

Evaluation Board for 15W Single-Output Switch-Mode Power Supply

1 Description

The iW1830-EVAL1 evaluation board implements a 15W power supply based on Dialog Semiconductor's iW1830 **AccuSwitch**™ digital off-line power supply controller IC. The evaluation board supplies a 5V, 3A regulated output voltage using a primary-side controlled quasi-resonant flyback converter that meets the U.S. Department of Energy's most recent level VI efficiency standard and the EU's Code of Conduct, Version 5, Tier 2 standard for both active mode and no-load standby power consumption.

The iW1830 controller integrates a 700V power MOSFET to lower the power supply BOM cost and uses Dialog's advanced **PrimAccurate**™ digital control technology to eliminate the need for external secondary-side feedback components, further reducing component count and cost, while improving reliability. It operates in quasi-resonant mode to improve efficiency and help meet EMI standards. This quasi-resonant operation and Dialog's **EZ-EMI**® technology enable EMI compliance with minimal external filtering. Proprietary control technology allows high efficiency across a broad range of loads, which enables the iW1830 to meet stringent international standards for power supply efficiency.



2 Features

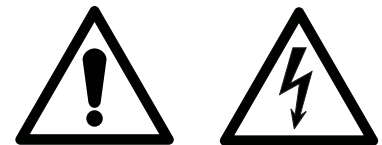
- Wide input voltage range: 90V_{AC} to 264V_{AC}
- Output voltage: 5V
- Output current: 3A
- Total output power: 15W max.
- Integrated 700V MOSFET
- Active mode efficiency > 82%
- Supports high capacitance loads up to 6,000μF
- Low no-load power: < 50mW (at 230 V_{AC})
- **EZ-EMI**® technology: excellent EMI performance with a minimum of EMI filtering components
- Quasi-resonant operation
- Low component count and small PCB footprint
- iW1830 IC protections:
 - » Output short-circuit, over-current, over-voltage
 - » Input voltage protection: brown-out, brown-in, unplug
 - » Over-temperature protection - internal sensor

3 Applications

- Power Supplies for:
 - » White Goods
 - » Home Appliances
 - » Industrial Control
 - » Network Devices

**Evaluation Board for 15W Single-Output
Switch-Mode Power Supply****WARNING****Disclaimer for High Voltage (Mains Powered) Evaluation Boards****Warning**

This evaluation board is powered by AC mains voltage. When powered, this evaluation board generates non-insulated high voltages which may produce electrical shock, burn, and/or fire hazards, resulting in risk of property damage, personal injury, and/or death.



When the evaluation board is powered, never touch the board or its electrical circuits since they may be operating at high voltages that can cause an electrical shock hazard.

TO BE USED FOR EVALUATION PURPOSES ONLY

This board is intended for evaluation purposes only and not intended for commercial use in an end product. Any other use is strictly prohibited by Dialog Semiconductor.

WORK AREA AND PERSONAL SAFETY

This board should be used in a test area/laboratory specifically designed and designated for working with, and evaluating high-voltage electrical devices. Only trained and qualified professional personnel with experience, knowledge and training in the use of high-voltage electrical circuits should use this evaluation board. Trained personnel must use required personal protective equipment and required laboratory equipment when working with the evaluation board.

The professional personnel operating this evaluation board and the test area/laboratory in which it is operated must be qualified according to the local regulations, guidelines and labor laws applicable to working with non-isolated mains voltages and high voltage circuits.

An isolated housing is highly recommended when using this evaluation board.

Use this evaluation board at your own risk.

NOT AGENCY APPROVED

This evaluation board has not been agency tested or approved for safety, technical performance, and/or regulatory requirements, such as electromagnetic interference or other technical regulatory or safety requirements.

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4 Evaluation Board Specifications

The table below shows the electrical specifications of the evaluation board specified at $T_A = 25^\circ\text{C}$, unless otherwise noted.

