University of Glasgow

Department of Electronics and Electrical Engineering

School of Engineering

Power Electronics

Lab Project: DC-DC Buck Converter

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Design:

In terms of the TL494 PWM Generator, most of the work had finished in lab1 session. As a result, design is not needed except for how to use it. Pin8, pin9 and pin1 are important for the usage of it. Datasheet will be shown to figure out the pin.

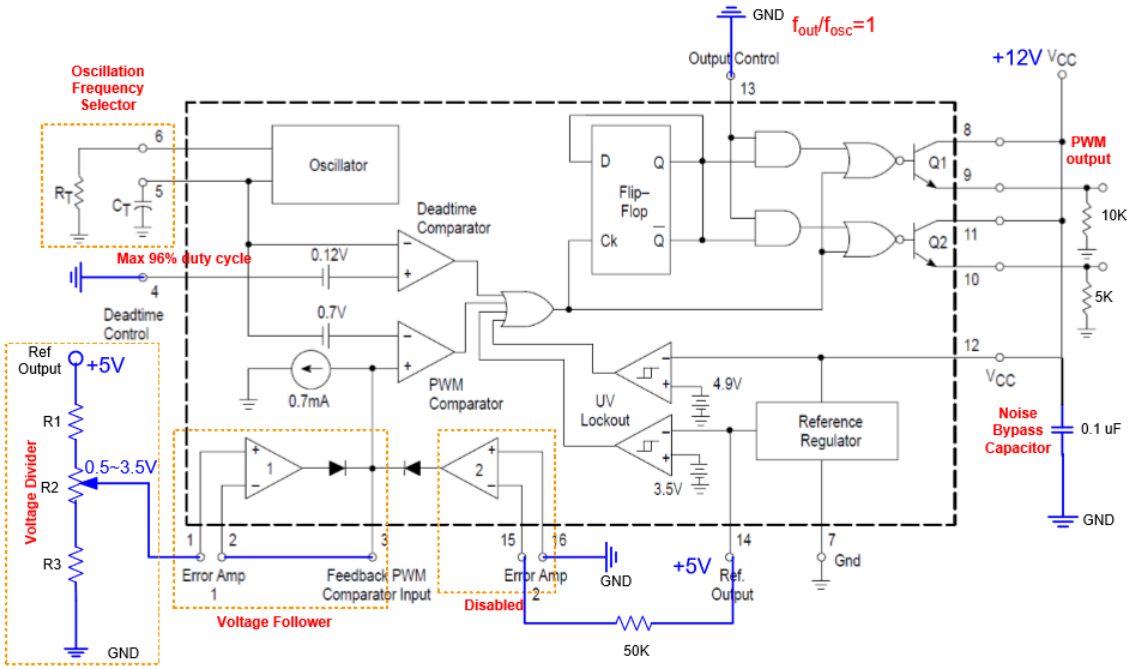
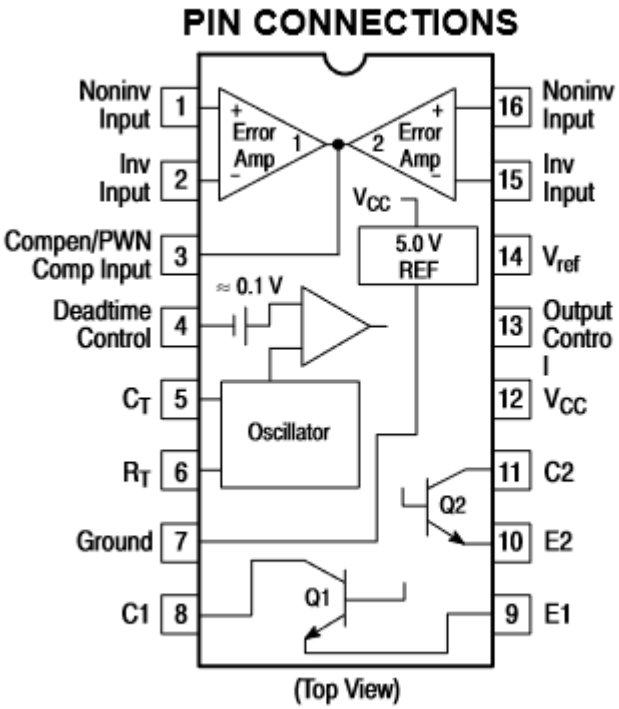


