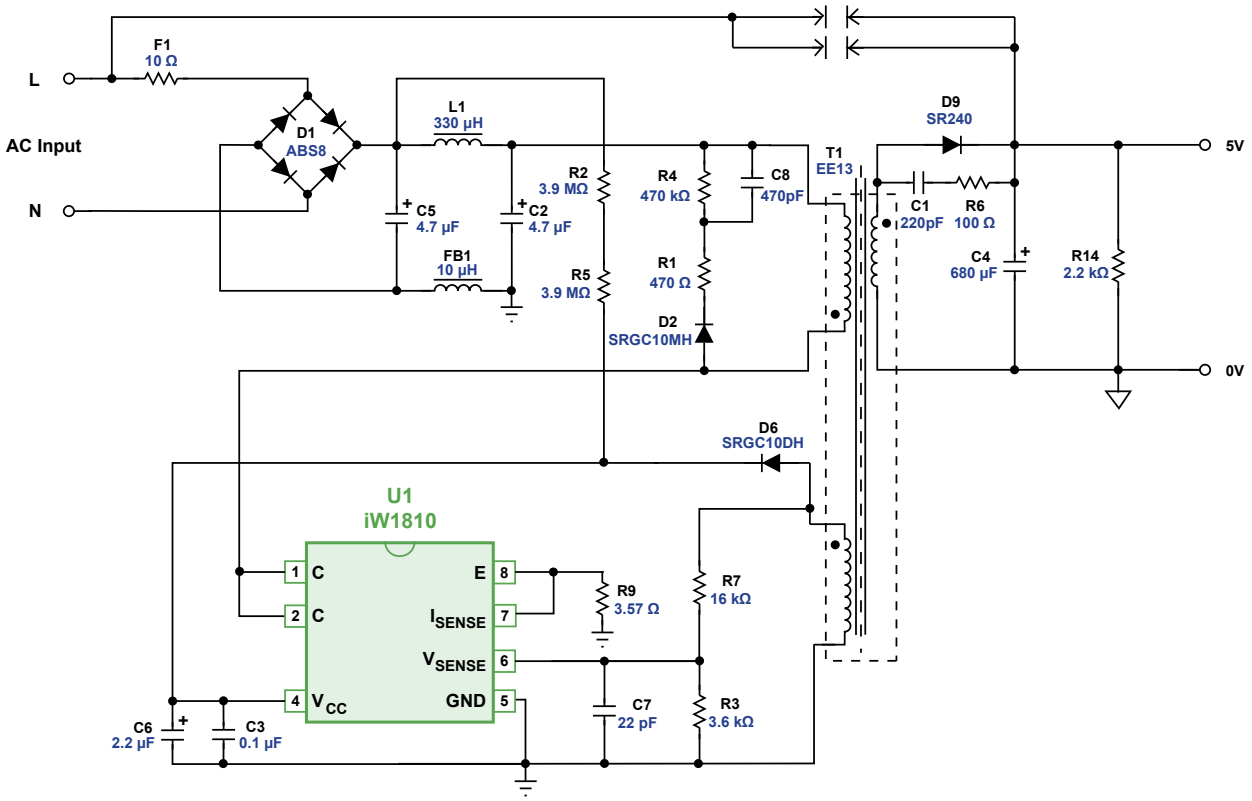
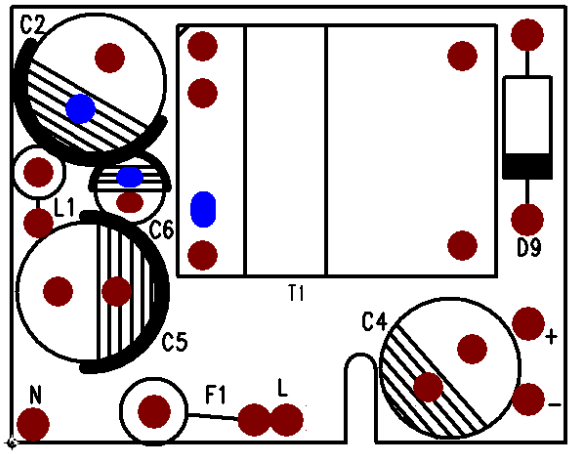
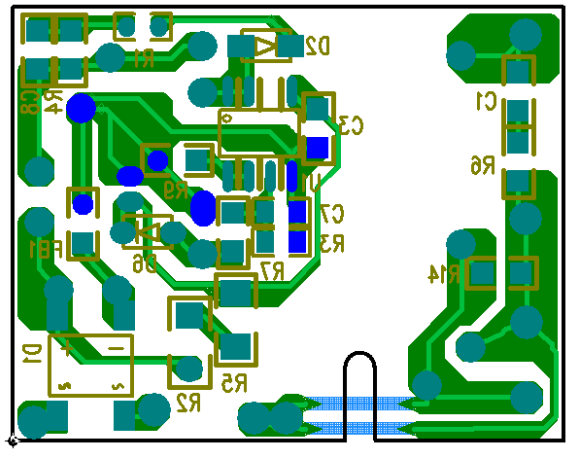