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 ($230V_{AC}$)				50	mW	
Output						
Output voltage	V_{OUT}	4.75	5.00	5.25	V	Measured at the end of PCB
Output current	I_{OUT}	0		3	A	
Output ripple voltage	V_{RIPPLE}			200	mV _{P-P}	Connected with 10 μ F E-cap and 100nF C-cap; $I_{OUT} = 3A @ T_A = 25^\circ\text{C}$ 20MHz Bandwidth
Total Output Power						
Continuous output power	P_{OUT}		15		W	
Over current protection	OCP			3.6	A	Auto-restart
Active mode efficiency	η	82.2			%	Average of efficiency measured at 25%/50%/75%/100% $V_{IN} = 115V_{AC}$
Environmental						
Safety (Note 1) (Note 2)	Designed to Meet UL1310 (up to $120V_{AC}$) Designed to Meet EN60335-1:2012					
Ambient temperature	T_{AMB}	0		40	$^\circ\text{C}$	Free convection, sea level

Note 1: The iW1830-EVAL1 has been designed to meet UL1310 (up to $120V_{AC}$) with the exception of the common mode choke L4 (see Note 2) and EN60335-1:2012, however individual boards have not been tested or verified to these standards.

Note 2: The iW1830-EVAL1 uses a common mode choke which is intended for 5V/3A designs that are used as part of circuits in white goods. Alternative UL-1310 compliant parts should be used if this design is used for a standalone 5V/3A power unit.

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5 Schematic

The schematic shown in Figure 5.1 is the complete schematic for the evaluation board. The specific part numbers can be found in the Bill-of-Materials in section 6.

