

### Description

The AP61102 is a 1A, 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.

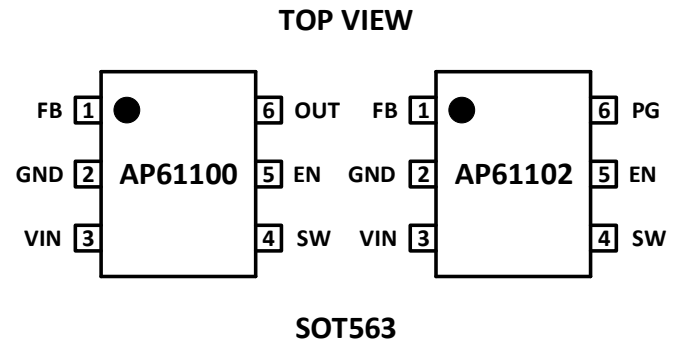
The AP61102 device is easily used by minimizing the external component count due to its adoption of constant on-time (COT) control to achieve fast transient responses, ease loop stabilization, and low output voltage ripple.

The device is available in a SOT563 package.

### Features

- Input Range: 2.3V to 5.5V
- Wide Output Voltage Range: 0.6V to 5.5V
- 1A Continuous Output Current
- 0.6V ± 2% Reference Voltage
- 14μA Ultralow Quiescent Current (Pulse Frequency Modulation)
- 2.2MHz Switching Frequency
- Power Good Indicator
- Programmable Modulation Mode Through EN
  - PFM ( $V_{in} - V_{EN} < 200\text{mV}$ )
  - PWM Regardless of Output Load ( $V_{in} - V_{EN} > 200\text{mV}$ )
- Protection Circuitry

