PEdAL SYnC™

AUDIO CONTROL CHIPS

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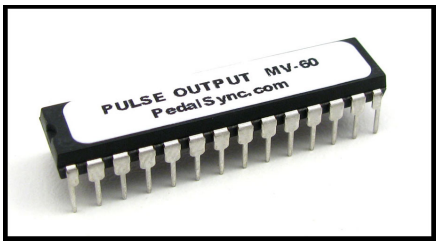
PedalSync™

Pulse Output chip MV-60



PedalSync Pulse Output chip MV-60 is designed to control BOSS™ effects that accept a pulse input such as the PH-3 Phase Shifter, AW-3 Dynamic Wah, and the DD-7 Delay. Any other devices that allow a pulse timing input can be similarly controlled.

MV-60 is also compatible with voltage controlled modular synth sequencing designs.

Key Features

- Two independent pulse outputs synchronized to the incoming clock
- Stores and recalls Clock/Tap Status, as well as Ratio, Offset, and Bypass Status for each output
- Six (6) total Simultaneous Outputs
- Ratio controls multiply or divide the outputs against the incoming clock for syncopation
- Offset controls allow users to independently offset each pulse's timing up to 360 degrees
- Robust, 128 program storage
- Simple, intuitive user interface
- Backwards-Compatible with MIDI
- Scalable - combine chips like building blocks to make elaborate designs
- Efficiently Designed to ensure Low part count
- Thru-Hole or SMT
- Easy to create stand-alone pedals that can be used traditionally and tested in-store
- Use PedalSync™ trademark on your devices and in advertising

Six (6) Simultaneous Outputs

MV-60 has the following six simultaneous outputs:

- **Output 1 Pulse** (*pin 9*)
- **Output 1 Tempo LED** (*pin 10*)
- **Output 2 Pulse** (*pin 11***)**
- **Output 2 Tempo LED** (*pin 18*)

The Output pins supply a (0 - 3.1 volt) square wave.

For each Output, the Pulse and Tempo LED signals are identical.

The Outputs are affected by their corresponding Ratio and Offset controls.

In Clock mode, the Outputs only pulse when an incoming clock signal is being received. In Tap mode, the Outputs constantly pulse.

The default rate for each program is 120 bpm.

The Outputs always pulse as described above, even if the Output is in Bypass mode.

Use a buffer if multiple circuits are driven off any one Output pin.

> *See* the schematic on page 10 for an example of how to connect the Outputs to control BOSS pedals. BOSS pedals trigger on the rising edge (when the 4066 switch turns off), therefore the Pulse Outputs are inverted through Schmitt Triggers.

- **Pin 14 - Synchronized Quarter-Note Pulse**

Pins 14 and 15 can be used together to control a 4017 Decade Counter chip for use in sequencer designs. *See schematic on next page.*

Pin 14 will output synchronized quarter note (0 - 3.1 volt) pulses with a 50% duty cycle which are not affected by any Offset or Ratio controls.

In Tap mode, the pulses are continuously sent in time with the 1:1 ratio, quarter note interval.

In Tap mode, the pulses continue even if the chip is in Bypass mode.

To synchronize the start and stop of a sequencer circuit in Tap mode, connect Pin 12 (for Output 1) or Pin 26 (for Output 2) *via an inverter* to the Clock Inhibit pin (pin 13 of the 4017 Decade Counter chip) rather than grounding that pin.

In Clock mode, the pulses are only sent when Clock data is being received and are synchronized to the incoming Clock. The CV pulses continue even if one or both Outputs are in Bypass mode.