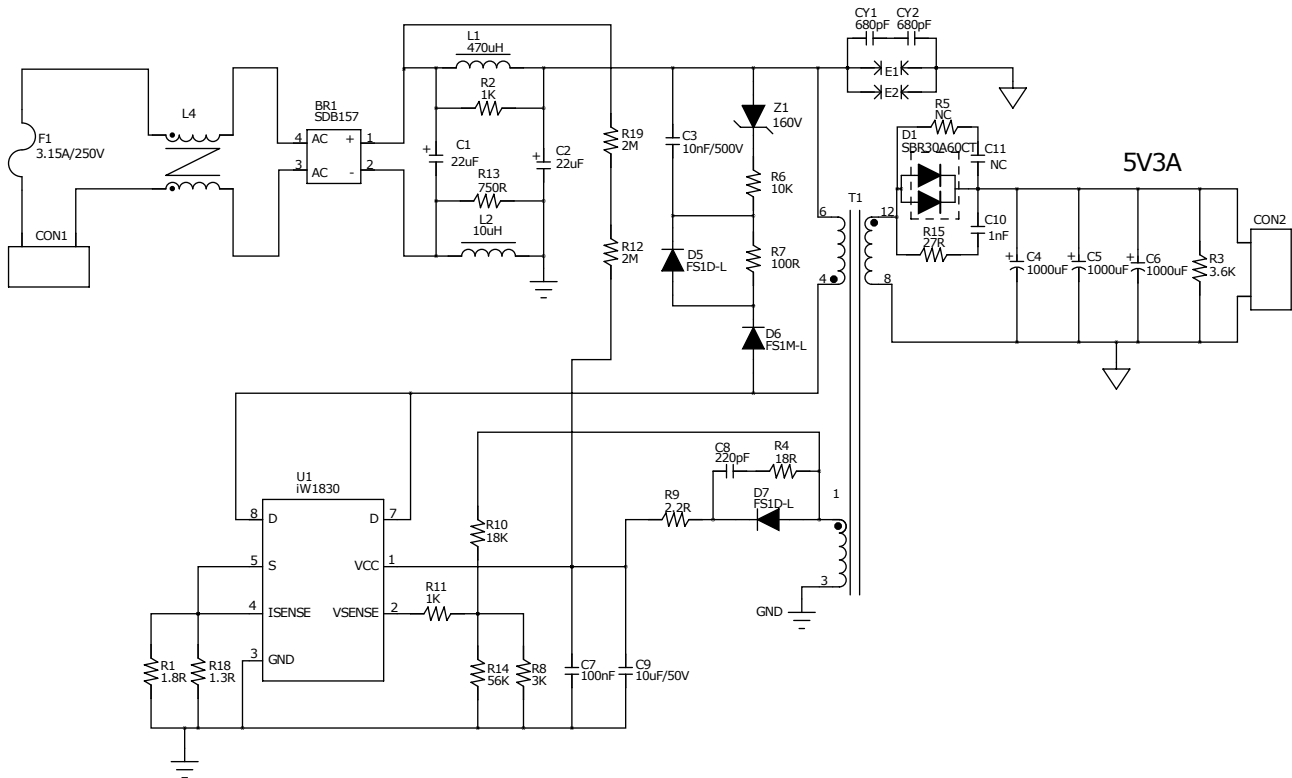


Figure 5.1 : Complete Evaluation Board Schematic for the iW1830-EVAL1 Board.

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6 Bill of Materials

Table 1: Bill-of-Materials List for EVB iW1830-EVAL1

Item	Qty.	Ref.	Description	Footprint	Mfg. Part Number	Manufacturer
1	1	U1	iW1830, Off-line digital PWM Controller with 4A/700V MOS co-packed, DIP 7	DIP-7	iW1830-00	Dialog Semiconductor
2	1	BR1	SDB157, 1000V, 1.5A, Bridge rectifier	SDB-1	SDB157-TP	Micro Commercial Components Corp.
3	2	C1, C2	22uF, 400V, Φ 12.5X20, E-CAP	CE12.5x20	EKXG401ELL220MK20S	Nippon Chemi-Con
4	1	C3	10nF, 500V, X7R, SMD-1206	CS1206	CC1206KKX7RBBB103	YAGEO Corporation
5	3	C4, C5, C6	1000uF, 10V, Φ 8X20, E-CAP	CE8X20	UPA1A102MPD1TD	Nichicon
7	1	C7	100nF, 50V, X7R, SMD-0805	CS0805	CC0805KRX7R9BB104	YAGEO Corporation
8	1	C8	220pF, 100V, X7R, SMD-0805	CS0806	CC0805KRX7R0BB221	YAGEO Corporation
9	1	C9	10uF, 50V, X5R, SMD-1206	CS1206	GRM32ER71H106KA12L	Murata Electronics
10	1	C10	1nF, 100V, X7R, SMD-0805	CS0805	CC0805KRX7R0BB102	YAGEO Corporation
11	1	C11	NA			
12	2	CY1, CY2	680pF, 250V, X1, Y1-cap	Radial, Disc	DE1B3KX681KN4AN01F	Murata Electronics
13	1	D1	SBR30A60CT, 30A, 60V	TO-220AB	SBR30A60CT	Diodes Incorporated
14	2	D5, D7	FS1D-L, 1A200V, Fast Recovery Rectifier (Trr=150ns)	DO-214AC	FS1D-LTP	Micro Commercial Components Corp.
15	1	D6	FS1M-L, 1A1000V, Fast Recovery Rectifier (Trr=500ns)	DO-214AC	FS1M-LTP	Micro Commercial Components Corp.
16	1	Z1	CMZ5954B, 160V, 1.5W, ZENER Diode, SMA	SMA	CMZ5954B	Central Semiconductor Corp.
17	1	F1	3.15A, 250V, Fuse, Φ 3.6X10mm	Axial-3.6x10	08743.15MXEP	Littelfuse Inc.
18	1	L1	470uH, 126mA, Color Ring Inductor, 0410	Axial-04x10	77F471J-RC	Bourns Inc.
19	1	L2	10uH, Chip Inductor (Chip Coil)	LS0805	LQM21FN100M80L	Murata Electronics
20	1	L4	CM Inductor, WE-CMB NiZn Common Mode Power Line Choke (Note 1)	LD4.5X10	744 841 330	Würth Elektronik
21	1	R1	1.8 Ω ±1%, SMD-1206	RS1206	RC1206FR-071R8L	YAGEO Corporation
22	1	R2	1K±5%, SMD-0805	RS0805	RC0805JR-071KL	YAGEO Corporation
23	1	R3	3.6K Ω ±5%, SMD-0805	RS0805	RC0805JR-073K6L	YAGEO Corporation
24	1	R4	18 Ω ±5%, SMD-0805	RS0805	RC0805JR-0718RL	YAGEO Corporation
25	1	R5	NA			
26	1	R6	10K Ω ±5%, SMD-1206	RS1206	RC1206JR-0710KL	YAGEO Corporation
27	1	R7	100 Ω ±5%, SMD-1206	RS1206	RC1206JR-07100RL	YAGEO Corporation
28	1	R8	3K Ω ±1%, SMD-0603	RS0603	RC0603FR-073KL	YAGEO Corporation
29	1	R9	2.2 Ω ±5%, SMD-0603	RS0603	RC0603JR-072R2L	YAGEO Corporation
30	1	R10	18K Ω ±1%, SMD-0603	RS0603	RC0603FR-0718KL	YAGEO Corporation
31	1	R11	1K Ω ±5%, SMD-0603	RS0603	RC0603JR-071KL	YAGEO Corporation
32	2	R12, R19	2M Ω ±5%, SMD-1206	RS1206	RC1206JR-072ML	YAGEO Corporation
33	1	R13	750 Ω ±5%, SMD-0805	RS0805	RC0805JR-07750RL	YAGEO Corporation
34	1	R14	56K Ω ±1%, SMD-0603	RS0603	RC0603FR-0756KL	YAGEO Corporation
35	1	R15	27 Ω ±5%, SMD-1206	RS1206	RC1206JR-0727RL	YAGEO Corporation
36	1	R18	1.3 Ω ±1%, SMD-1206	RS1206	RC1206FR-071R3L	YAGEO Corporation
37	1	CON1	Serie 2169 - 7.50mm Horizontal Entry Modular with Rising Cage Clamp - 3.5mm ² Wires WR-TBL		691 216 910 002	Würth Elektronik
38	1	CON2	WR-TBL Terminal block-serie 101, 5.00mm - Modular-blue-Horizontal entry with pressure clamp - 12.6mm		691 101 710 002	Würth Elektronik
39	1	T1	EE20/10/6 (EF20), 14-Pin EXT, THT, Horizontal for 5V3A		750 343 109	Würth Elektronik
40	4	Supporter	Self-Retaining Spacer WA-SNSR, Nylon 66, natural		702 917 000	Würth Elektronik
41	1	HeatSink	HeatSink for D1, Thermal resistance 36K/W		V5629W32	ASSMANN WSW COMPONENTS