Figure 4.1 Design Schematic

5.0 PCB Layout



PCB Top



PCB Bottom

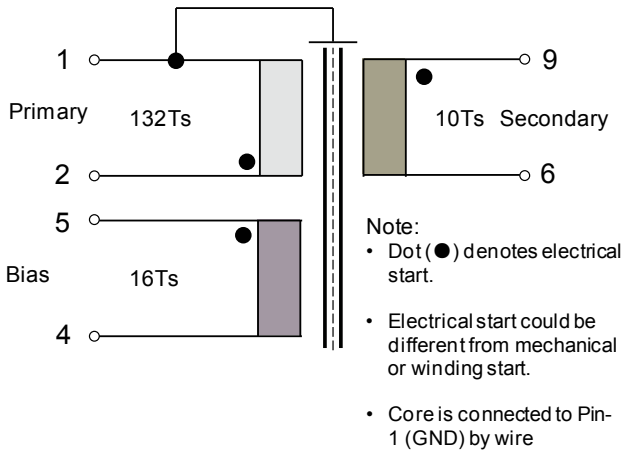
Figure 5.1 PCB Layout 33.0 mm x 26.0 mm

6.0 Bill of Materials

Item	Qty.	Ref.	Description	Manufacturer P/N	Manufacturer
1	1	U1	iW1810-00, off-line digital&primary VMS controller, SOIC-7	iW1810-00	iWatt, Inc
2	1	C1	220pF, 100V, X7R, SMD-0805	08051C221KAT2A	AVX Corporation
3	2	C2,C5	4.7μF, 400V, E-CAP, (Φ8mm×12mm)	KLH-400V4R7MF120	KOSHIN
4	1	C3	100nF, 25V, X7R, SMD-0603	C1608X7R1E104K	TDK Corporation
5	1	C4	680μF, 10V, E-CAP, low ESR, (Φ8mm×12mm)	KLH-010V681MF120	KOSHIN
6	1	C6	2.2μF, 50V, E-CAP, low ESR, (Φ5mm×11mm)	KLH-050V2R2MF110	KOSHIN
7	1	C7	22pF, NPO, 25V, SMD-0603	06033A220JAT2A	AVX Corporation
8	1	C8	470pF, 250V, X7R, SMD-0805	0805VC471KAT2A	AVX Corporation
9	1	R1	470Ω ±5%, SMD-0805	ERJ-6GEYJ471V	Panasonic - ECG
10	2	R2,R5	3.9MΩ ±5%, SMD-1206	ERJ-8GEYJ395V	Panasonic - ECG
11	1	R3	3.6KΩ ±1%, SMD-0603	ERJ-3EKF3601V	Panasonic - ECG
12	1	R4	470KΩ ±5%, SMD-0805	ERJ-6GEYJ474V	Panasonic - ECG
13	1	R6	100Ω ±5%, SMD-0805	ERJ-6GEYJ101V	Panasonic - ECG
14	1	R7	16KΩ ±1%, SMD-0805	ERJ-6ENF1602V	Panasonic - ECG
15	1	R9	3.57Ω ±1%, SMD-0805	RC0805FR-073R57L	Yageo
16	1	R14	2.2KΩ ±5%, SMD-0805	ERJ-6GEYJ222V	Panasonic - ECG
17	1	D1	1A, 800V, rectifier bridge, ABS	ABS8	Taiwan Semiconductor
18	1	D2	1A, 1000V, fast recovery rectifier, 1206-S	SRGC10MH	ZOWIE
19	1	D6	1A, 200V, fast recovery rectifier, 1206-S	SRGC10DH	ZOWIE
20	1	D9	2A, 40V, schottky diode, DO-15	SR240	Won-Top Electronics
21	1	F1	10Ω, fusible resistor, 1W	FRM1WJT-52-10R	Yageo
22	1	L1	330μH, filter inductor, 0410	8230-80-RC	Bourns Inc.
23	1	FB1	10μH, chip inductor, SMD-0805	LQM21FN100M80L	Murata Electronics
24	1	T1	EE13, vertical(Renco Electronics, RLiw-1000)		

