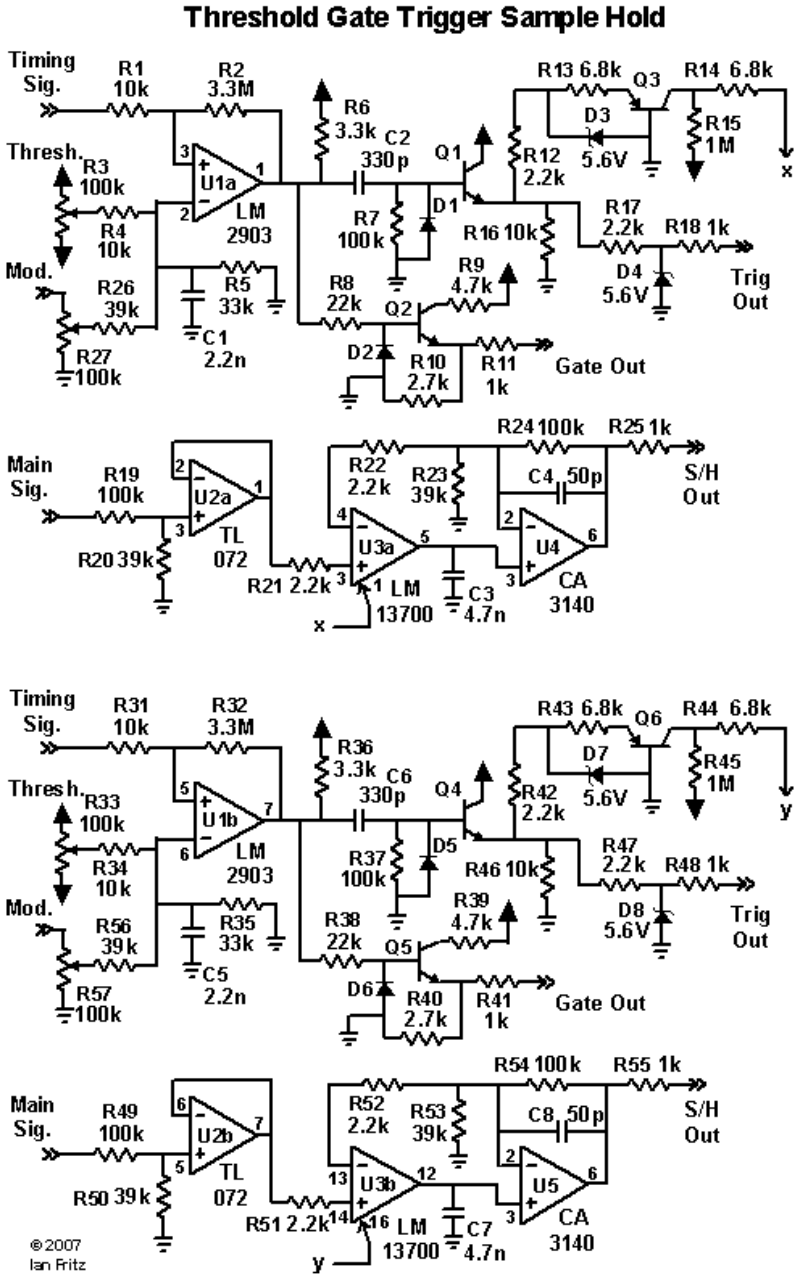
Threshold/Gate/Trigger/Sample/Hold Circuit

Ian Fritz, June 2007

This is a circuit that combines two important synthesizer functions. It produces trigger and gate signals whenever a "timing" signal input crosses a user-defined threshold. At the same time, the trigger pulse fires a high-performance sample-and-hold circuit that samples a second "main" signal input. Two of these circuits are contained on a single board.

Schematic:



Component List:

ICs:

U1	LM2903 (or equivalent) dual comparator
U2	TL072 (or similar) dual opamp
U3	LM13700 OTA
U4, U5	CA3140 (or other low bias-current opamp)

Transistors:

Q1, Q2, Q4, Q5	2N3904 NPN (or similar)
Q3, Q6	2N3906 PNP (or similar)

Diodes:

D1, D2, D5, D6	1N4148 (or similar) switching diode
D3, D4, D7, D8	1N752A (or equivalent) 5.6 V Zener diode

Resistors (all metal film 5%):

R11, R18, R25	1 kOhm
R41, R48, R55	" "
R12, R17, R21, R22	2.2 kOhm
R42, R47, R51, R52	" "
R10, R40	2.7 kOhm
R6, R36	3.3 kOhm
R9, R39	4.7 kOhm
R13, R14, R43, R44	6.8 kOhm
R1, R4, R16	10 kOhm
R31, R34, R46	" "
R8, R38	22 kOhm
R5, R35	33 kOhm
R20, R23, R26*	39 kOhm
R50, R53, R56*	" "
R7, R19, R24	100 kOhm
R37, R49, R54	" "
R15, R45	1 MOhm
R2, R32	3.3 MOhm (carbon film OK)

