AUTOMOTIVE-COMPLIANT, 5.5V INPUT, 600mA LOW IQ SYNCHRONOUS BUCK CONVERTER

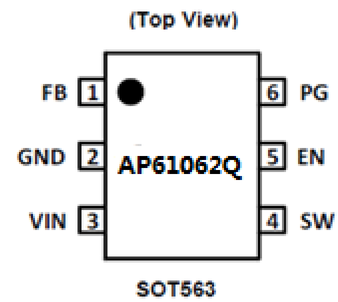
DESCRIPTION

The AP61062Q is a 600mA, synchronous buck converter with an input voltage range of 2.3V to 5.5V and fully integrates a 120mΩ high-side power MOSFET and a 80mΩ low-side power MOSFET to provide high-efficiency step-down DC/DC conversion.

The AP61062Q device is easily used by minimizing the external component count due to its adoption of constant on-time (COT) control to achieve fast transient responses, ease loop stabilization, and low output voltage ripple. Moreover, AP61062Q also features force PWM mode control through EN pin.

The device is available in a SOT563 package.

PIN ASSIGNMENTS



FEATURES

- Input Range: 2.3V to 5.5V
- Wide Output Voltage Range: 0.6V to 5.5V
- 600mA Continuous Output Current
- 0.6V ± 2% Reference Voltage
- 14µA Ultralow Quiescent Current (Pulse Frequency Modulation)
- 2.2MHz Switching Frequency
- Programmable Modulation Mode Through EN
  - PFM (Vin –VEN < 200mV)
  - PWM Regardless of Output Load (Vin –VEN > 200mV)
- Protection Circuitry
  - Undervoltage Lockout (UVLO)
  - VIN Overvoltage Protection (OVP)
  - Peak Current Limit
  - Valley Current Limit
  - Thermal Shutdown

APPLICATIONS

- 5V input distributed power bus supplies
- White goods and small home appliances
- FPGA, DSP, and ASIC supplies
- Network video cameras
- Wireless routers
- Consumer electronics
- General-purpose point of load

