

### General Description

The AL5817 is an 8-terminal adjustable linear LED driver-controller offering excellent temperature stability and output current capability. It works with a wide input voltage range from 4.5V to 60V. With an external LED driving power device, its internal power dissipation is minimized compared with traditional linear LED drivers. This makes it ideal for medium to high current LED circuits.

The AL5817 has internal output drive capability up to 15mA, which enables it to drive external bipolar transistors or MOSFETs. It also provides the capability to drive longer LED chains with low drop out voltage and multiple LED channels.

VSET pin is used to directly set output current feedback level. Using a resistor divider between REF pin and VSET pin, the output current can be set. Additionally, the use of an NTC resistor allows the creation of an accurate and configurable thermal foldback behavior.

The AL5817 provides an LED-open detection feature through its VFAULT pin. If VFAULT is brought lower than 2.5V (by any one of the multiple LED channels going open) the AL5817's output will go low turning off the external transistors. The device will recover when the open condition is removed.

An enable pin ENB is available to externally turn on and off the LEDs. An input voltage higher than 2V disables the device and external transistor drive. This ability of ENB to turn off the external transistors also allows low frequency PWM dimming of the

LED current by adding PWM control signal on ENB pin.

AL5817 is available in the thermally enhanced MSOP-8EP package.

### Applications

- Linear LED Driver
- LED Signs
- Instrumentation Illumination
- Refrigerator Lights

### Key Features

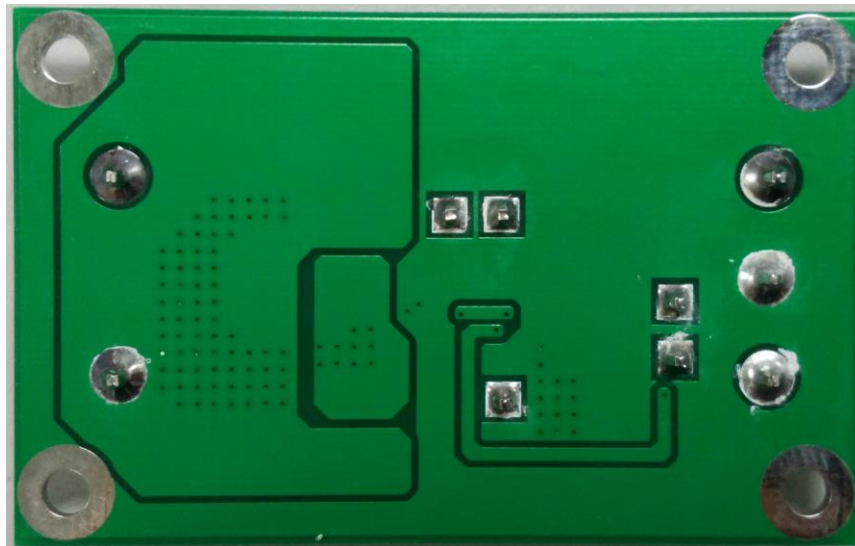
- Wide Input Voltage Range from 4.5V to 60V;
- Wide Input Voltage Range from 4.5V to 60V;
- Configurable LED Current Setting;
- 3% Reference Voltage Tolerance;
- Low Temperature Drift;
- 15mA Output Drive Capability for MOSFET or Bipolar Transistor;
- LED Open Protection Detected by VFAULT Pin;
- LED Thermal Foldback Configured by VSET;
- Over Temperature Protection (OTP);
- UVLO Protection;
- PWM Dimming Realized through VFAULT pin or ENB pin.

### AL5817EV1 Specifications

Parameter	Value
Input Voltage	4.5VDC to 60VDC
LED Current	1A
Number of LEDs	1~17pcs
XY Dimension	63mm x 40mm