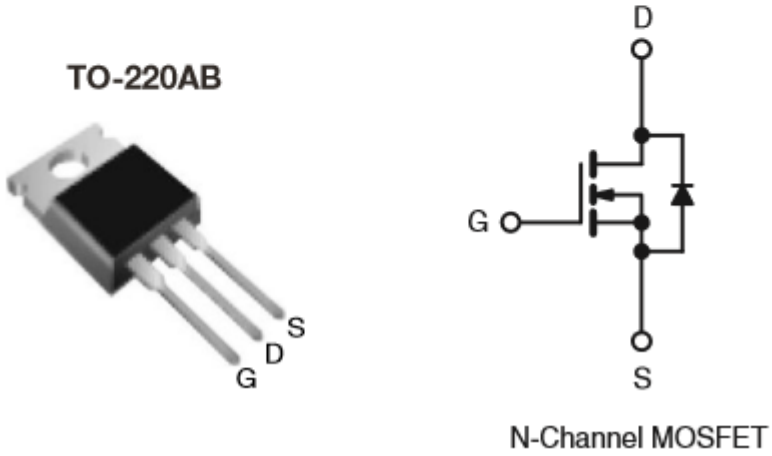
Figure 10: TL494-based PWM Signal Generation Circuit Connection



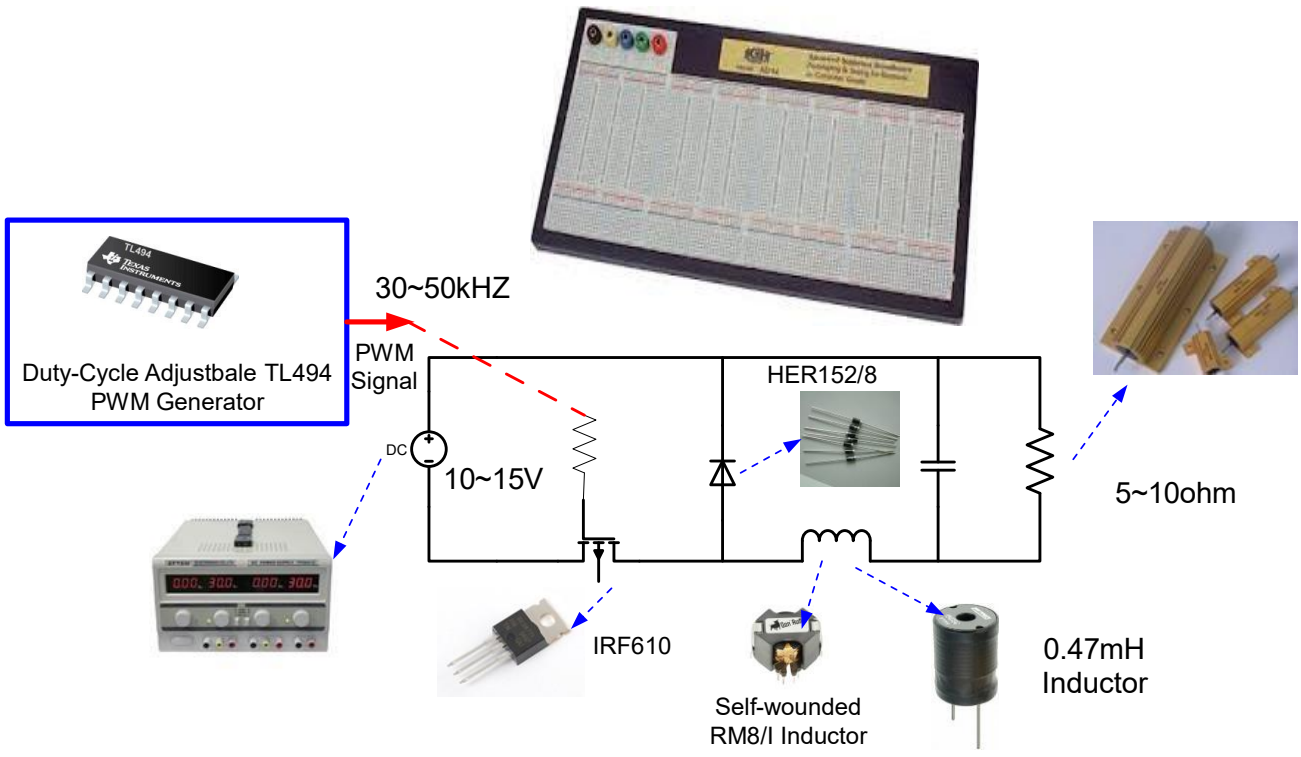
As for the self-wounded RM8/I inductor, copper wire is needed for construction. Since the iron pieces are difficult to be fixed, copper wire is used for both the rotation of magnetic core and the rope of the whole inductor.