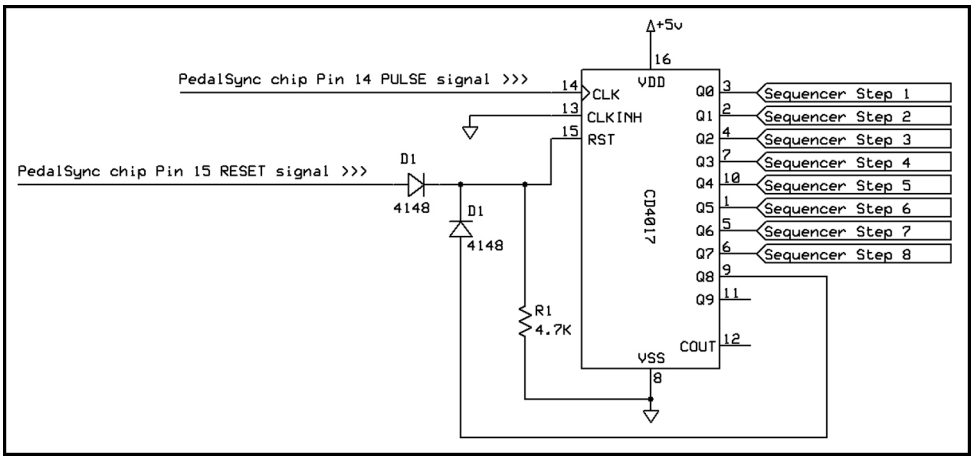
- **Pin 15 - Control Voltage (CV) Reset**

To synchronize the Reset of a sequencer circuit, connect MV-60 Pin 15 to the Reset pin of the 4017 Decade Counter chip (also pin 15).

In Tap mode, the CV Reset signal is sent upon the receipt of an initial Tap (*i.e.* the Tap Button has not been pressed for at least 2.5 seconds). As such, a single tap can reset the sequencer.

In Clock mode, the CV Reset signal is sent following each MIDI Start command.

4017 8-step Sequencer connection:



Pots

Ratio (*pin 2, pot 0 & pin 3, pot1*)

The Ratio pots multiply or divide the Output pulse speeds relative to either the incoming clock (in Clock Mode), or tap interval (in Tap Mode).

The Ratios are based on nine (9) musical subdivisions: two whole notes; whole note; half note; half note triplet; quarter note (tap speed); quarter note triplet; 8th note; 8th note triplet; 16th note. As a result, synchronized devices can switch at different yet complimentary rates.

Offset (*pin 4, pot2 & pin 5, pot 3*)

The Offset pots adjust the pulse timing against the incoming clock with up to 360 degrees of offset shift. As a result, the pulses can accent, syncopate, push the beat, or get right in the pocket.

User Interface

Program Storage

The Pulse Output chip stores 128 programs. Programs are stored by toggling the Write Switch (*pin 16*) or upon a command from the PedalSync Master Controller.

Program Recall

Programs are recalled using the PedalSync Master Controller, standard MIDI Program Change messages on Channel 15, or the PedalSync 4 Presets chip (MV-59).

On power up, the chip always loads program 1.

Write switch (*pin 16*)

It is possible to use a momentary pushbutton for the Write switch, however a toggle switch is recommended to make it difficult for users to inadvertently program a setting.

Using a toggle switch, the user will switch down then up again to write the current settings to the currently selected program. If the switch is in the down position, the user will need to go up, down, then up again.

Status LED (*pin 17*)

The Status LED is normally on. When a program is written, the Status LED will blink.

Whenever the potentiometers are not stable (*i.e.* when they are moving or have recently moved), the Status LED will turn off until they become stable again. Each pot will stabilize after approximately three (3) seconds of no motion.

Tap button (*pin 23*)

When in Tap Mode (Clock/Tap LED off), the tempo can be adjusted by tapping a momentary switch two or more times. The timing between the two most recent taps determines the tempo. The tap button times out after approximately 2.5 seconds.

A single initial tap will reset the pulses to align with the tap. This allows users sync up the pulses with a single tap or when a CV clock starts transmitting. Again, this is only in Tap mode.

The chip syncs with incoming taps, and switches from Pot to Tap mode, at the moment of the *second* tap.

The Tap button can change the *Tap Mode* output tempo while the chip is in *Clock Mode*, however changes will not be apparent until the chip is switched to Tap Mode.

Clock/Tap Mode switch (*pin 22*)

The Pulse Output timing source is selected for both outputs with a single switch:
[a] Clock, or
[b] Tap Button

When Pin 22 is grounded, Tap is selected

Disconnecting Pin 22 places the chip into Clock mode.

When a program is read from memory, the Clock or Tap Mode is recalled. If, for example, the program uses Clock mode and the pin is already grounded, the user will need to toggle the switch twice to enter Tap mode.

The program default is Tap Mode, allowing stand-alone effects that do not need an external clock signal. If the design does not use an incoming clock, the Clock/Tap pin should remain unconnected.