**Figure 1: Top View**



**Figure 2: Bottom View**

### Connection Instructions

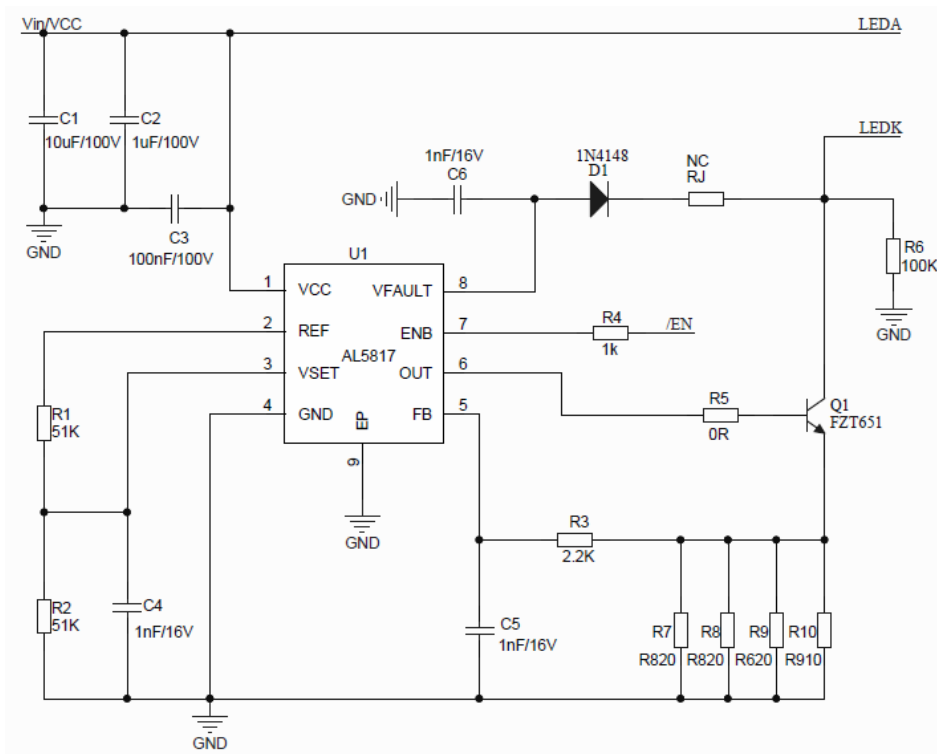
Power Supply Input: 4.5~60V<sub>DC</sub> (VIN, GND);

For LED-open detection operation: add a 0805 0 ohm resistor on location RJ;

For PWM dimming operation: add PWM dimming signal to the ENB pin;

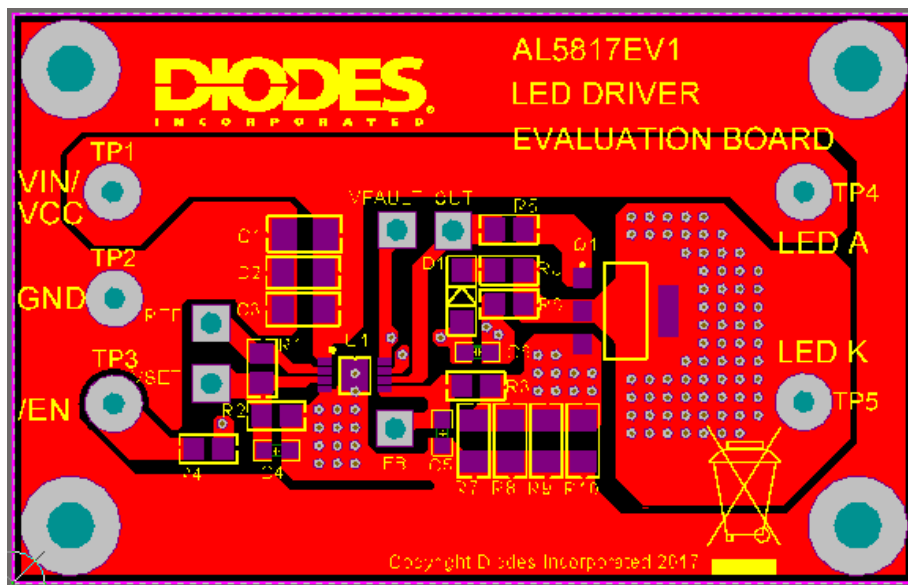
Device enabling signal input (ENB, GND): Floating and low/ON, high/OFF.

