Description

The ELM413 is both an LED controller and a circuit startup timer in an 8 pin package. The high current capabilities of its outputs allow most LEDs to be directly driven, usually only requiring a single current limiting resistor.

The circuit startup, or warmup feature is useful for allowing a stabilizing time period to pass before enabling other circuits. This type of function is often used in audio amplifier circuits where it is desirable to block the speaker outputs until the amplifier stages have stabilized. This can eliminate the annoying 'pop' occasionally heard from audio amplifiers.
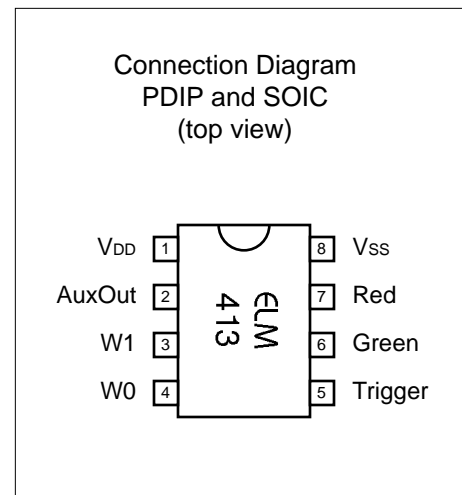
The duration of the warmup period is selected by logic levels on two input pins, providing four discrete time intervals. All circuit timing is derived from internal circuitry, and no additional timing components are required for circuit operation.
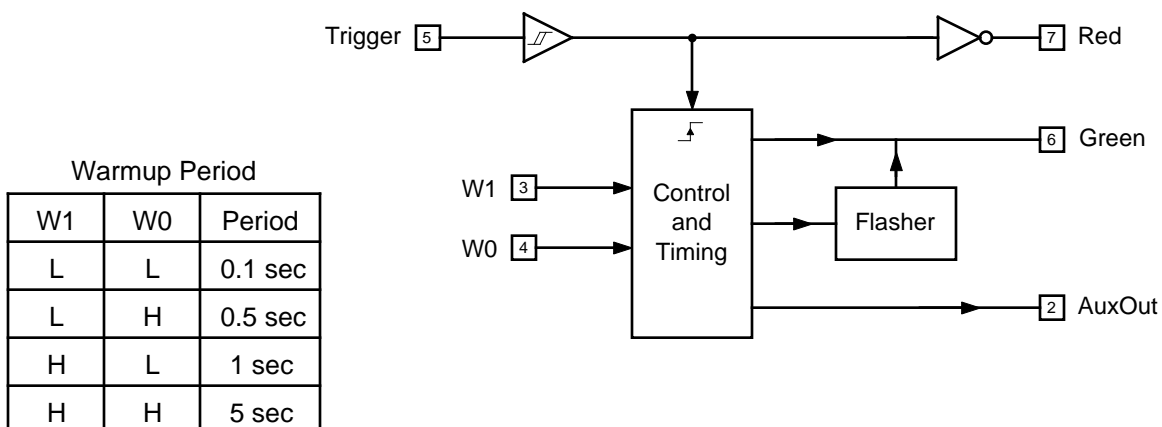
Applications

• Pilot 'lamp' circuits
• Sequentially enabled systems
• Delay on operate circuits
• Audio amplifier power managers
• Monostable (one-shot) circuits

Features

• Low power CMOS design - typically 1mA at 5V
• Operates over a supply range of 3.0 to 5.5 volts
• Schmitt trigger controlled operation
• Requires no external timing components
• Warmup periods from 0.1 to 5 seconds
• Auxiliary output active after warmup period
• High current drive outputs - up to 25 mA

Connection Diagram
PDIP and SOIC
(top view)

V_{DD}	1	8	V_{SS}
AuxOut	2	7	Red
W1	3	6	Green
W0	4	5	Trigger

ELM
413

Block Diagram

Warmup Period

W1	W0	Period
L	L	0.1 sec
L	H	0.5 sec
H	L	1 sec
H	H	5 sec

Pin Descriptions

V$_{DD}$ (pin 1)

This pin is the positive supply pin, and should always be the most positive point in the circuit. Internal circuitry connected to this pin is used to provide power on reset of the microprocessor, so an external reset signal is normally not required. Refer to the Electrical Characteristics section for further information.