FUNCTIONAL BLOCK

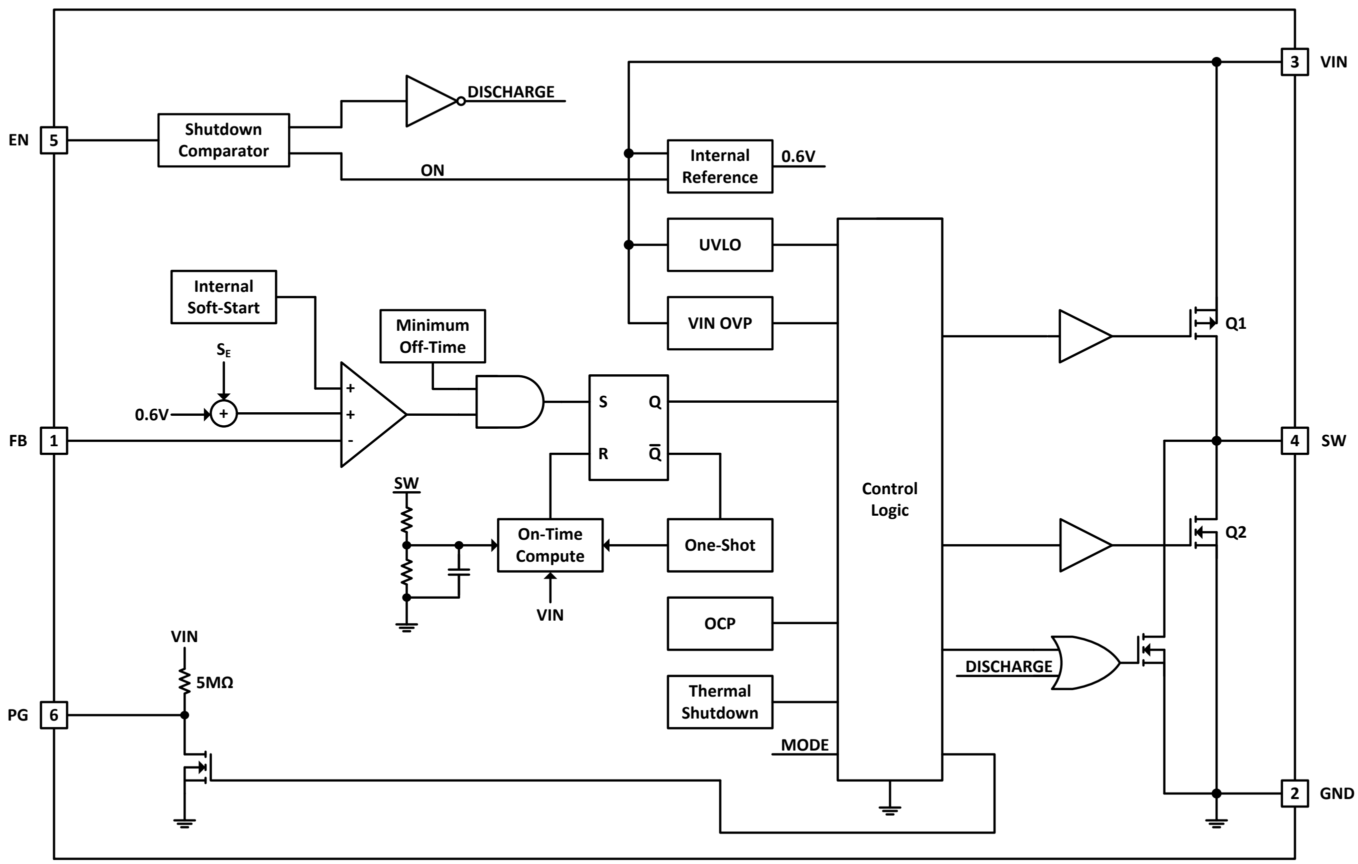


Figure 1. Functional Block Diagram

ABSOLUTE MAXIMUM RATINGS (Note 4) (@ T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Rating	Unit
VIN	Supply Pin Voltage	-0.3 to +6.5 (DC)	V
		-0.3 to +7.0 (400ms)	
VFB	Feedback Pin Voltage	-0.3 to VIN + 0.3	V
VSW	Switch Pin Voltage	-1.0 to VIN + 0.3 (DC)	V
		-3 to VIN + 2.0 (20ns)	
VEN	Enable Pin Voltage	-0.3 to VIN + 0.3	V
TST	Storage Temperature	-65 to +150	°C
TJ	Junction Temperature	+160	°C
TL	Lead Temperature	+260	°C
ESD Susceptibility (Note 5)			
HBM	Human Body Model	6000	V
CDM	Charged Device Model	1500	V

Notes: 4. Stresses greater than the **Absolute Maximum Ratings** specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.
5. Semiconductor devices are ESD sensitive and may be damaged by exposure to ESD events. Suitable ESD precautions should be taken when handling and transporting these devices.

RECOMMENDED OPERATING CONDITIONS (@ T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
VIN	Supply Voltage	2.3	5.5	V
VOUT	Output Voltage	0.6	5.5	V
T_A	Operating Ambient Temperature Range	-40	+125	°C
T_J	Operating Junction Temperature Range	-40	+150	°C

QUICK START GUIDE

The AP61062QZ6-EVM has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP61062QZ6, follow the procedure below:

1. For evaluation board configured at V_{OUT}=1.8V, connect a power supply to the input terminals VIN and GND. Set VIN to 5V.
2. Connect the positive terminal of the electronic load to VOUT and negative terminal to GND.
3. For Enable, place a jumper to “H” position to enable IC. Jump to “L” position to disable IC.
3. The evaluation board should now power up with a 1.8V output voltage.
4. Check for the proper output voltage of 1.8V (±1%) at the output terminals VOUT and GND. Measurement can also be done with a multimeter with the positive and negative leads between VOUT and GND.
5. Set the load to 600mA through the electronic load. Check for the stable operation of the SW signal on the oscilloscope. Measure the switching frequency.