**Evaluation Board Schematic**



**Figure 3: Evaluation Board Schematic**

**Evaluation Board Layout**



**Figure 4: PCB Board Layout Top View**

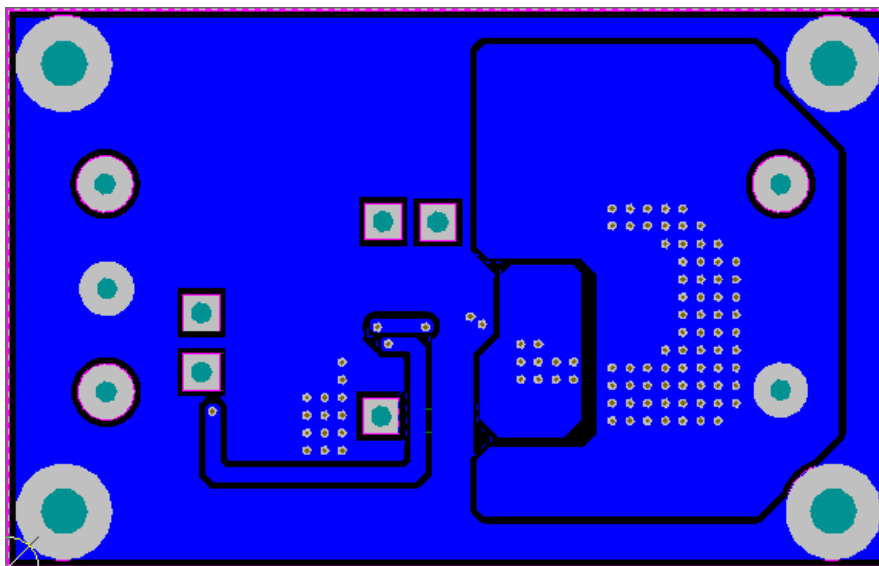


Figure 5: PCB Board Layout Bottom View

### Bill of Material

#	Item	Description	Package
1	C1	Ceramic Cap,10uF/100V, X7R	1210
2	C2	NC	NC
3	C3	Ceramic Cap,0.1uF/100V, X7R	1206
4	C4	Ceramic Cap,1nF/16V, X7R	0603
5	C5	Ceramic Cap,1nF/16V, X7R	0603
6	C6	Ceramic Cap,1nF/16V, X7R	0603
7	Q1	FZT651TA, 60V/3A, NPN Transistor, Diodes Inc	SOT223
8	R1	SMD Resistor, 51K, 5%, 1/8W	0805
9	R2	SMD Resistor, 51K, 5%, 1/8W	0805
10	R3	SMD Resistor, 2.2K, 5%, 1/8W	0805
11	R4	SMD Resistor,1K, 5%, 1/8W	0805
12	R5	SMD Resistor, 0R, 5%, 1/8W	0805
13	R6	SMD Resistor, 100K, 5%, 1/8W	0805
14	RJ	NC	NC
15	R7	SMD Resistor, R820, 1%, 1/4W	1206
16	R8	SMD Resistor, R820, 1%, 1/4W	1206
17	R9	SMD Resistor, R620, 1%, 1/4W	1206
18	R10	SMD Resistor, R910, 1%, 1/4W	1206
19	D1	1N4148, SOD123, Diodes Inc	SOD123
20	U1	AL5817, Diodes Inc	MSOP-8EP

### Quick Start Guide

1. By default, the LED current of evaluation board is preset at 1A.
2. Ensure that the DC source is switched OFF or disconnected before soldering or connecting.
3. Connect the anode wire of external LED string to LED A of the evaluation board.
4. Connect the cathode wire of external LED string to LED K of the evaluation board.
5. Connect two DC line wires to the VIN and GND terminals on the evaluation board.
6. Ensure that the area around the board is clear and safe, and preferably that the board and LEDs are enclosed in a transparent safety cover.
7. Turn on the main switch. LEDs string should light up with LEDs.

### LED current setup

The LED current is set by the reference voltage at the emitter/drain voltage of the LED driving transistor. This reference voltage is determined by the resistor R1 and R2. On the demo board, the VSET voltage is preset to 0.2V.

Then the output current for LED strings can be calculated by:

$$I_{OUT} = V_{VSET} / R_{SENSE}$$

On the board, the  $R_{SENSE}$  consists of R7, R8, R9, R10; the effective resistance is 0.2 ohm, so the output current is 1A.

The LED driver's LED current behavior under different ambient or LED temperatures can be configured by using NTC for R2 shown in Figure 6.