AuxOut (pin 2)

This is an output signal for gating auxiliary circuits off and on. It is set to its active high level after the trigger input has been at a high level for the time determined by W1 and W0. It is forced low if the trigger input drops below the lower threshold.

W1 (pin 3), and W0 (pin 4)

These are the two digital input pins that are used to select the warmup period as shown in the chart on page 1.

Trigger (pin 5)

This is a schmitt trigger input that is used to initiate the circuit activity. A rising (low to high) edge at this pin will cause the red LED to go off, the green LED to become active, and the warmup timer to begin timing. Once initiated, pin activity is ignored until the warmup period is complete.

Green (pin 6)

This output pin signifies the power on (trigger above the threshold) condition. It becomes active once the threshold is exceeded, and remains so until the trigger resets and the warmup period is complete.

During the warmup period, this output will flash if either the 1 second or the 5 second time is selected. Flash rates are nominally 2 Hz and 1 Hz respectively. For the 0.1 and 0.5 second periods, the pin remains at a constant high level.

Red (pin 7)

This is the red LED drive output. It will be at a high level when the circuit is at idle and the trigger input is a low level. At all other times, this pin is at a low output level.

V$_{SS}$ (pin 8)

Circuit common is connected to this pin. This is the most negative point in the circuit.

Ordering Information

These integrated circuits are available in either the 300 mil plastic DIP format, or in the 200 mil SOIC surface mount type of package. To order, add the appropriate suffix to the part number:

300 mil Plastic DIP.............................. ELM413P   200 mil SOIC.................................... ELM413SM

Absolute Maximum Ratings

Storage Temperature........................ -65°C to +150°C

Ambient Temperature with
Power Applied.....................................-40°C to +85°C

Voltage on V$_{DD}$ with respect to V$_{SS}$............ 0 to +7.5V

Voltage on any other pin with
respect to V$_{SS}$........................... -0.6V to (V$_{DD}$ + 0.6V)

Note:

Stresses beyond those listed here will likely damage the device. These values are given as a design guideline only. The ability to operate to these levels is neither inferred nor recommended.

Electrical Characteristics

All values are for operation at 25°C and a 5V supply, unless otherwise noted. For further information, refer to note 1 below.

Characteristic	Minimum	Typical	Maximum	Units	Conditions
Supply voltage, V$_{DD}$	3.0	5.0	5.5	V	
V$_{DD}$ rate of rise	0.05			V/ms	see note 2
Average supply current, I$_{DD}$		1.0	2.4	mA	V$_{DD}$ = 5V, see note 3
Maximum allowable input current	-0.5		+0.5	mA	trigger input only, see note 4
Input low voltage	V$_{SS}$		0.75	V	W0 or W1
Input high voltage	4.25		V$_{DD}$	V	W0 or W1
Trigger pulse width	4			µsec	during idle periods, see note 5
Trigger input thresholds		2.8	4.25	V	transition point - rising edge
	0.75	1.3		V	transition point - falling edge
Output high voltage		4.4		V	Current (source) = 8 mA
		4.0		V	Current (source) = 13 mA
Output low voltage		0.4		V	Current (sink) = 8 mA
		0.75		V	Current (sink) = 13 mA

Notes:

1. This integrated circuit is produced with a Microchip Technology Inc.'s PIC12C5XX as the core embedded microcontroller. For further device specifications, and possibly clarification of those given, please refer to the appropriate Microchip documentation.