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Item	Qty.	Ref.	Description	Footprint	Mfg. Part Number	Manufacturer
42	1	Thermal Grease	HEAT SINK GREASE SILICONE FREE for Heatsink and D1		CW7270	Chemtronics
43	1	Screw set	Machine screw pan phillips M3 for heatsink and D1		MPMS 003 0008 PH	B&F Fastener Supply
44	1	Screw set	Washer flat M3 steel for heatsink and D1		MFWZ 003	B&F Fastener Supply
45	1	Screw set	Washer split lock M3 steel for heatsink and D1		MLWZ 003	B&F Fastener Supply

Note 1: The iW1830-EVAL1 evaluation board uses a common mode choke which is intended for 5V/3A designs that are used as part of circuits in white goods. Alternative UL-1310 compliant parts should be used if this design is used for a standalone 5V/3A power unit.

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Disclaimer

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The user, and/or user's employer, if user is using this evaluation board for employer-related purposes, understands that this evaluation board has not been agency tested or approved for safety, technical performance, and/or regulatory requirements, by any agency. This includes electromagnetic interference or other technical regulatory or safety testing and certifications.

The user, and/or user's employer, if user is using this evaluation board for employer-related purposes, assumes all responsibility for using this evaluation board in a test area or laboratory which is qualified and/or certified according to the local regulations, guidelines and labor laws applicable to working with non-isolated mains voltages and high voltage circuits.

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