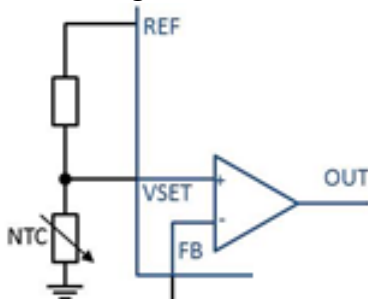


Figure 6: Thermal Fold Back Circuit Basing on NTC

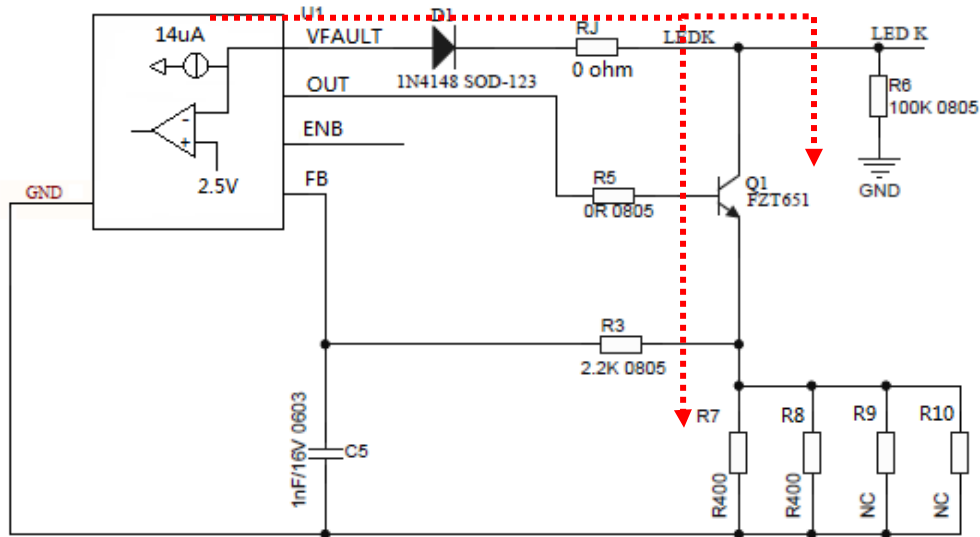
### LED-open detection function

This demo board is preset with no LED-open detection function. If this function is needed, change the demo board with the following action:

- 1) A 0 ohm SMD resistor should be added on location RJ;
- 2) Differential voltage between input and output should be higher than 2.7V to ensure VFAULT pin function working normally.

#### ● VFAULT

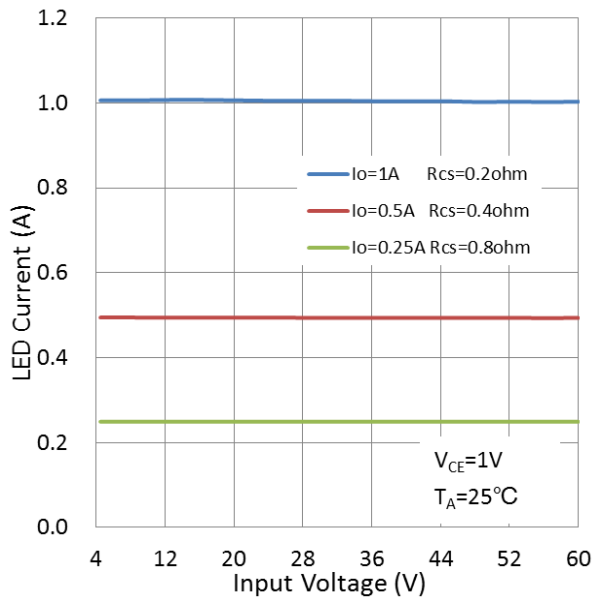
The AL5817 detects open conditions on the collector/drain of the external transistor driving the LEDs using the VFAULT pin, see Figure 7.



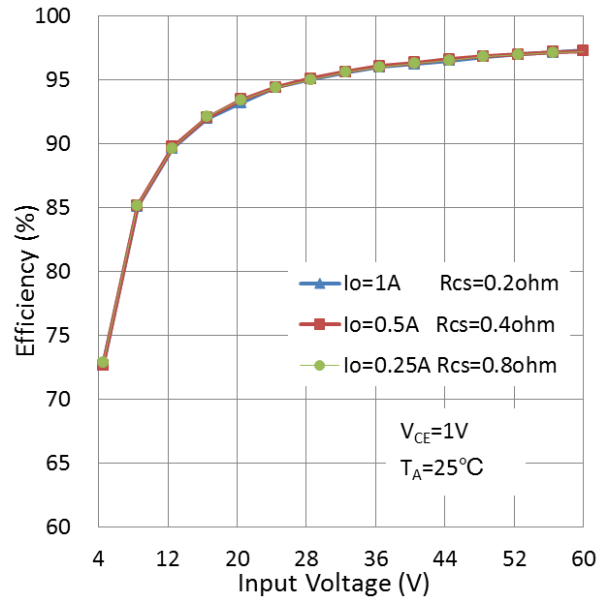
**Figure 7: VFAULT configuration**

If the LED string becomes open, VFAULT pin will be pulled down by the power bipolar or MOSFET below its internal 2.5V threshold. This condition triggers an output disable condition causing OUT to go low, turning off the external MOSFET/BJT. A resistor (R6, 100K) is needed to keep the VFAULT signal low during a fault condition. A 100k will keep this node low. When the fault condition is fixed and VFAULT pin rises above 2.63V the device will operate normally.