In terms of the MOSFET, understanding the position of G S D-terminal counts.

PRODUCT SUMMARY		
V_{DS} (V)	200	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	1.5
Q_g (Max.) (nC)	8.2	
Q_{gs} (nC)	1.8	
Q_{gd} (nC)	4.5	
Configuration	Single	



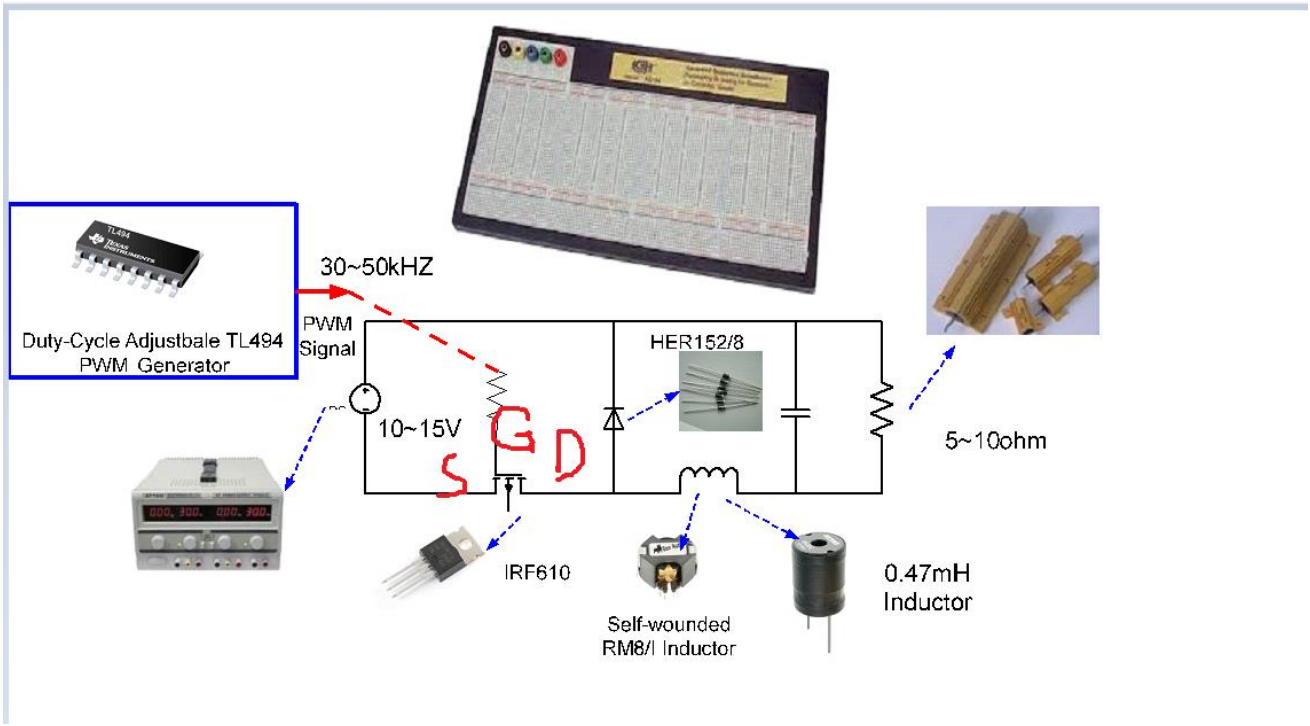
The circuit is constructed below.