### Pin Assignments



### 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**

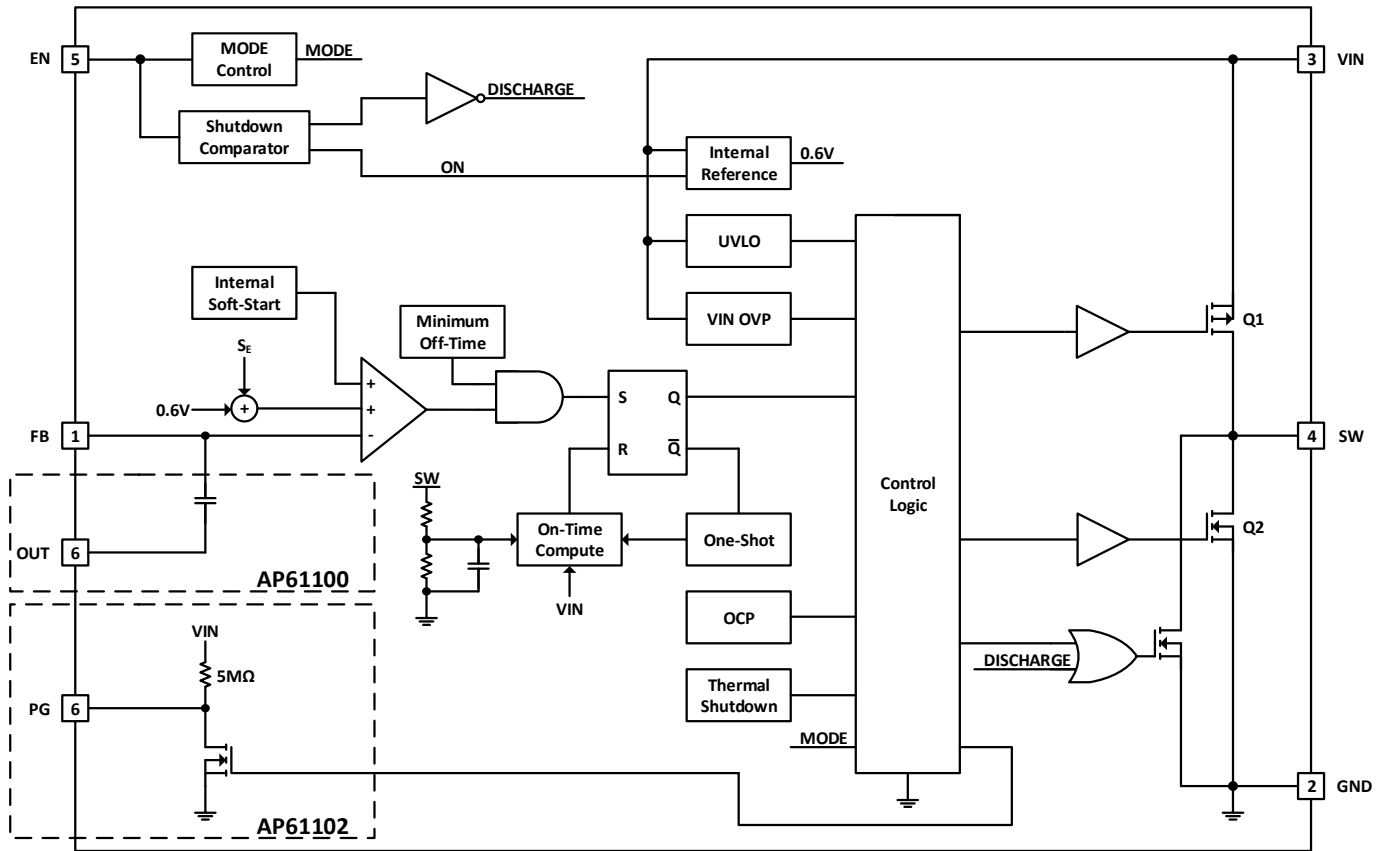


Figure 1. Functional Block Diagram

### Absolute Maximum Ratings (Note 4) (At $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Symbol                             | Parameter              | Rating                 | Unit             |
|------------------------------------|------------------------|------------------------|------------------|
| VIN                                | Supply Pin Voltage     | -0.3 to +6.0 (DC)      | V                |
|                                    |                        | -0.3 to +6.5(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                |
| VPG                                | Power-Good Pin Voltage | -0.3 to +6.0 (DC)      | V                |
| TST                                | Storage Temperature    | -65 to +150            | $^\circ\text{C}$ |
| TJ                                 | Junction Temperature   | +150                   | $^\circ\text{C}$ |
| TL                                 | Lead Temperature       | +260                   | $^\circ\text{C}$ |
| <b>ESD Susceptibility (Note 5)</b> |                        |                        |                  |
| HBM                                | Human Body Model       | 2000                   | V                |
| CDM                                | Charged Device Model   | 1000                   | V                |

- Notes:
- 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.
  - 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 (At $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Symbol | Parameter                            | Min | Max  | Unit             |
|--------|--------------------------------------|-----|------|------------------|
| VIN    | Supply Voltage                       | 2.3 | 5.5  | V                |
| VOU    | Output Voltage                       | 0.6 | 5.5  | V                |
| $T_A$  | Operating Ambient Temperature Range  | -40 | +85  | $^\circ\text{C}$ |
| $T_J$  | Operating Junction Temperature Range | -40 | +125 | $^\circ\text{C}$ |

### Quick Start Guide

The AP61102Z6-EVM has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP61102Z6-EVM, follow the procedure below:

- For evaluation board configured at  $V_{OUT}=1.8\text{V}$ , connect a power supply to the input terminals VIN and GND. Set VIN to 5V.
- Connect the positive terminal of the electronic load to VOUT and negative terminal to GND.
- For Enable, place a jumper to "H" position to enable IC. Jump to "L" position to disable IC.
- The evaluation board should now power up with a 1.8V output voltage.
- Check for the proper output voltage of 1.8V ( $\pm 2\%$ ) 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.
- Set the load to 1A 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 AP61102

1) Setting the output voltage

The AP61102 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, R1 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

| AP61100/AP61102    |         |         |        |         |         |         |         |
|--------------------|---------|---------|--------|---------|---------|---------|---------|
| Output Voltage (V) | R1 (kΩ) | R2 (kΩ) | L (μH) | C2 (μF) | C3 (μF) | C5 (pF) |         |
|                    |         |         |        |         |         | AP61100 | AP61102 |
| 1.0                | 200.0   | 301.0   | 1.0    | 10      | 10      | OPEN    | 33      |
| 1.2                | 200.0   | 200.0   | 1.0    | 10      | 10      | OPEN    | 33      |
| 1.5                | 200.0   | 133.0   | 1.0    | 10      | 10      | OPEN    | 33      |
| 1.8                | 200.0   | 100.0   | 1.0    | 10      | 10      | OPEN    | 33      |
| 2.5                | 200.0   | 63.2    | 1.0    | 10      | 10      | OPEN    | 33      |
| 3.3                | 200.0   | 44.2    | 1.0    | 10      | 10      | OPEN    | 33      |

### External Component Selection:

- 1) Inductor (L)
  - (1) Low DCR for good efficiency
  - (2) Inductance saturate current must be higher than 2.5A
  - (3) 1.0μH inductor of Würth Elektronik(PN. 744 383 560 10) is recommended for all application circuit.