**System Performance**

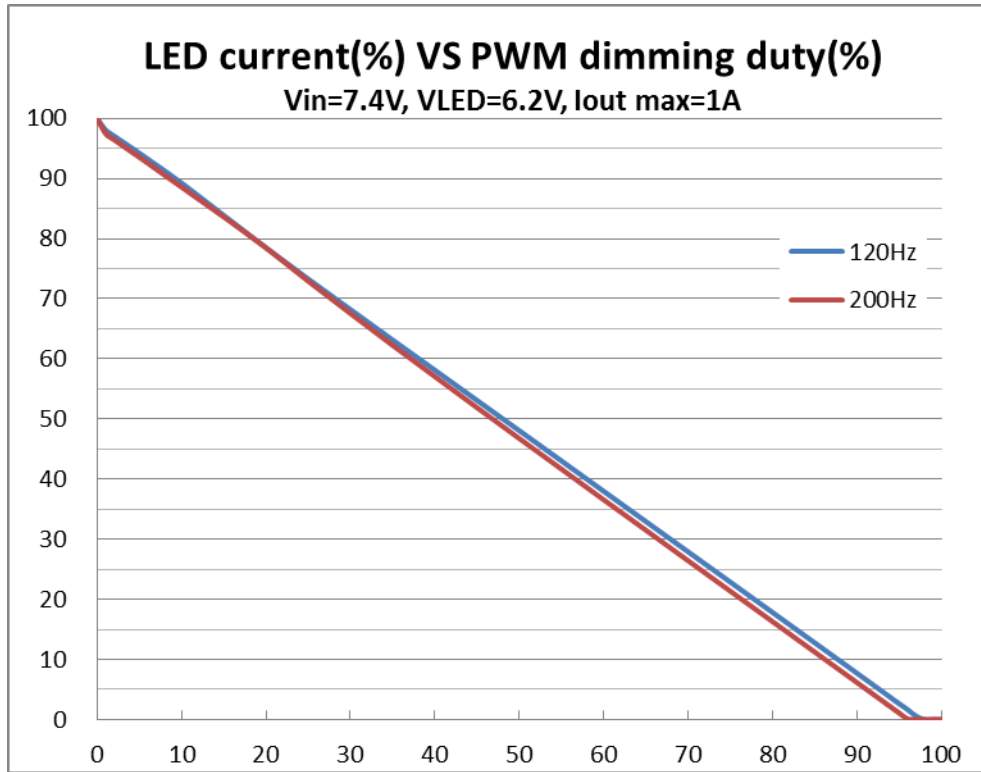


**Figure 8: LED current VS input voltage**



**Figure 9: Efficiency VS input voltage**

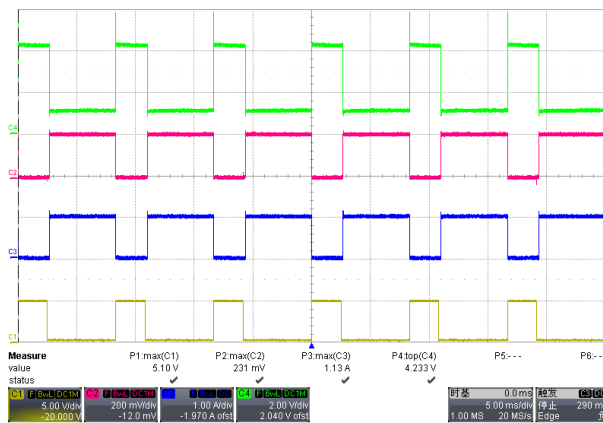
**Dimming curve**



**Figure 10: Dimming Curve**

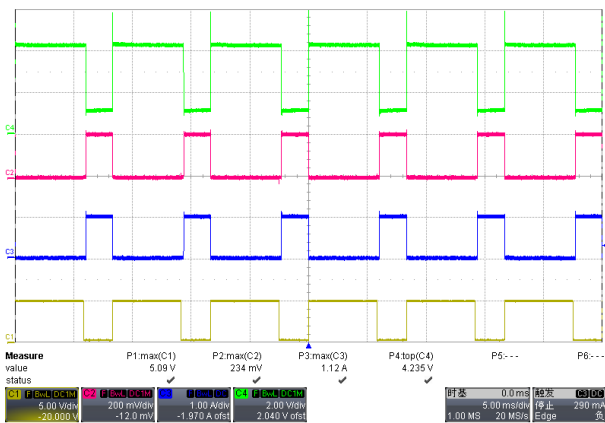
**Dimming waveform**

**PWM**   **FB**   **I<sub>LED</sub>**   **V<sub>LED\_K</sub>**



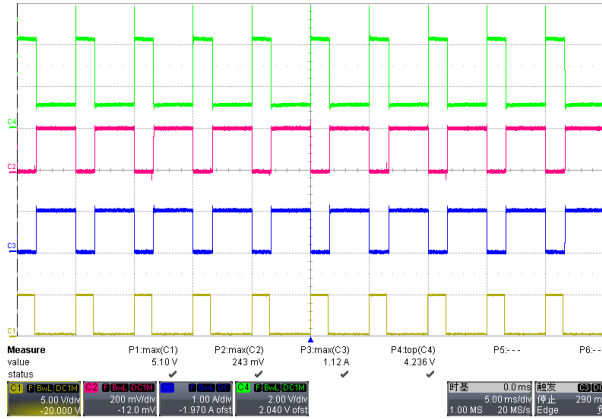
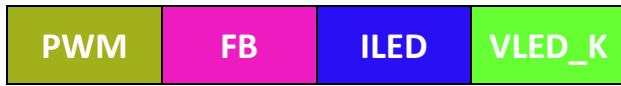