MEASUREMENT/PERFORMANCE GUIDELINES

1) When measuring the output voltage ripple, maintain the shortest possible ground lengths on the oscilloscope probe. Long ground leads can erroneously inject high frequency noise into the measured ripple.
2) For efficiency measurements, connect an ammeter in series with the input supply to measure the input current. Connect an electronic load to the output for output current. Test the input capacitor voltage and output capacitor voltage with a multimeter as input voltage and output voltage.

SETTING THE OUTPUT VOLTAGE OF AP61062Q

Setting the output voltage

The AP61062Q features external programmable output voltage by using a resistor divider network R1 and R2 as shown in the typical application circuit. The output voltage is calculated as below,

$$V_{OUT} = 0.6 \times \left(\frac{R_1 + R_2}{R_2} \right)$$

First, select a value for R2 according to the value recommended in the table 1. Then, R2 is determined. The output voltage is given by Table 1 for reference. For accurate output voltage, 1% tolerance is required.

Table 1. Resistor selection for output voltage setting

AP61062Q						
Output Voltage (V)	**R1 (kΩ)**	**R2 (kΩ)**	**L (µH)**	**C1 (µF)**	**C2 (µF)**	**C3 (pF)**
1.0	200.0	301.0	1.0	10	10	33
1.2	200.0	200.0	1.0	10	10	33
1.5	200.0	133.0	1.0	10	10	33
1.8	200.0	100.0	1.0	10	10	33
2.5	200.0	63.2	1.0	10	10	33
3.3	200.0	44.2	1.0	10	10	33

EXTERNAL COMPONENT SELECTION:

Inductor (L)

(1) Low DCR for good efficiency

(2) Inductance saturate current must be higher than 2.5A

1.0µH inductor (WURTH ELEC744316100) is recommended for all application circuit.