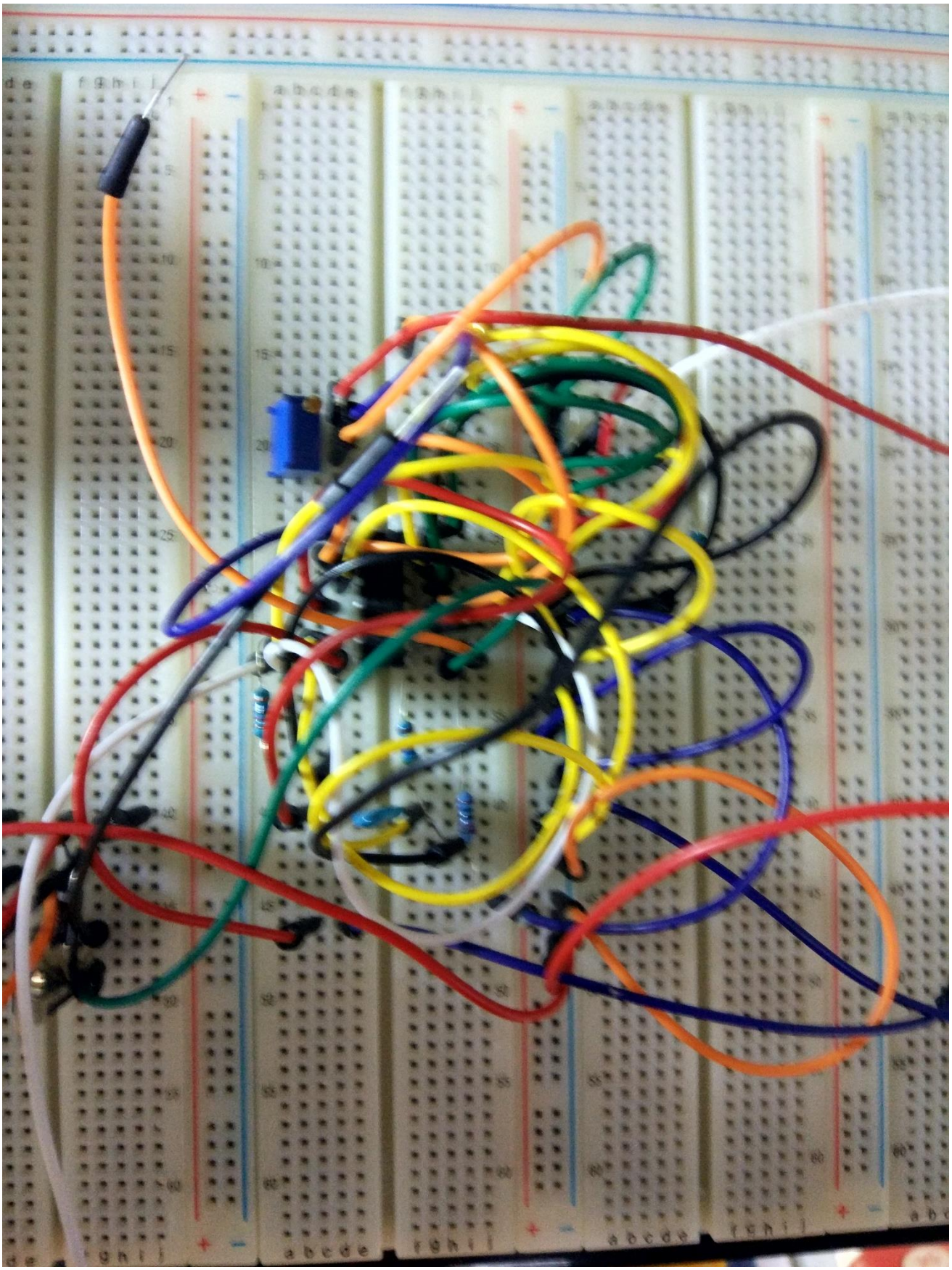
Operation:

Firstly, a 0.47mH inductor in the lab room can be used to replace the self-wounded RM8/I inductor temporarily, then the teammate can combine and construct the self-wounded RM8/I inductor properly while the other was devoted to the circuit.