Frequency=120Hz, duty=30%

**Figure 11: Dimming waveform (1)**



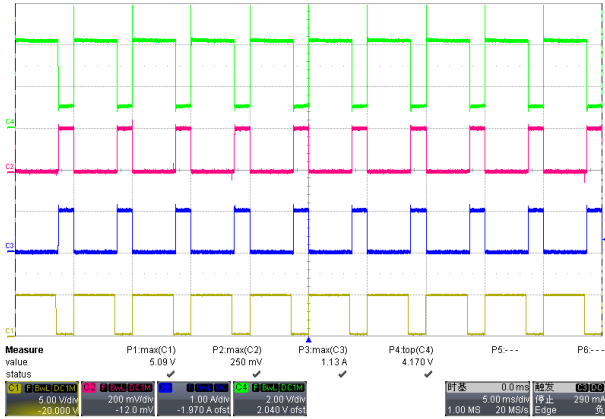
Frequency=120Hz, duty=70%

**Figure 12: Dimming waveform (2)**



Frequency=120Hz, duty=30%

**Figure 13: Dimming waveform (3)**

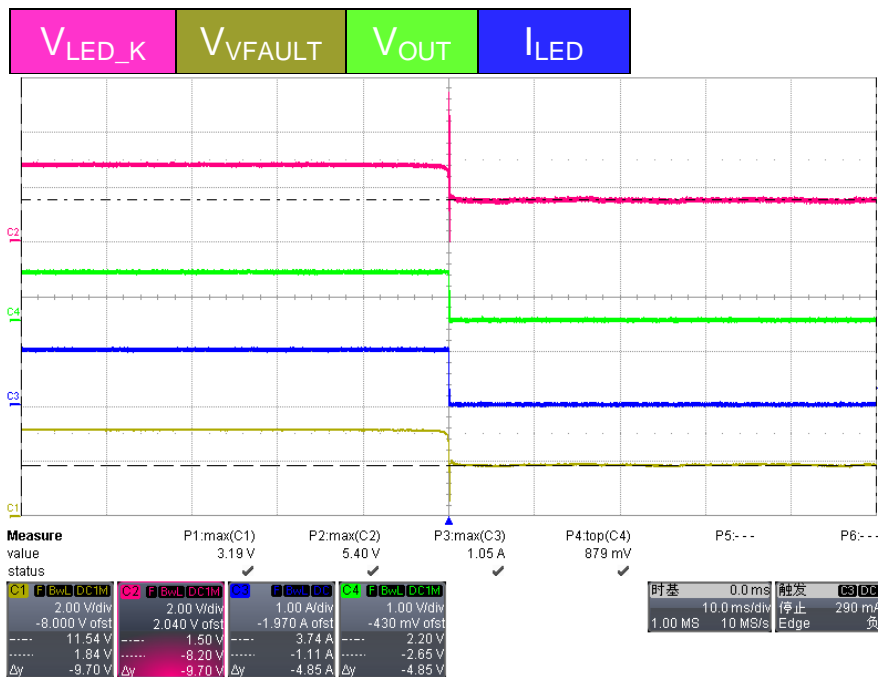


Frequency=120Hz, duty=70%

**Figure 14: Dimming waveform (4)**

**LED-Open detection Waveforms:**

Test condition: input 9.85V dc; output 7.05V 2S4P LEDs/1A.