EVALUATION BOARD SCHEMATIC

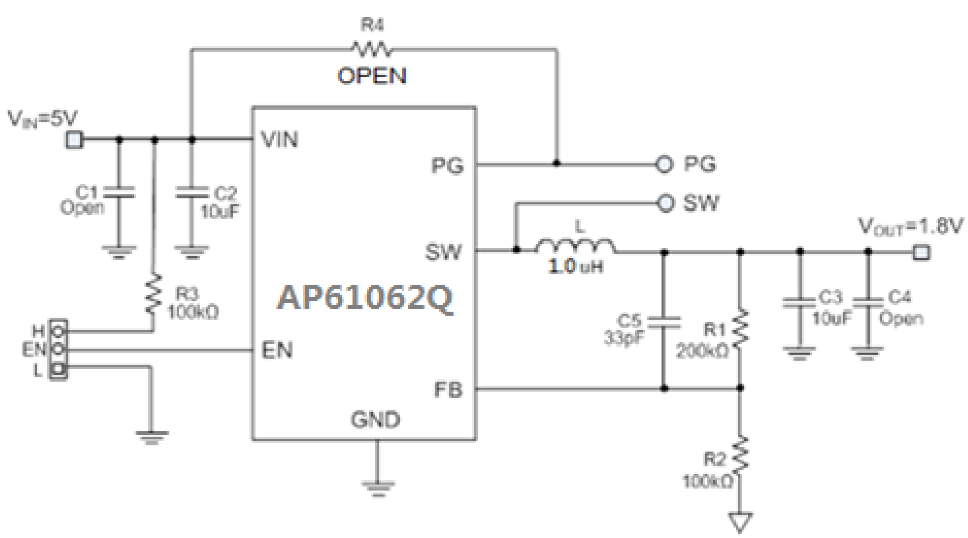


Figure 2. Typical Application Circuit

PCB TOP LAYOUT

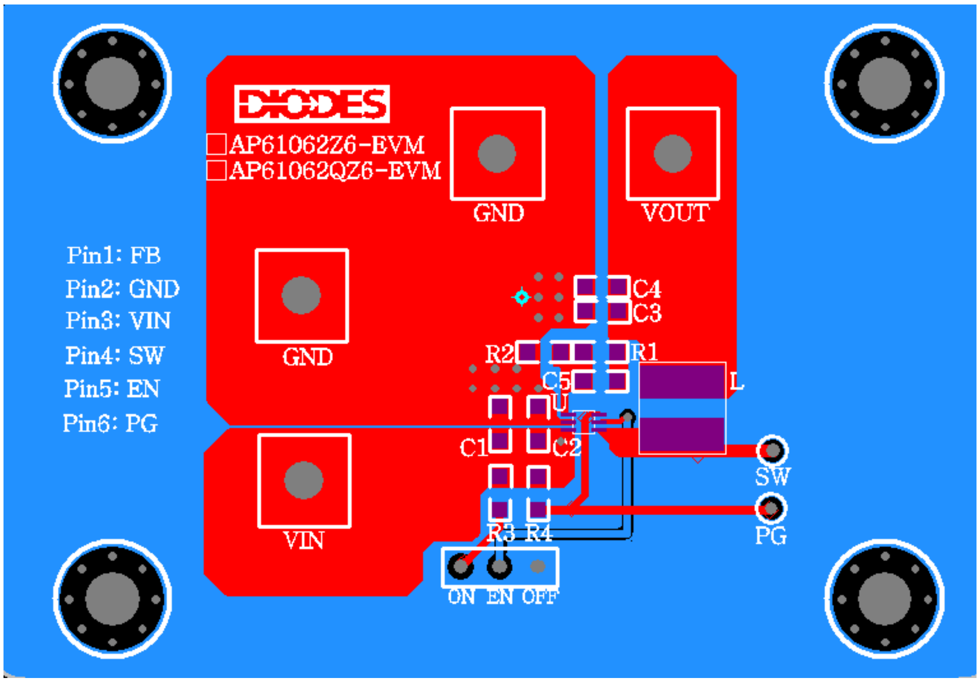


Figure 3. AP61062QZ6 - EVM - Top Layer

PCB BOTTOM LAYOUT

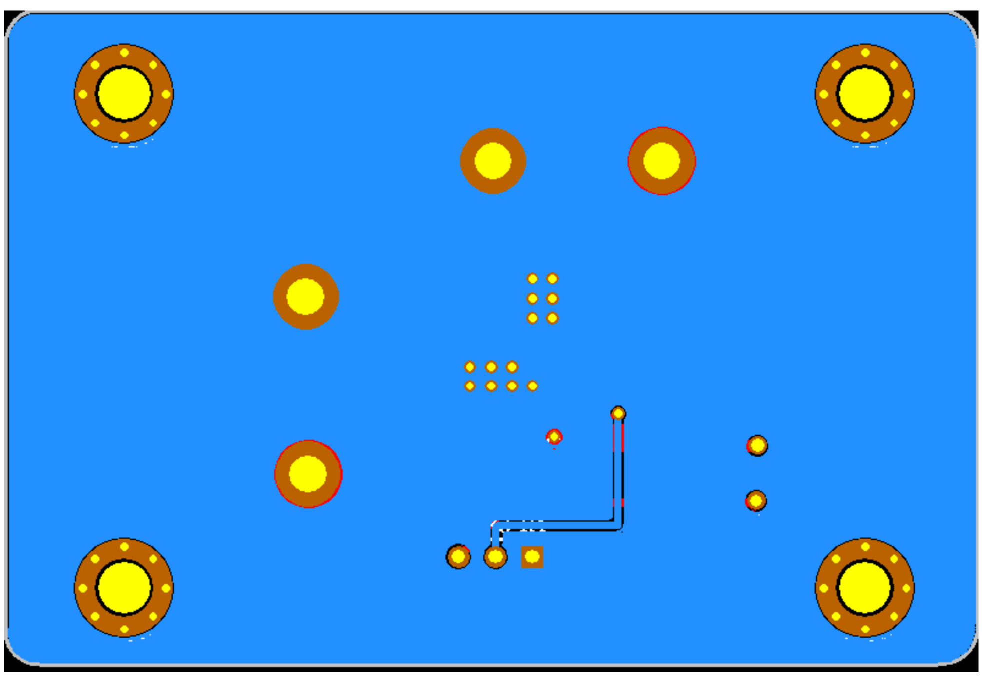


Figure 4. AP61062QZ6 - EVM - Bottom Layer

EV BOARD VIEW

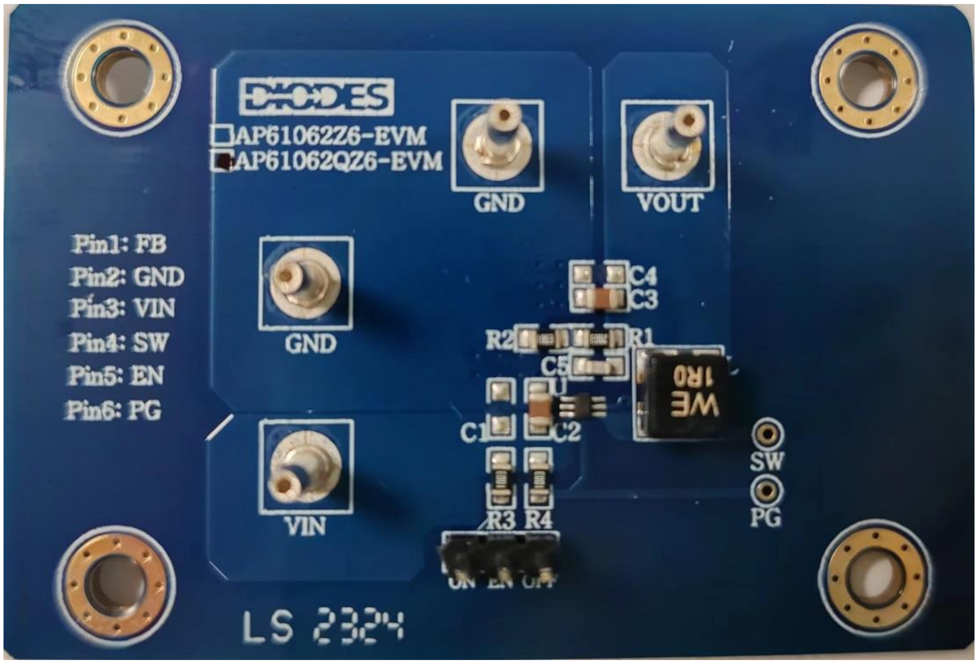


Figure 5. AP61062QZ6 EV Board View

BILL OF MATERIALS for AP61062QZ6-EVM (V_{OUT}=1.8V)

Item	Value	Type	Rating	Description	Manufacturer PN
C2	10uF	X8L, Ceramic/0805	10V	Input CAP	C2012X8L600mA106K125AC
C3	10uF	X8L, Ceramic/0805	10V	Output CAP	C2012X8L600mA106K125AC
C5	33pF	NP0, Ceramic/0603	100V	Feedforward CAP	C1608NP02A330J080AA
L	1.0uH	SMD	>5A	Inductor	WURTH ELEC 744316100
R1	200K	1%，0805	1%	Voltage set RES	-
R2	100K	1%，0805	1%		
R3	100K	1%，0805	1%	Enable RES	
R4	100K	1%，0805	1%	Power Good RES	
U1	-	AP61062QZ6	-	SOT563	Diodes BCD

