

# 2 Arduino - Dual Channel - Triple AND Gate (Perfect Pulse Driver)

By: Chris Bake

**Arduino Code:** <https://bitbucket.org/cbake6807/dualtripleseq/src/master/>

## Parts List

1. **External Signal Generator:** 0-5Vppk output.
2. **Power Supply:** ATX is ideal, providing +5V REG and +12V REG.
3. **2N7000 Signal MOSFETs:** Quantity 6.
4. **IRFP460 or Similar Power N-channel MOSFET:** Quantity 2.
5. **56Ω 1/8W Resistors:** Quantity 10.
6. **100Ω 1/2W Resistors:** Quantity 2.
7. **4.7kΩ Resistors:** Quantity 2.
8. **2N3906 PNP General Purpose Transistor:** Quantity 2 (can be substituted with any general PNP transistor).
9. **IR2110PB Gate Driver Chip 14-pin:** Quantity 2.
10. **Arduino Nano (or similar):** Quantity 2 (must support hardware PCNT).
11. **Rotary Encoder:** Quantity 1.

## Software Requirements

- **Arduino IDE:** Ensure it is installed and updated to the latest version.
- **Encoder Library:** Install via the Arduino Library Manager.

## Arduino Setup

Pulse Counter Arduino

### 1. Upload Script

- Open the Arduino IDE.
- Connect the first Arduino (PulseCounter) to your PC.
- Open `PulseCounter.ino` from the provided file.
- Upload the script to the Arduino.

### 2. Connect the Encoder

- Connect the encoder's VCC to the Arduino's 5V pin.
- Connect the encoder's GND to the Arduino's GND pin.
- Connect the encoder's CLK and DT pins to two digital pins on the Arduino D2 and D3.
- Connect the encoder's Button pin to **D4**.

### 3. Verify Encoder Output

- Open the Serial Monitor in the Arduino IDE.
- Rotate the encoder and check the output to confirm it is functioning correctly.

```
const int outputPin = 9;
const int encoderPinA = 2;
const int encoderPinB = 3;
const int encoderSwitchPin = 4;
const int disableSwitchPin = 6;
```

## Adding a Pushbutton for Sync Mode Toggle

To add a pushbutton to the Sequencer Arduino for toggling the sync mode, follow these instructions:

### Parts Required

- **Pushbutton**: Quantity 1
- **10kΩ Resistor**: Quantity 1
- **Connecting Wires**

### Hardware Connections

#### 1. Connect the Pushbuttons

- NANO1 - **D6** -> BUTTON -> GND
- NANO2 - **D4** -> BUTTON -> GND

#### Summary of Connections

## Sequencer Arduino

### 1. Upload Script

- Disconnect the PulseCounter Arduino and connect the second Arduino (Sequencer) to your PC.

- Open `Sequencer.ino` from the provided file.
- Upload the script to the Arduino.

# Pin Mapping and Connections

## Connecting the Two Arduinos

### • PulseCounter Arduino to Sequencer Arduino

- Signal Generator (+5Vppk max) → PulseCounter NANO1 - D5 (Input)
  - Signal Generator (+5Vppk max) → Q2 **First** 2N7000 FET Gate
  - Signal Generator (+5Vppk max) → Q7 **First** 2N7000 FET Gate (opposite branch)
- PulseCounter NANO1 - D9 (Output) → Sequencer NANO2 - D2 (Input)
  - PulseCounter NANO1 - D9 (Output) → Q1 **Second** 2N7000 FET Gate
  - PulseCounter NANO1 - D9 (Output) → Q6 **Second** 2N7000 FET Gate (opposite branch)

### • Sequencer Arduino Outputs

- Sequencer NANO2- D9 (Output) → Input to Q4 - **Third** 2N7000 Gate.
- Sequencer NANO2 - D10 (Output) → Input to Q9 - **Third** 2N7000 Gate (opposite branch)

### • Gate Enable/Disable Button

- Connect NANO1 - D6 -> BUTTON -> GND

### • SyncMode / Offset Mode Button

- Connect NANO2 - D4 -> BUTTON -> GND

**Note:** The schematic shows the outputs merged due to limitations, but there should be dual outputs from the sequencer, D9 and D10, each connecting to a separate AND gate tree.

### • Shared Connections

- Both Arduinos' GND pins should be connected together to ensure a common ground.

