Evaluation Board User Guide

EVAL-ADPL54203-AZ

Micropower No-Opto Isolated Flyback Converter

General Description

The evaluation circuit EVAL-ADPL54203-AZ is a micropower no-opto isolated flyback converter featuring the ADPL54203. This demo circuit outputs 5V and maintains tight regulation with a load current from 10mA to 2.2A over an input voltage from 10V to 28V. The output current capability increases with the input voltage. The ADPL54203 typically needs less than 0.5% of its full output power as a minimum load to maintain good output voltage regulation. On the EVAL-ADPL54203-AZ, to avoid pre-loading, a 5.6V Zener diode is placed between its V_{OUT}+ and V_{OUT}– to serve as a minimum load. Transformer leakage inductance causes a voltage spike on the primary side after the power switch turns off. To limit this leakage inductance spike within MOSFET voltage rating of 60V, an RC snubber and a TVS clamp are installed to damp the ringing and clamp the MOSFET drain voltage to a safe level.

The Performance Summary table summarizes the performance of the demo board at room temperature. The demo circuit can be easily modified for different applications with some predesigned transformers.

The ADPL54203 is a simple to use monolithic micropower isolated flyback converter. By sampling the isolated output voltage directly from the primary-side flyback waveform, the part requires no third winding or opto-isolator for regulation. The output voltage is programmed with two external resistors and a third optional temperature compensation resistor. By integrating the loop compensation and soft-start inside, the part reduces the number of external components. Boundary mode operation provides a small magnetic solution with excellent load regulation. Low ripple Burst Mode® operation maintains high efficiency at light load while minimizing the output voltage ripple. A 3.4A, 60V DMOS power switch is integrated along with all the high voltage circuitry and control logic into a thermally enhanced 8-lead SO package.

The ADPL54203 data sheet gives a complete description of the part, operation and application information and must be consulted with this quick start guide for evaluation circuit EVAL-ADPL54203-AZ.

Design files for this circuit board are available at *Product Evaluation Boards and Kits | Design Center | Analog Devices*.

Performance Summary (T_A = 25°C)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage		10	24	28	V
Output Voltage	V_{IN} = 10V – 28V I_{OUT} = 10mA – 2.2A	4.75	5	5.25	V
Maximum Output Current	V_{IN} > 15V	2.2			A
Output Voltage Ripple (Peak-to-Peak)	V_{IN} = 10V – 28V, I_{OUT} = 2.2A			100	mV
Typical Switching Frequency	V_{IN} = 24V, I_{OUT} = 2.2A		345		kHz
Minimum Switching Frequency	I_{OUT} = 0mA		12		kHz
Efficiency	V_{IN} = 10V, I_{OUT} = 2.2A		80		%
Efficiency	V_{IN} = 24V, I_{OUT} = 2.2A		84		%

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Quick Start Procedure

The evaluation circuit EVAL-ADPL54203-AZ is easy to setup to evaluate the performance of the ADPL54203. For proper measurement equipment setup, see *Figure 1* and do the following procedures:

1. With power off, connect the input power supply to the board through V_{IN} (TP1) and GND (TP2) terminals. Connect the load to the terminals V_{OUT}+ (TP3) and V_{OUT}– (TP4) on the board.
2. Turn on the power at the input. Increase V_{IN} slowly to 10V.

   NOTE: Make sure that the input voltage is always within spec. To operate the board with higher input/output voltage, input/output capacitor, and output diode with higher voltage ratings are needed.
3. Check for the proper output voltages. The output should be regulated at 5.0V (±5%).

   NOTE: The EVAL-ADPL54203-AZ requires very small minimum load to maintain good output voltage regulation. A Zener diode is placed on the output to clamp the voltage to 5.6V. This Zener diode can be replaced with a 560Ω resistor at the trade-off of lower efficiency.
4. Once the proper output voltage is established, adjust the input voltage and load current within the operating range and observe the output voltage regulation, ripple voltage, efficiency, and other parameters.

   NOTE: When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the V_{IN} (TP1) and GND (TP2), or V_{OUT}+ (TP3) and V_{OUT}– (TP4) terminals.

