DC-AC Converter

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Contents

***Abstract*—This manual provides the design of a DC-AC Converter.**

1 Components

Component	Value	Quantity
Arduino Uno		1
Capacitor	47 uF, 22 uF, 25 V	8 each
Capacitor	100 uF, 25 V	8
n-MOS	IRF 640	4
Jumper Wires	M-M	20
Diode	3 A	10
Gate Driver	TLP350	4
Transformers	12-0-12V, 3A	4

TABLE I

2 Circuit Operation

The DC-AC converter Block diagram and circuit are shown in Fig. 1 and Fig. 2

Problem 2.1. Generate 4 dc sources of +12 V and -5 V each using the voltage regulator circuit as shown in the Fig.3

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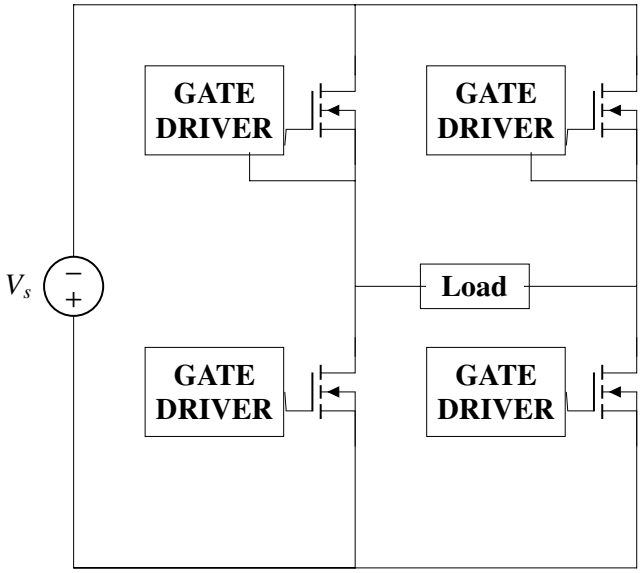

Fig. 1: DC-AC converter

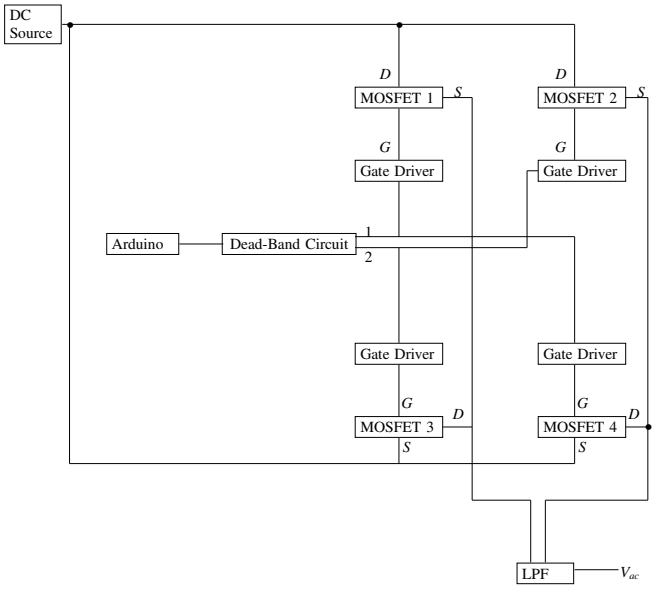

Fig. 2: DC-AC converter Block-diagram

Problem 2.2. Program the arduino to generate a square wave with *Duty Cycle* $D = 0.5$ and frequency $f = 50Hz$ and observe the waveform on the oscil-

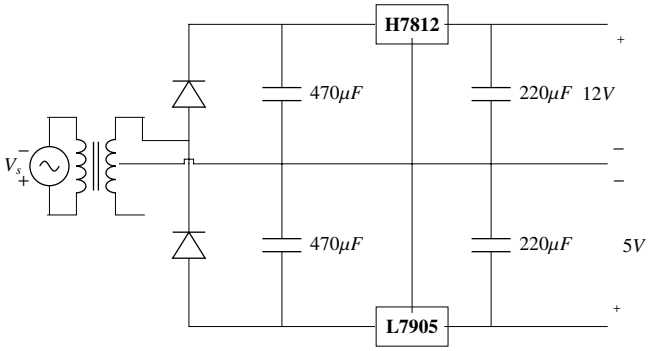

Fig. 3: Voltage-Regulator Circuit

loscope.