2. This spec must be met in order to ensure that a correct power on reset occurs. It is quite easily achieved using most common types of supplies, but may be violated if one uses a slowly varying supply voltage, as may be obtained through direct connection to solar cells, or some charge pump circuits.

3. Device only. Does not include any current supplied to external components.

4. This is the maximum allowable current through the protection diodes when applying large voltages to the trigger input (pin 5) through a current limiting resistance. With V$_{DD}$ > V$_{in}$ > V$_{SS}$, the circuit presents a typical CMOS input load.

5. The trigger input is ignored during the warmup period.

Example Application

Figure 1 below shows the ELM413 used in a typical speaker control and pilot lamp circuit for an audio amplifier. In this instance, the majority of the circuit components required are associated with the relay that is used to block the speaker outputs until the power has stabilized.

For this application, W0 and W1 are both tied to a logic high level, so the warmup period is selected to be 5 seconds. This is likely a good choice for most circuits of this type, although some may be able to use the 1 second setting.

The ELM413 has its trigger pin connected directly to Vdd, causing the circuit to sequence whenever the power is turned on. If the trigger input should be connected to another voltage source, keep in mind that a series resistor should always be used. The resistor limits current flow when either supply is at a different level than the other. Typical values would be about 100K , so that the input current shown under the Electrical Characteristics section is not exceeded.

Only one LED is used for this circuit, as a red LED would never be lit in this instance. Other applications may require that both red and green

LEDs be used, and the ELM413 adapts easily to this as it has separate outputs for both. The outputs can easily drive back to back two wire LEDs as well as the common cathode three wire types, and of course, discrete diodes. As the red and green outputs are not active at the same time, a single series current limiting resistor is usually all that is required.

The circuit shown below causes the green LED to flash for 5 seconds, followed by a steady output. If one wanted a solid output without flashing, the LED could have been connected directly to V_{DD}, or it could have been connected from V_{DD} to pin 7 of the ELM413 (with a series resistor). The latter case would likely be needed for circuits that are retriggered using pin 5, without the power being cycled.

The ELM413 is a simple yet versatile circuit that is convenient and easy to use. Other uses would include generating pulses from a trigger input, or connecting several in series to generate sequential events…
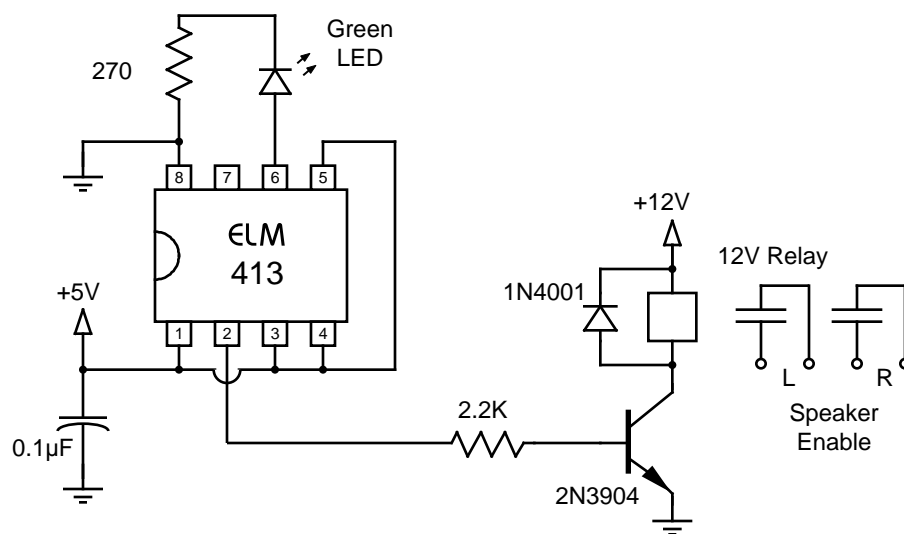

Figure 1. Typical Speaker Control Circuit