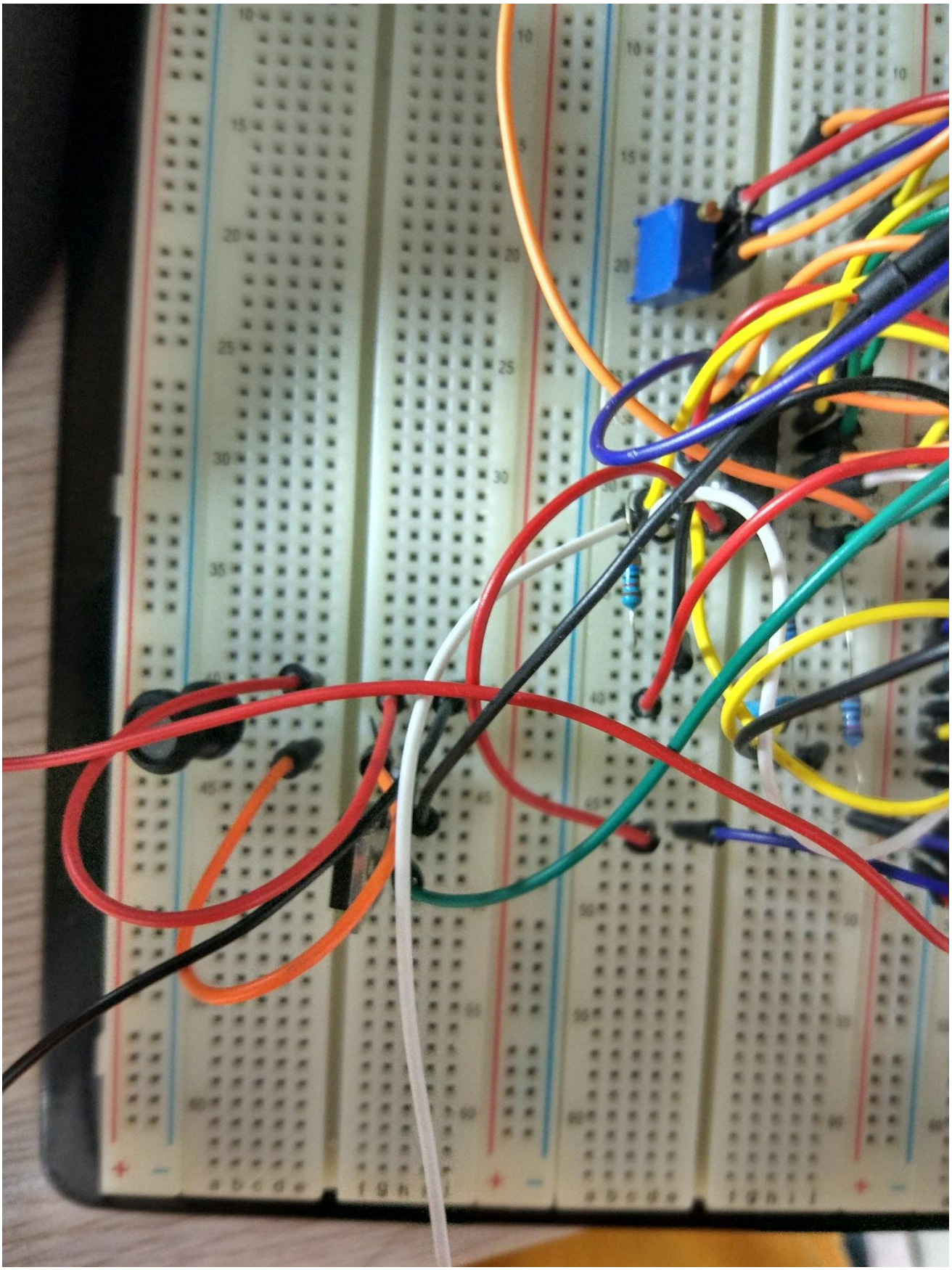
Based on the lab 1's TL494 PWM Generator, the pin 8 is connected to +12V, and pin 9 is connected to the Gate of the MOSFET. As for the MOSFTE, the D-terminal is connected to the node, which is the end of self-wounded RM8/I inductor and the positive terminal of semiconductor HER152/8 simultaneously. Negative terminal of the voltage source is connected to the S-terminal of the MOSFET. Moreover, others are connected below.



The actual TL494, combined in lab1.