7.0 Transformer Drawing

Schematic:



Electrical Specifications:	
1.	Primary inductance (Lp) = 2.4mH ± (8%) @10KHz
2.	Primary leakage inductance < 5% * L_P, short pin7-pin10
3.	Electrical strength = 3KV, 50/60Hz, 1min.
Materials:	
1.	Core: EE13 (ferrite material TDK PC40 or equivalent)
2.	Bobbin: EE13 vertical
3.	Magnet wires (pri): type 2-UEW
4.	Magnet wire (sec): triple insulated wires
5.	Layer insulation tape: 3M1298 or equivalent
Finished:	
1.	Varnish the complete assembly

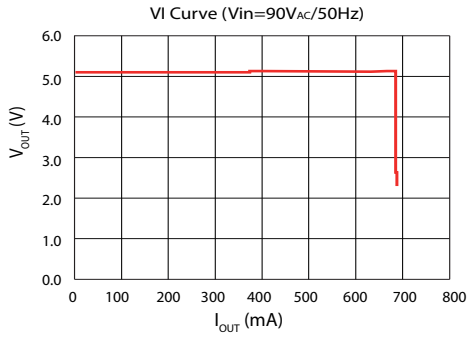
8.0 Performance

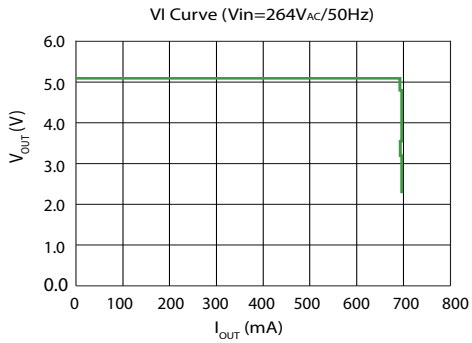
8.1 Regulation, Ripple and Efficiency Measurement

* Note: Output voltage is measured at end of PCB

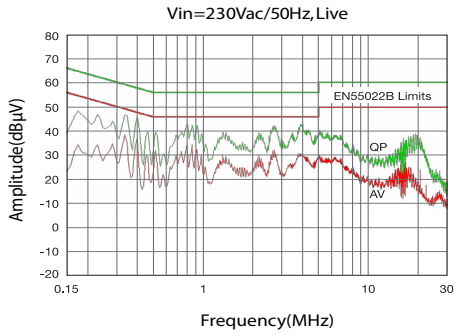
V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (mA)	V_{RIPPLE} (mV_{P-P})	P_{OUT} (W)	η (%)	OCP (mA)	Average η (%)
90	0.037	5.10	0	12			718	76.83
	1.008	5.11	150	28	0.77	76.04		
	1.969	5.12	300	36	1.54	78.01		
	2.982	5.12	450	40	2.30	77.26		
	4.049	5.13	600	52	3.08	76.02		
115	0.039	5.09	0	12			739	78.21
	1.006	5.11	150	28	0.77	76.19		
	1.952	5.12	300	40	1.54	78.69		
	2.920	5.13	450	36	2.31	79.06		
	3.908	5.14	600	40	3.08	78.92		
230	0.059	5.08	0	12			723	76.44
	1.059	5.14	150	28	0.77	72.80		
	2.014	5.12	300	44	1.54	76.27		
	2.968	5.13	450	36	2.31	77.78		
	3.908	5.14	600	40	3.08	78.92		
264	0.069	5.08	0	12			718	75.18
	1.091	5.14	150	28	0.77	70.67		
	2.042	5.12	300	40	1.54	75.22		
	3.008	5.13	450	60	2.31	76.75		
	3.949	5.14	600	40	3.08	78.10		

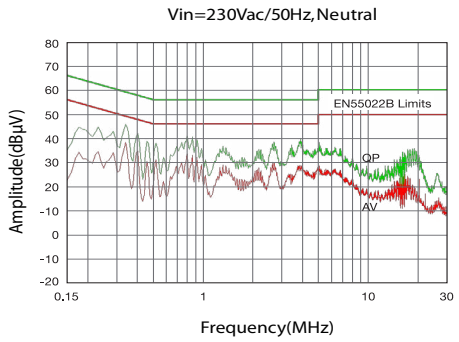
8.2 CV and CC Regulation





8.3 Conducted EMI





Trademark Information

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