**Evaluation Board Schematic**

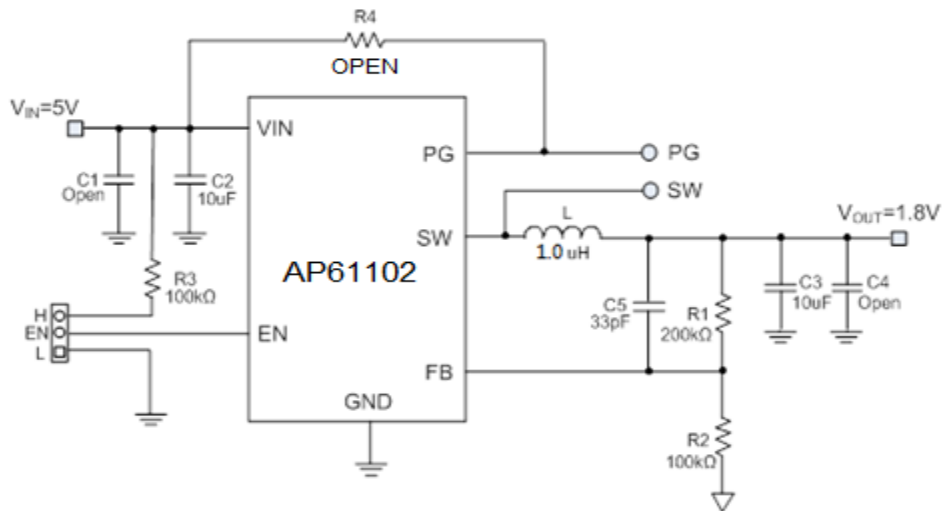


Figure 2. AP61102Z6-EVM Schematic (Vo=1.8V)