TYPICAL PERFORMANCE CHARACTERISTICS

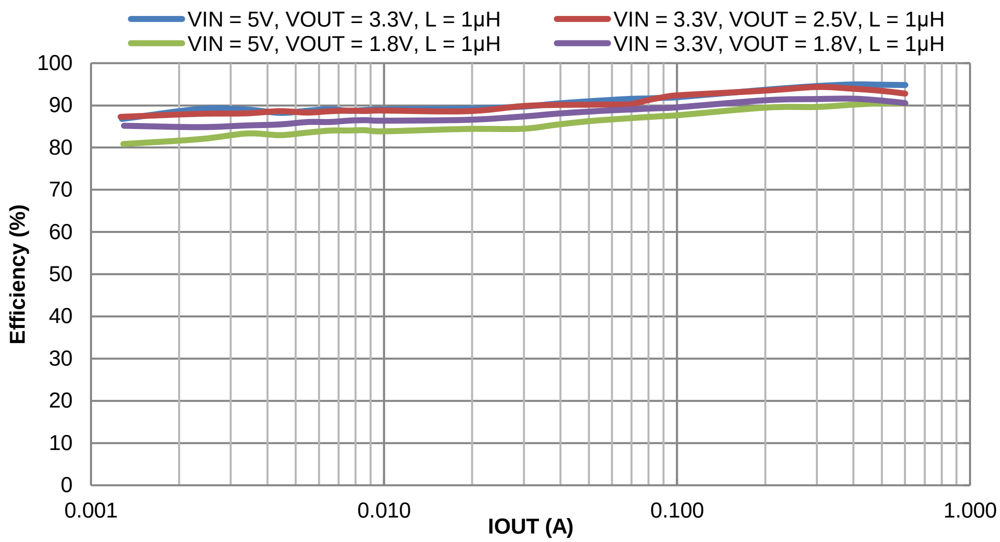


Figure 6. PFM Efficiency vs. Output Current

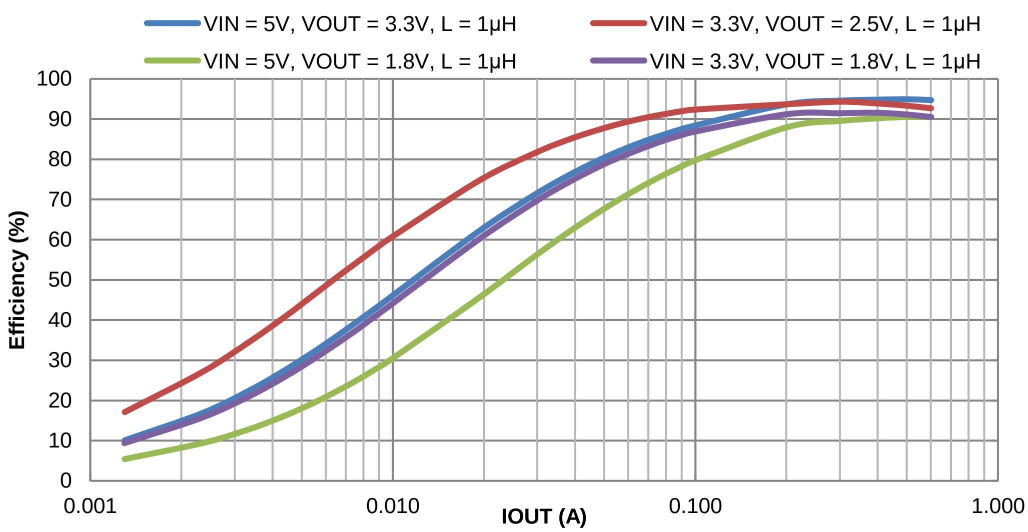


Figure 7. PWM Efficiency vs. Output Current

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