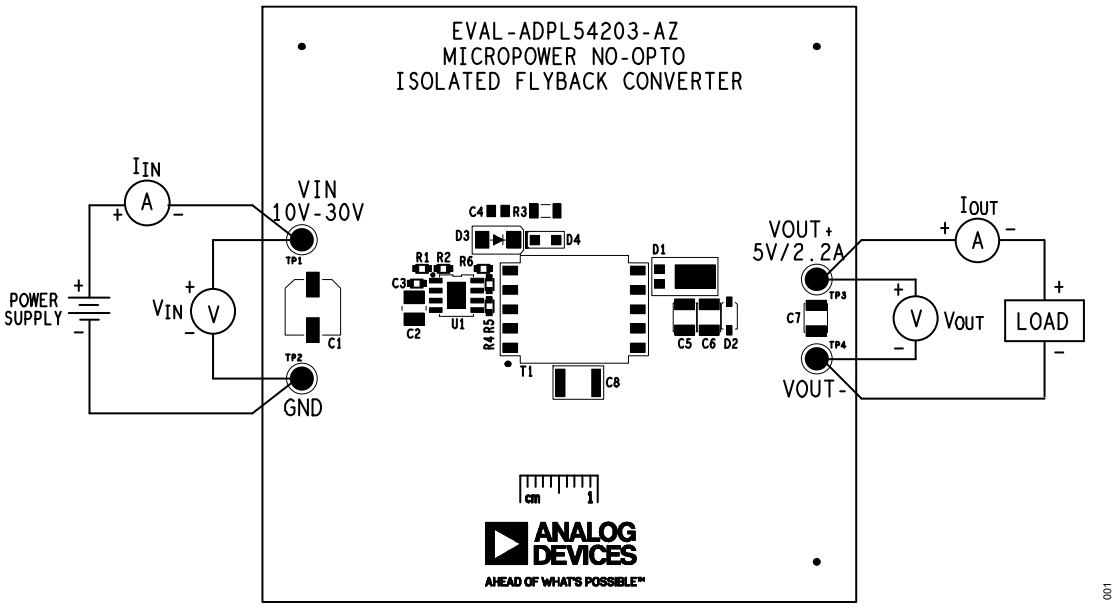

Figure 1. EVAL-ADPL54023-AZ Board Connections

Performance

(T_A = +25°C unless otherwise noted.)