# Gate Driver Chip Connections

## IR2110PB Gate Driver Chip

### 1. Power Connections

- VCC (Pin 3) → +12V REG
- VSS (Pin 2, 10, 11, 15) → GND
- VDD (Pin 9) +5V REG

### 2. Input Connections

- LIN (Pin 12) → Arduino PWM pin (as per script)

### 3. Output Connections

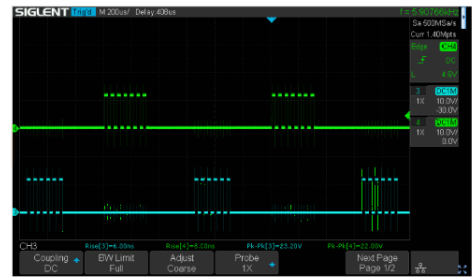
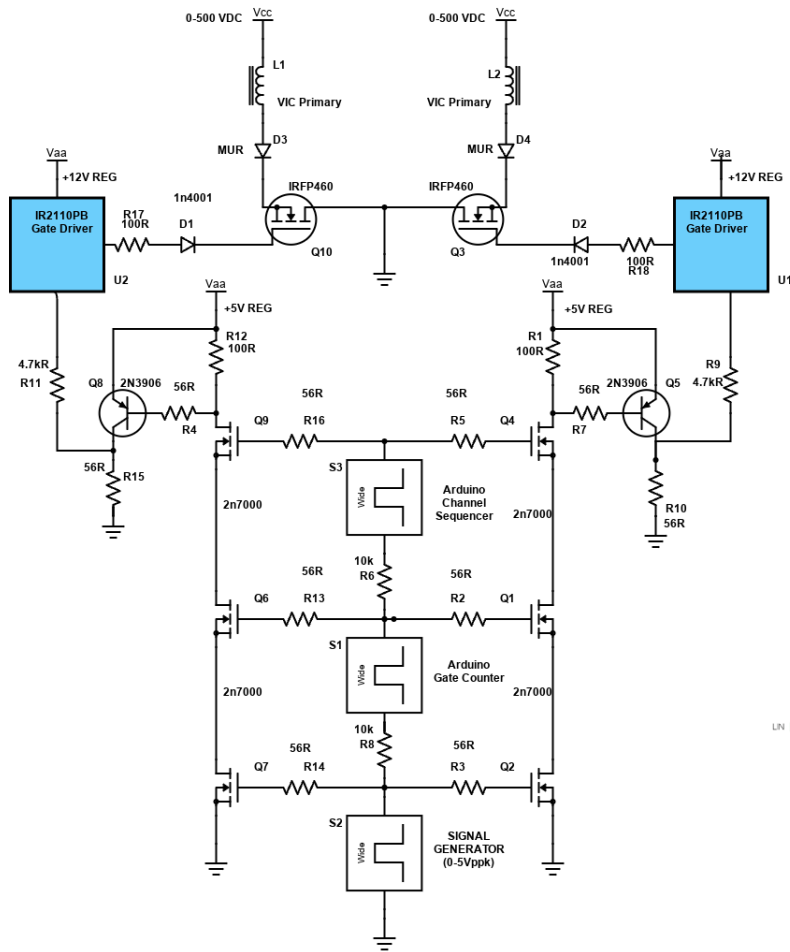
- LO (Pin 1) → Gate of the IRFP460 MOSFET
4. **Bootstrap Capacitor**
    - Connect a 22 $\mu$ F and a 100nF capacitor near VDD (Pin 9) and Ground.
  5. **No Connection**
    1. Pin 6, 7 - NC
  6. **Noise Filtering**
    - R2: Connect a 10 $\Omega$  resistor between LO and the gate of the MOSFET.
    - D2: Place a 1N4001 diode in parallel with the Resistor R2 in reverse direction for added noise filtering and protection.

## Schematic Overview

Refer to the schematic image to visualize these connections. The IR2110PB gate driver chips control the IRFP460 MOSFETs, enabling high-power switching of the VIC (Voltage Intensifier Circuit) primaries.

## Additional Notes

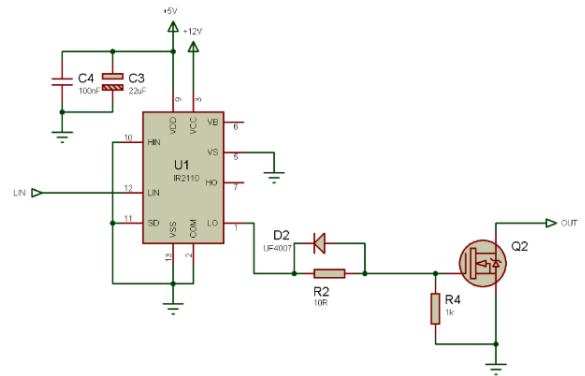
- **Resistor Tolerances:** The resistors can have a large tolerance. The 56 $\Omega$  value is selected to preserve signal clarity. Any value  $\leq 220\Omega$  should be acceptable.
- **Merged Outputs:** The Arduino Channel Sequencer has 2 outputs shown merged due to Scheme-It limitations.



**Perfect Pulse - Triple AND Gate Sequencer - Dual Gate Driver**

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Arduino code required. See Gate Driver below for additional chip connections.



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