Solution:

```
void setup(){
  pinMode(13,OUTPUT);

}

void loop(){
  digitalWrite(13,LOW);
  delay(10);
  digitalWrite(13,HIGH);
  delay(10);

}
```

Problem 2.3. Calculate the R and C values for the dead band circuit shown in Fig.4 for the delay of 2.5 μsec.

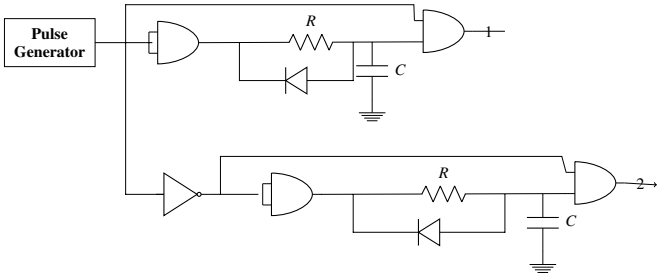

Fig. 4: Dead-Band Circuit

Solution:

$$V_{th}(LogicGate) = V_{pulse}(Highlevel) \times (1 - e^{-\frac{t}{RC}})$$
$$RC = 3.82 \times 10^{-6}$$

selected R = 390Ω and C = 10nF

Problem 2.4. Connect the 13^{th} pin of arduino to the Dead-band circuit and generate the Non-inverted(at 1) and Inverted(at 2) pulses and observe them on the oscilloscope.

Problem 2.5. Assemble the DC-AC circuit according to Figs. 1,2, 5 and Table II.

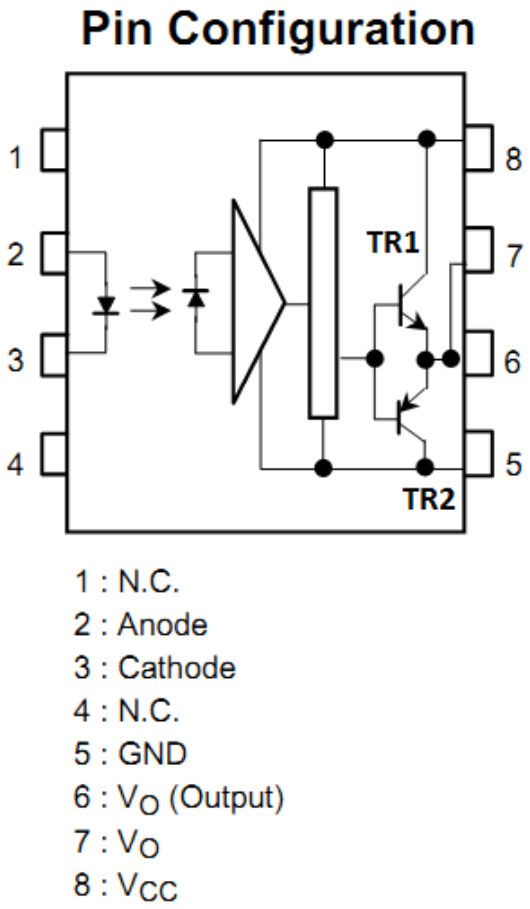

Fig. 5: TLP350

TLP350	1	2	3	4	5	6	7	8
ARDUINO	NA	13	GND	NA			NA	
					-5 V	10 Ω		12 V
MOSFET					S	G		

TABLE II: Pin Connections

3 Fourier Series Analysis of DC-AC Converter

Problem 3.1. Observe the output across the load in Fig. 1 on the oscilloscope. What do you observe?

Problem 3.2. Find the Fourier series expansion for the result in Problem.3.1.

Problem 3.3. Design a 4^{th} order RC Low pass filter with cut-off frequency 50 Hz and observe the output of the Low pass filter.

Problem 3.4. Find the output of the lowpass filter designed in 3.3 with input as obtained from the result of 3.1. What do you observe?

Problem 3.5. Demonstrate your results through a Python script.