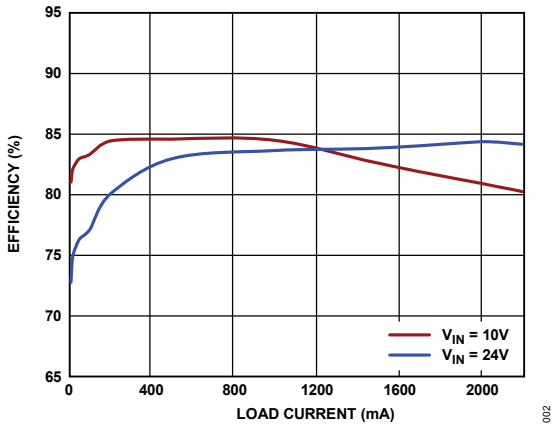

Figure 2. Efficiency vs. Load Current

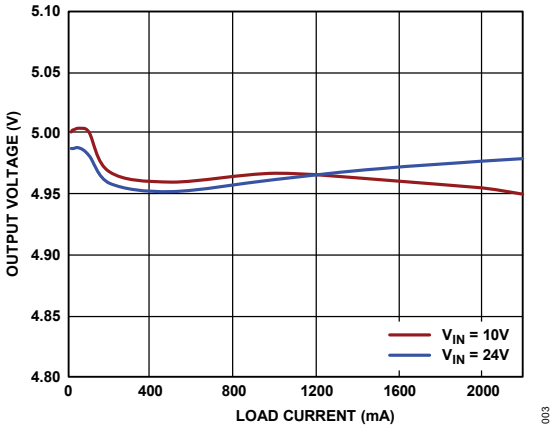

Figure 3. Output Voltage vs. Load Current

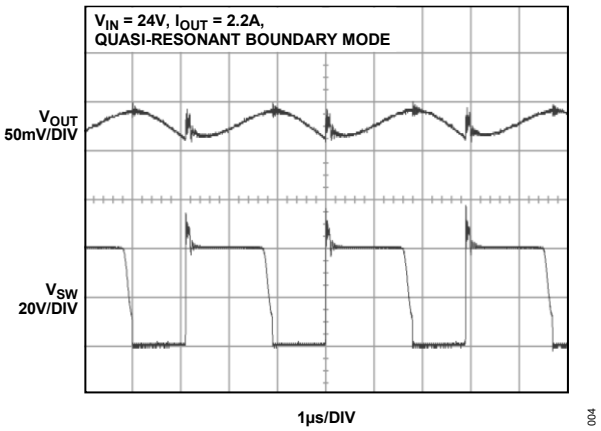

Figure 4. Steady-State Switching Waveform

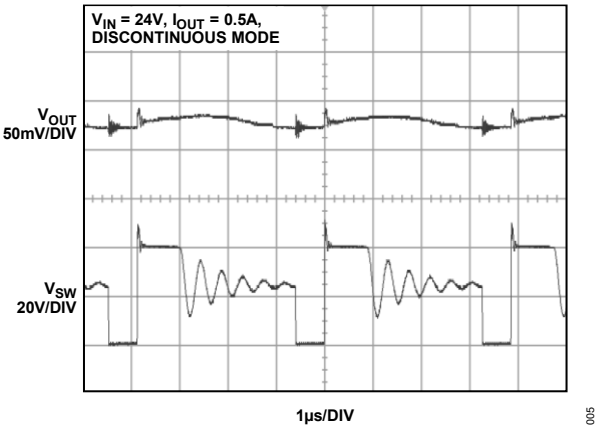

Figure 5. Steady-State Switching Waveform

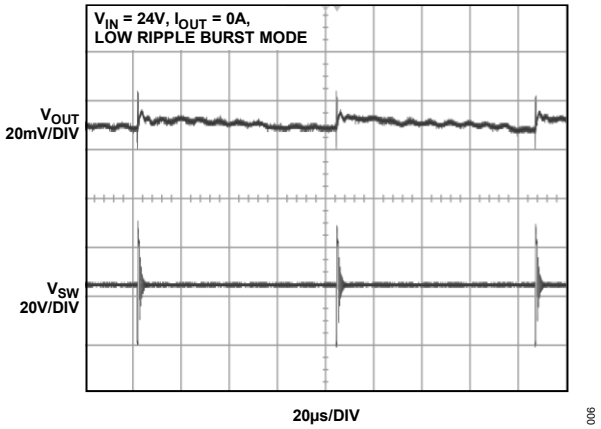

Figure 6. Steady-State Switching Waveform

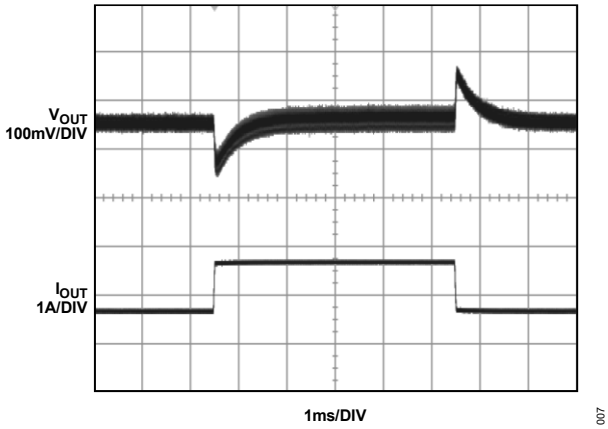

Figure 7. Load Transient Response (V_{IN} = 24V, I_{OUT} = 1A – 2A)