**Figure 15: LED-Open Detection**



Turn ON:

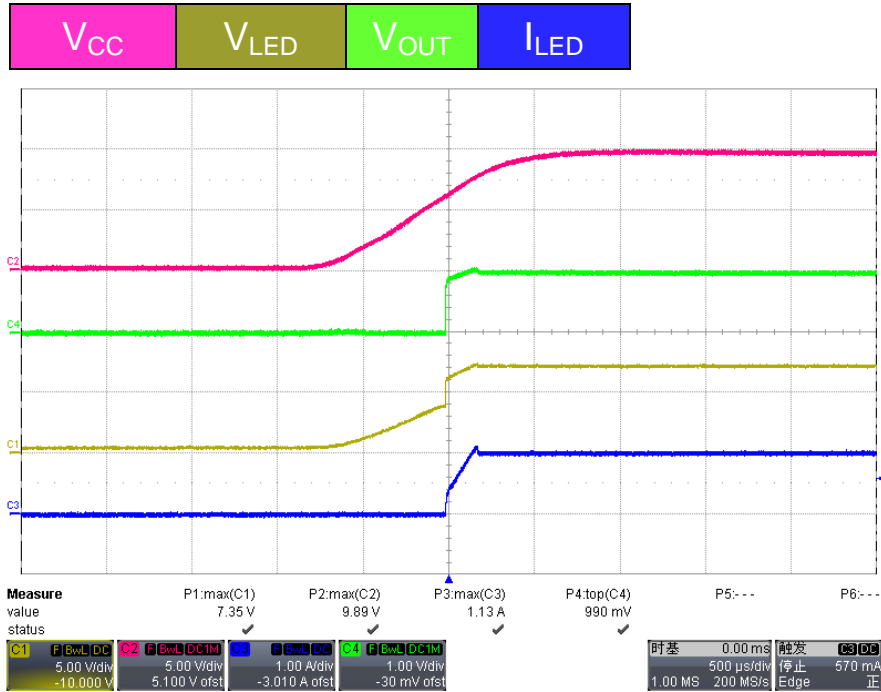


Figure 16: Turn ON (1)

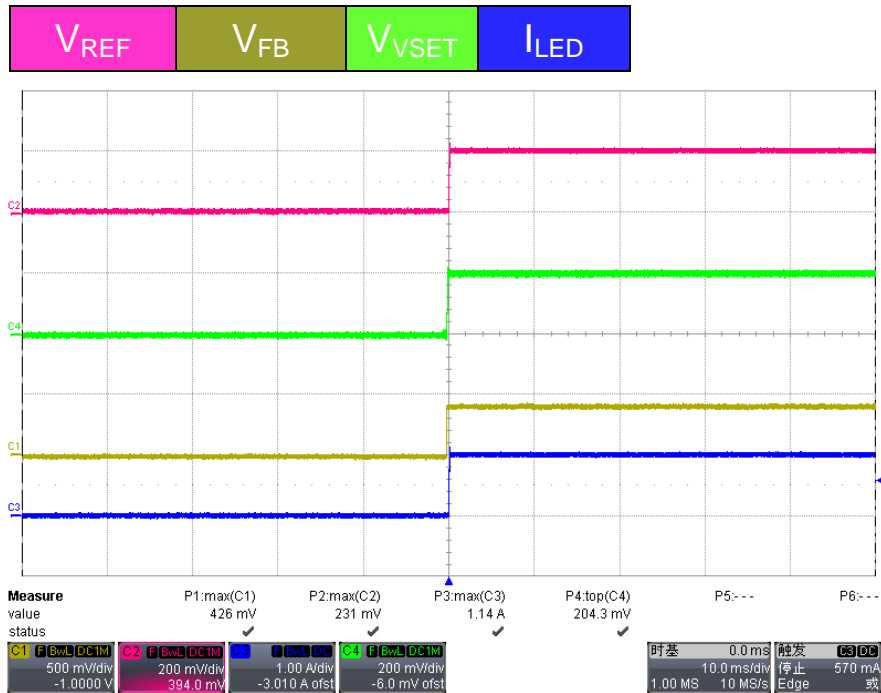


Figure 17: Turn ON (2)