**PCB Top Layout**

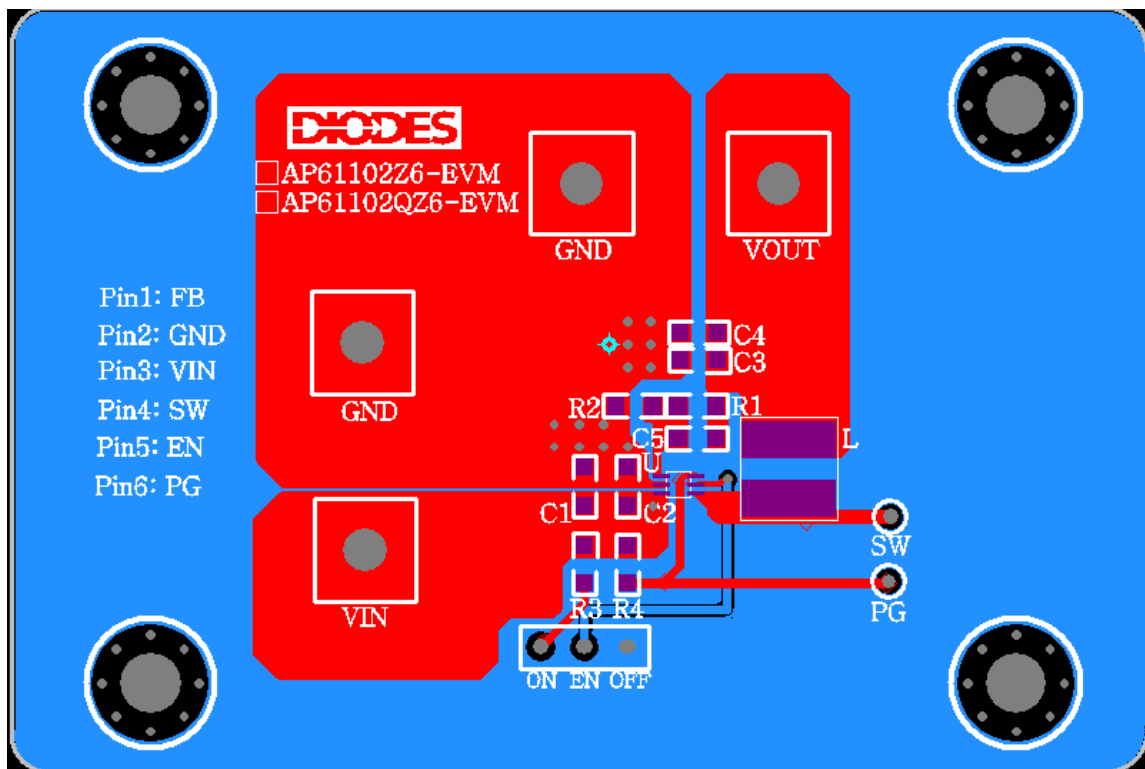


Figure 3. AP61102Z6 - EVM - Top Layer

**PCB Bottom Layout**

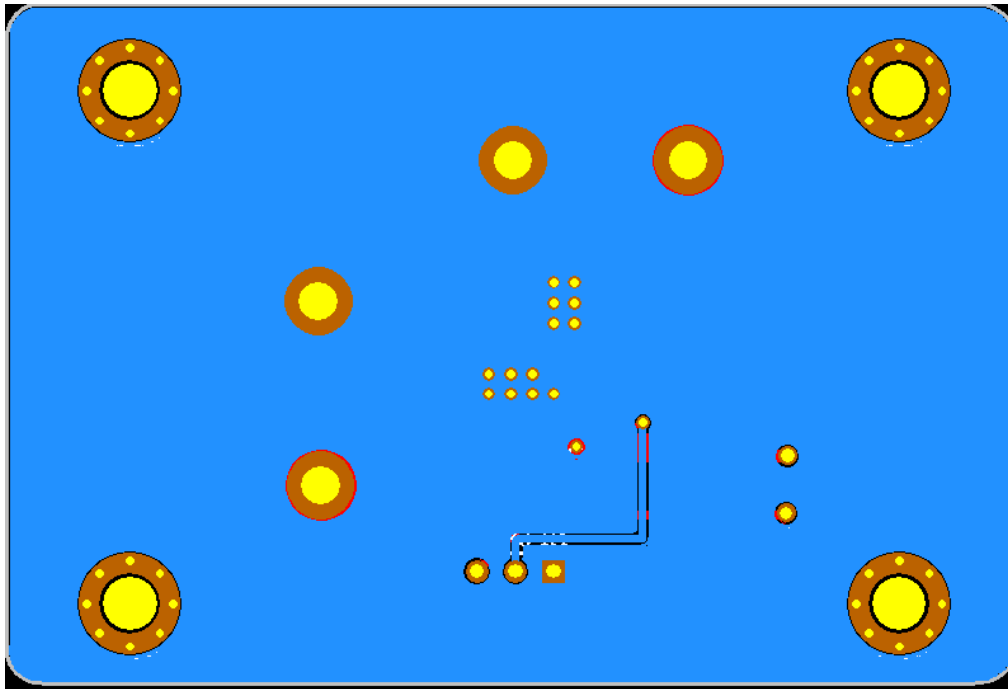


Figure 4. AP61102Z6 - EVM - Bottom Layer EV Board View

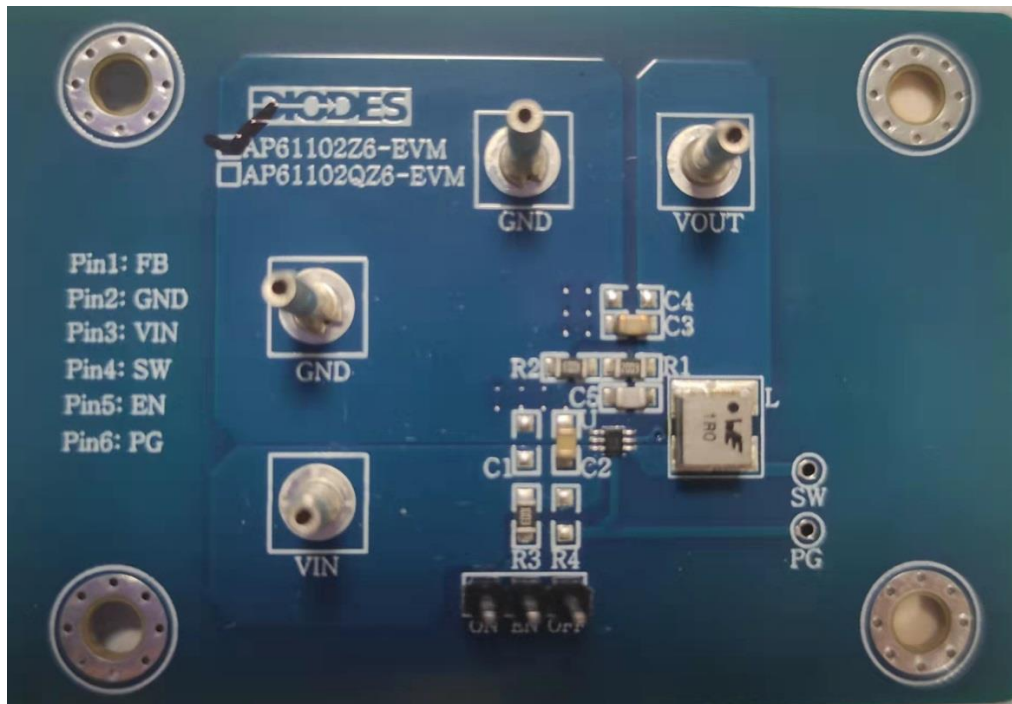


Figure 5. AP61102Z6 EV Board View

**Bill of Materials for AP61102Z6-EVM ( $V_{OUT}=1.8V$ )**

| Item | Value       | Type                            | Rating | Description     |
|------|-------------|---------------------------------|--------|-----------------|
| C2   | 10 $\mu$ F  | X5R/X7R, Ceramic/0805           | 10V    | Input CAP       |