Bill of Materials

ITEM	QTY	DESIGNATOR	DESCRIPTION	MANUFACTURER, PART NUMBER
REQUIRED CIRCUIT COMPONENTS				
1	1	C1	Aluminum Electrolytic Capacitor, 22µF, 50V, 20%, 6.3mm × 5.8mm, 0.165A, 2000h, AEC-Q200	Panasonic, EEEFK1H220P
2	1	C2	Ceramic Capacitor, 10µF, 50V, 10%, X7R, 1210	Murata, GRM32ER71H106KA12L
3	1	C3	Ceramic Capacitor, 1µF, 25V, 10%, X5R, 0603	AVX Corporation, 06033D105KAT2A
4	1	C4	Ceramic Capacitor, 220pF, 50V, 5%, C0G, 0805	Yageo, CC0805JRNPO9BN221
5	3	C5, C6, C7	Ceramic Capacitors, 100µF, 10V, 20%, X5R, 1210	Samsung, CL32A107MPVNNNE
6	1	C8	Ceramic Capacitor, 4700pF, 250V, 10%, X7R, 1812	Murata, GA343DR7GD472KW01L
7	1	D1	Diode, Low Forward Voltage (V_F), Schottky Barrier Rectifier	Diodes Incorporated, PDS1040L
8	1	D2	Silicon Zener Diode	Central Semiconductor, CMHZ5232B TR
9	1	D3	Voltage Suppressor Diode	Diodes Incorporated, SMAJ18A-13-F
10	1	D4	Schottky Rectifier Diode, 1A	Central Semiconductor, CMMSH1-100G TR
11	1	R1	Resistor, SMD, 1MΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic, ERJ-3EKF1004V
12	1	R2	Resistor, SMD, 200kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic, ERJ-3EKF2003V
13	1	R3	Resistor, SMD, 100Ω, 1%, 1/4W, 1206	Yageo, RC1206FR-07100RL
14	1	R4	Resistor, SMD 150kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic, ERJ-3EKF1503V
15	1	R5	Resistor, SMD, 113kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic, ERJ-3EKF1133V
16	1	R6	Resistor, SMD, 10kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic, ERJ-3EKF1002V
17	1	T1	Switching Flyback Transformer	Wurth Elektronik, 750311564
18	1	U1	IC-ADI Micropower No-Opto Isolated Flyback Converter	Analog Devices Inc., *ADPL54203ES8E#PBF*
HARDWARE – FOR DEMO BOARD ONLY				
1	4	TP1, TP2, TP3, TP4	PCB-Connectors, Solder Terminal Test Point Turret, Mounting Hole Diameter 0.094", PCB Thickness 0.062"	Mill-Max, 2501-2-00-80-00-00-07-0

Evaluation Board Schematic

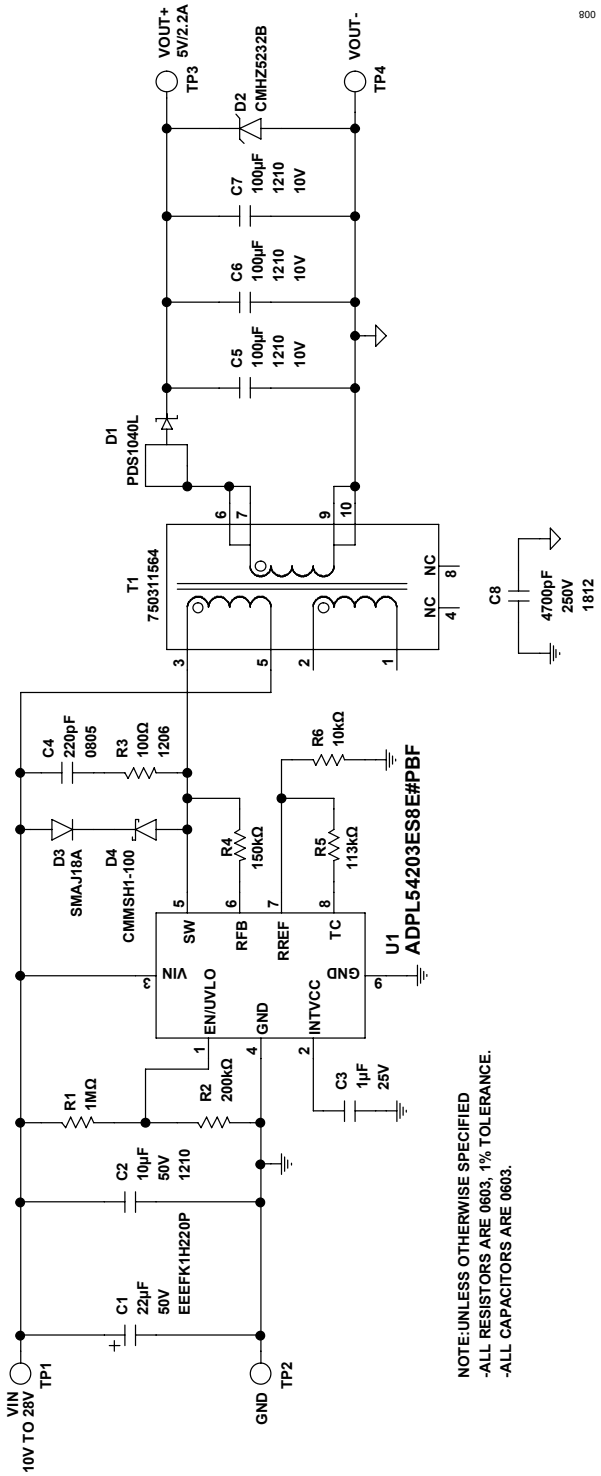

Figure 8. EVAL-ADPL54203-AZ Evaluation Board Schematic

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/23	Initial Release	—