In Clock mode, the pulses reset upon each MIDI Start command.

Clock Mode LED (*pin 24*)

The Clock Mode LED will be lit when then Pulse Outputs are controlled by the incoming clock. When the Pulse Outputs are controlled by the Tap button this LED is not lit.

When in Clock Mode, the tempo is controlled by an incoming MIDI Clock at pin 21. If no Clock is present, the Pulse Outputs will not pulse and remain low.

Bypass buttons (*pin 7 & pin 25*)

Pressing a momentary Bypass button toggles the corresponding output pin (*12 & 26, respectively*).

The program default for the Bypass buttons is OFF. If using the PedalSync Relay Bypass chip (MV-57), this corresponds to having the device bypassed.

Bypass Output or LED (*pin 12 & pin 26*)

Pins 12 and 26 can be used to control the PedalSync Relay Bypass chip (MV-57). The program default for the Bypass Button is OFF. If using the Relay Bypass chip (MV-57), this corresponds to having the device bypassed.

Pins 12 and 26 can also be connected *via an inverter* to the Clock Inhibit pin of a 4017 Decade Counter chip to synchronize the start and stop of a sequencer circuit.

The Bypass buttons and outputs can alternately control other device features such as different signal paths.

If more than one circuit is connected to an output, be sure to use a buffer.

Control Voltage (CV) Input

In Tap Mode, a Control Voltage (CV) can be used to continuously control the tempo. Have the control voltage trigger a 4066 CMOS Quad Bilateral Switch and ground pin 23 (the Tap button input). In the alternative, consider an optocoupler or transistor design.

The ideal CV signal will have a 50% duty cycle. At the downbeat pin 23 should be grounded. If this is not the case, invert your CV signal.

The Pulse Outputs adjust immediately upon the latest tap.

Program Defaults

- Outputs Bypassed
- Tap mode
- Offset = zero
- 1:1 Ratio
- Speed - 120 bpm

MIDI - Backward Compatibility

The exclusive MIDI channel for the PedalSync system is MIDI Channel 15. MIDI Program Change messages sent on any other channel will be ignored by the chip.

The Pulse Output chip will respond to standard MIDI Start, Stop, and Clock messages.

Pin 15 sends a Reset signal each time a MIDI Start command is received.

Note: in Clock mode, the chip will not function properly outside of its 24-240 bpm range limits

Electrical Considerations

The schematic on page 10 shows the necessary connections. Note that you can use different resistors for the LEDs depending on the type of LED used, but do not exceed the current limits of the underlying chip.

If you require brighter LEDs, consider using buffers for the LEDs that connect directly to the chip, or use ultra-bright LEDs.

Place C16 as close as possible to Pin 13.

Place C2 as close as possible to Pin 20.

Place C1 as close as possible to Pins 27 and 28.

The datasheet for the underlying dsPIC33FJ64GP202 chip can be found here:
http://www.microchip.com/wwwproducts/Devices.aspx?dDocName=en532310

Pin Voltage and Current Limits

Pin	Max Voltage	Max Current*
1	5	4
2	3.3	12
3	3.3	12
4	3.3	12
5	3.3	12
6	3.3	4
7	3.3	4
8	GND	
9	3.3	4
10	3.3	**25**
11	3.3	12
12	3.3	4
13	3.3	
14	5	12
15	5	12
16	5	4
17	5	12
18	5	12
19	GND	
20	N/A	
21	5	12
22	5	12
23	3.3	4
24	3.3	4
25	3.3	4
26	3.3	4
27	GND	
28	3.3	

* 200 mA max current sink or source for the whole chip at any given time, except on the Module which is limited to ~50 mA. Keep your currents low to minimize noise.