| C3   | 10 $\mu$ F  | X5R/X7R, Ceramic/0805           | 6.3V   | Output CAP      |
| C5   | 33pF        | X5R/X7R, Ceramic/0805           | 50V    | Feedforward CAP |
| L    | 1.0 $\mu$ H | Würth Elektronik<br>74438356010 | >3A    | Inductor        |
| 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   |             | AP61102Z6                       |        | SOT563          |

**Typical Performance Characteristics**

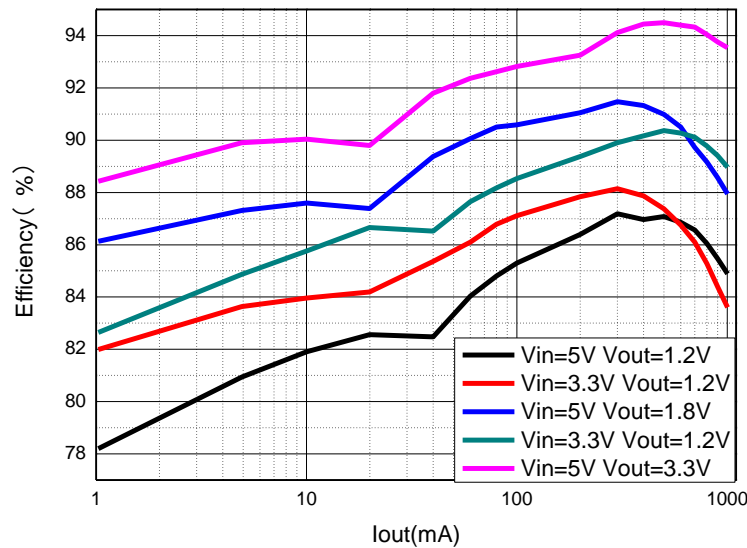


Figure 8. Efficiency vs. Output Current

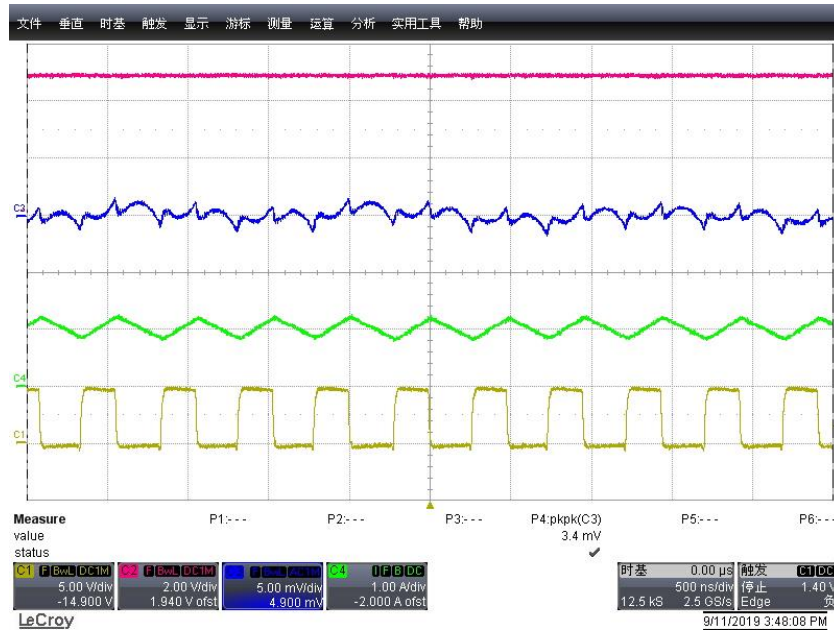


Figure 9. Output Voltage Ripple,  $I_{OUT} = 1A$  ( $V_{OUT} = 1.8V$ )



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