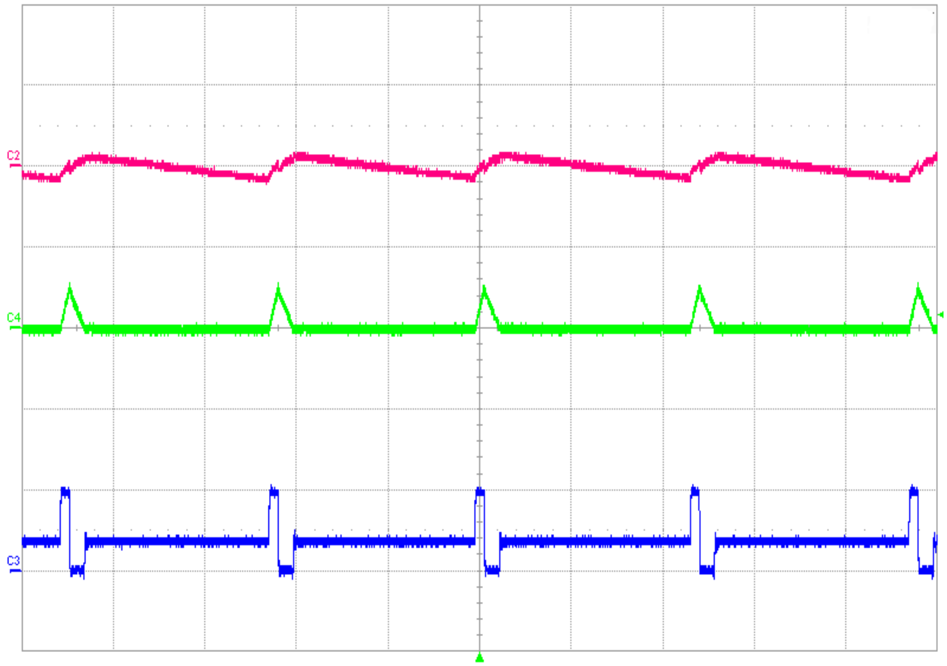


Figure 8. Output Voltage Ripple, IOUT = 30mA

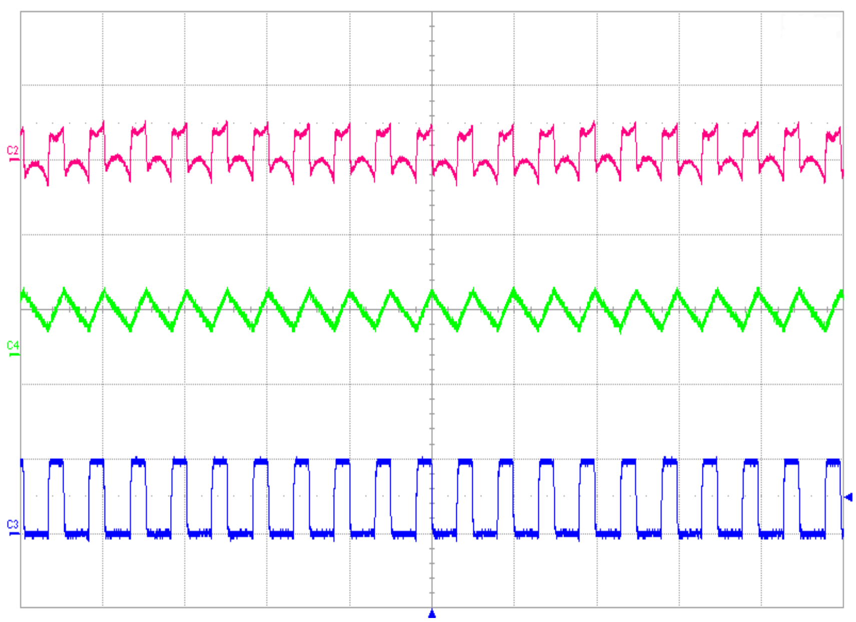


Figure 9. Output Voltage Ripple, IOUT =600mA

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