Other actual part except the TL494

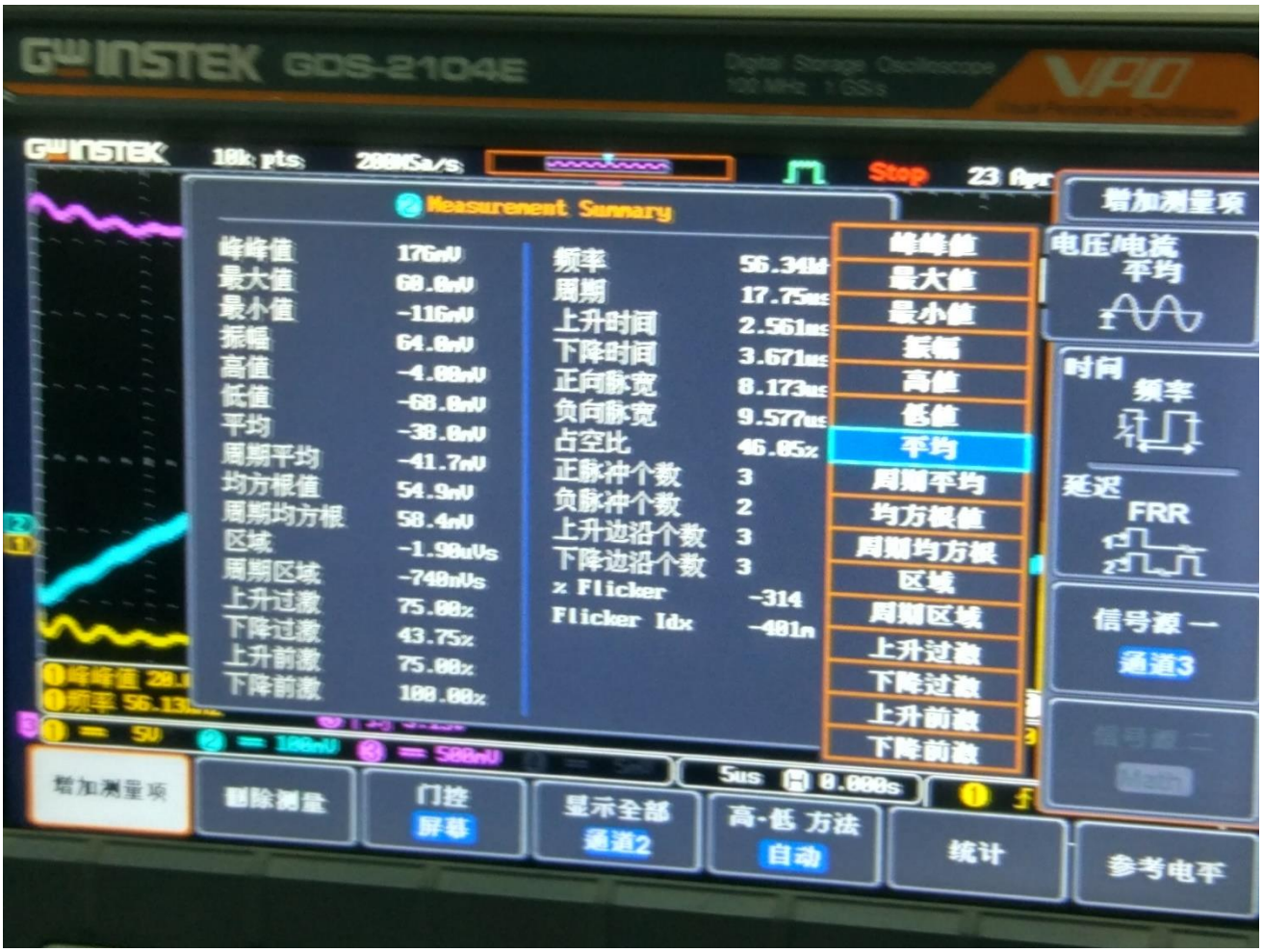


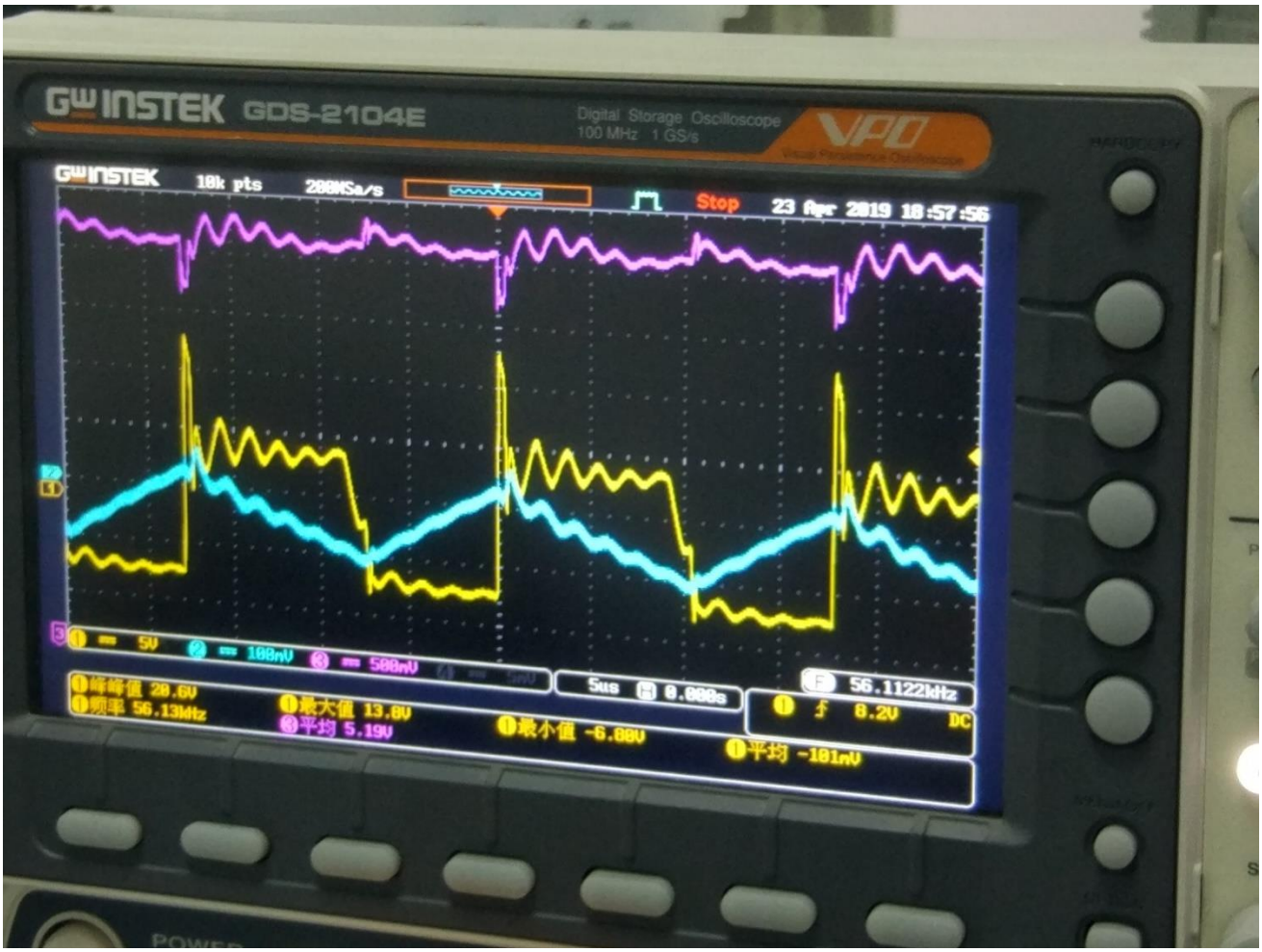
Overall performance:

Thanks to the god, despite the difficulties and troubles, our team passed Dr Zhou' s check in 6.30.

The voltage across the resistor is moderately stable, and the change in the duty cycle of the inductor voltage follows the pin 1, despite the noise. Our results are shown below:

Photos of figure is shown here.




GW INSTEK GDS-2104E
Digital Storage Oscilloscope
100 MHz 1 GS/s
GW INSTEK 10k pts 200MSa/s Stop 23 Apr 2019 18:57:56
5V 100mV 500mV
峰峰值 20.6V
频率 56.13MHz
最大值 13.8V
平均 5.19V
最小值 -6.80V
平均 -101mV
5us 0.000s
56.1122kHz
8.2V DC