Turn OFF:

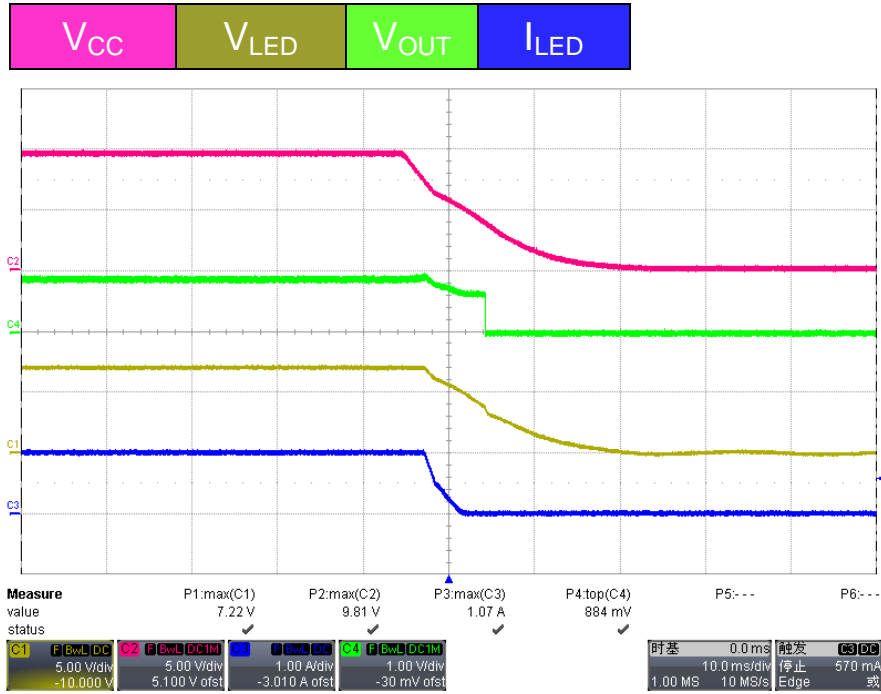


Figure 18: Turn OFF (1)

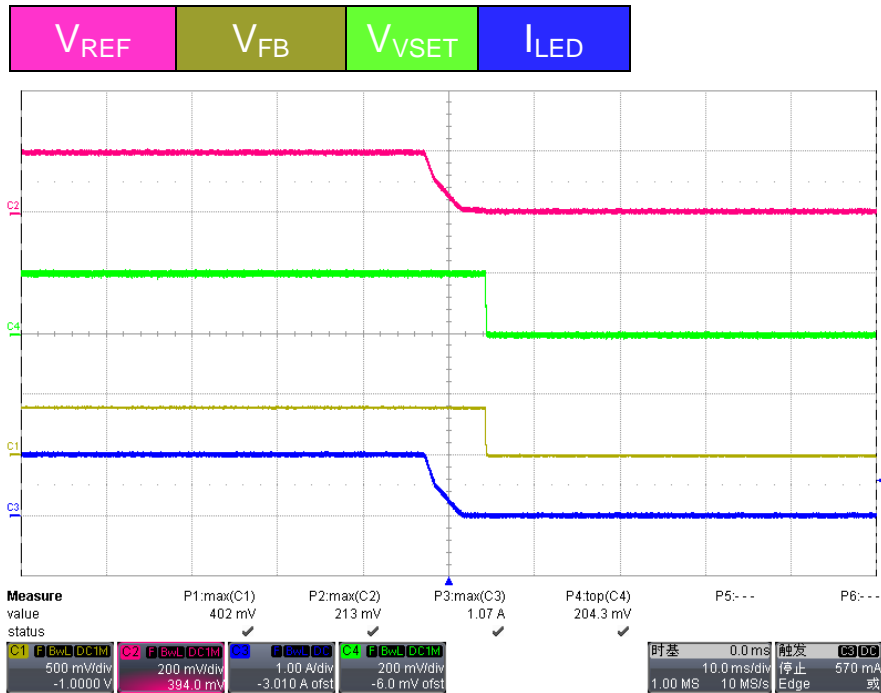


Figure 19: Turn OFF (2)

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