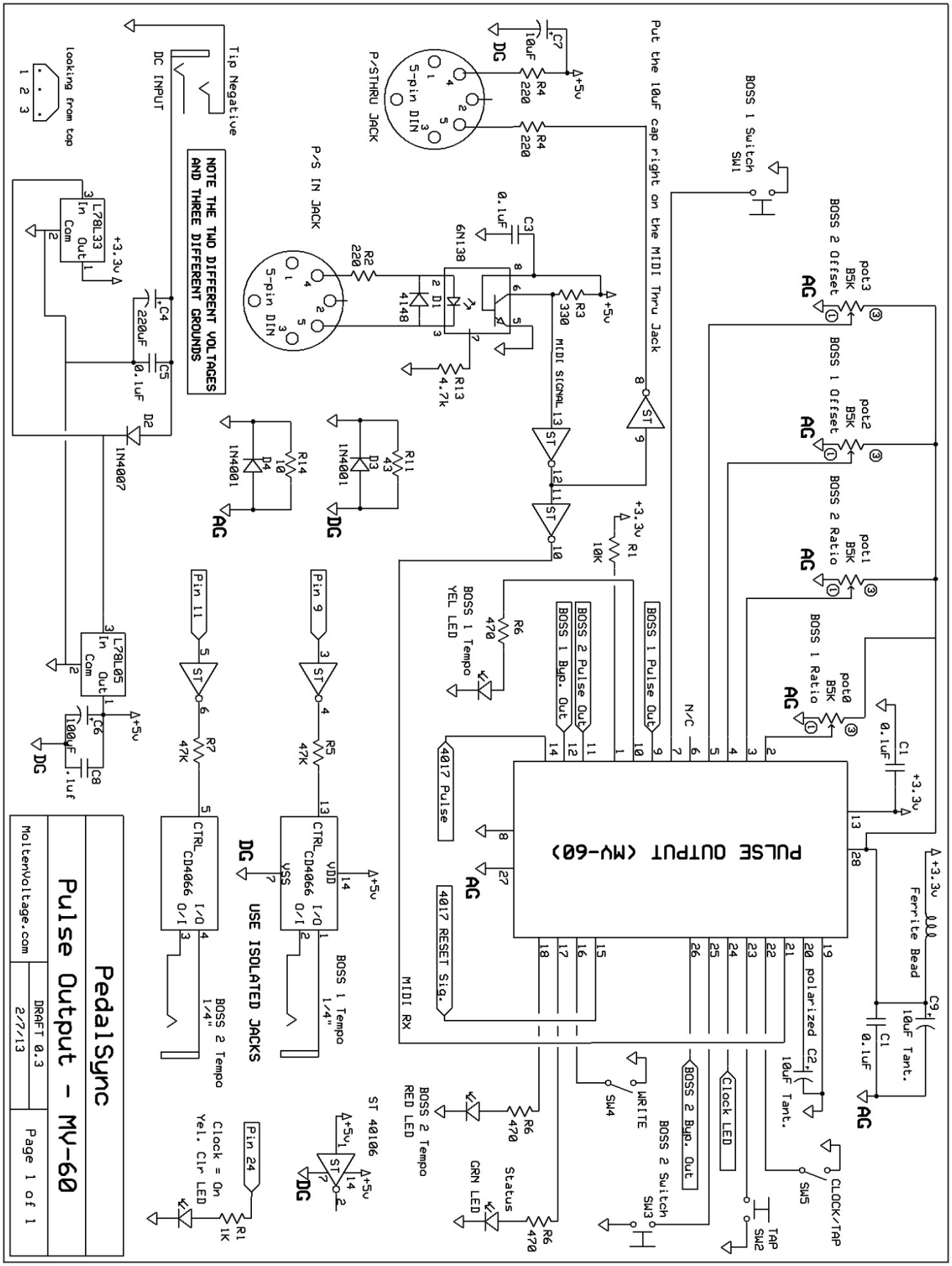
Noise

It is very important to properly filter your power supply as shown in the schematic.

To minimize digital noise bleeding into your audio circuit, be careful to run three separate grounds as indicated on the schematic.

Follow proper PCB layout design rules and isolate the digital and analog sections of your circuit as much as possible, connecting the grounds at a common point at the power supply.

The Ferrite on AVDD may not be totally necessary but will quiet down and stabilize the analog voltage. Thru hole values for ferrites are limited and may not be available beyond 800 ohms. The recommended part for SMT designs is a 2.5 KOhm Impedance 50mA Ferrite, such as Murata P/N BLM18BD252SN1D.



Related Products

- Use with 4 Presets chip (MV-59) to make a stand-alone device that can store and recall four programs.
- Use with the PedalSync Master Control Dev. Board to store 128 programs and their associated tempos
- Use with PedalSync Relay Bypass chip MV-57 or module to add silent true bypass switching

Support

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