Pots:

R3, R27*, R33, R57*	100 kOhm

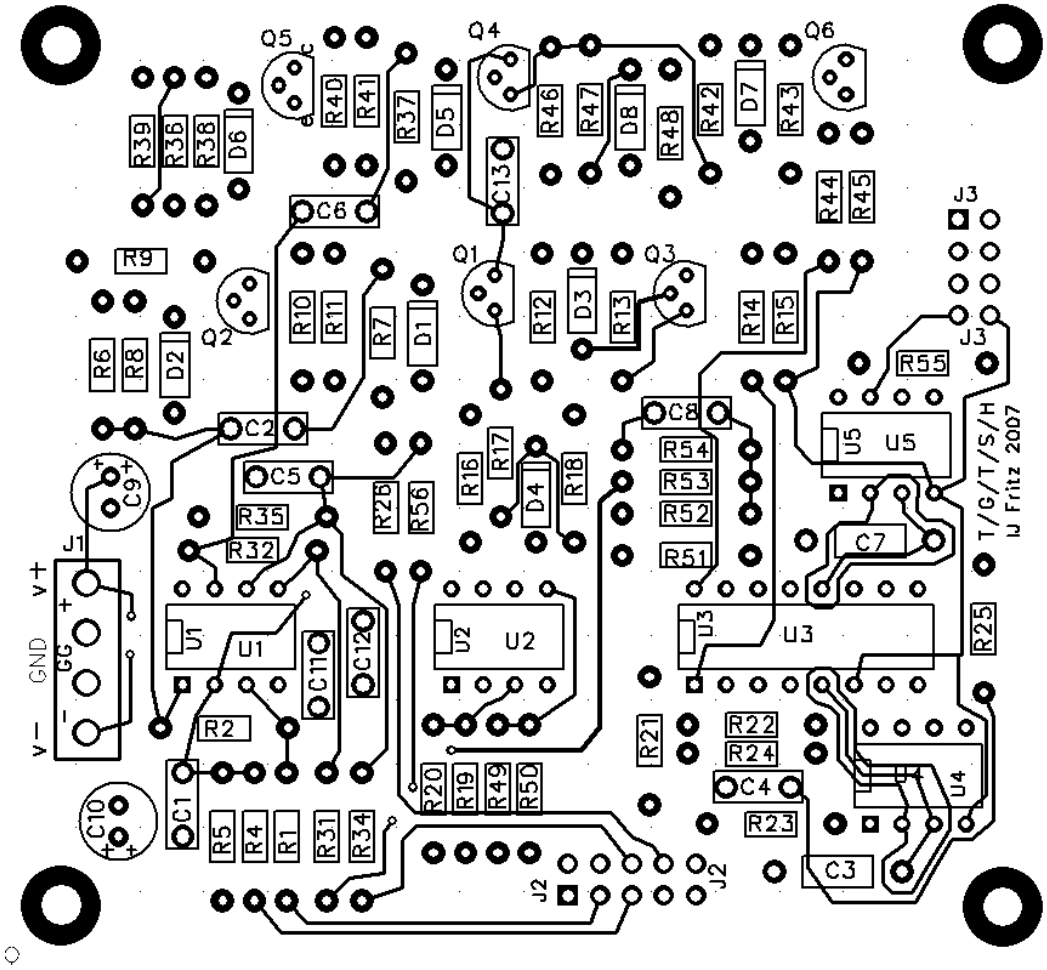
Caps:

C4, C8	50 pF 10% ceramic or poly
C2, C6	330 pF 10% ceramic or poly
C1, C5	2.2 nF 10% ceramic or poly
C3, C7	4.7 nF 10% polystyrene
C11, C12, C13	.1 uF ceramic or poly bypass (not on schematic)
C9, C10	4.7 uF electrolytic bypass (not on schematic)

* Optional components for threshold modulation.

Circuit Board:

The board is double sided with overall dimensions of 3.25" x 3.0". The mounting holes are spaced by 2.95" and 2.7". Component placement is indicated on the following drawing:



I/O Connector J2 Pinout:

Pin#	Connection	Pin#	Connection
1	Main Sig. 1	2	Main Sig. 2
3	Timing Sig. 1	4	Timing Sig. 2
5	Threshold 1: R3 (2)	6	Threshold 2: R33 (2)
7	Gnd: R27 (3), R57 (3)	8	Modulation 1: R27 (2)
9	Gnd	10	Modulation 2: R57 (2)

I/O Connector J3 Pinout:

Pin#	Connection	Pin#	Connection
1	Gate Out 1	2	Gate Out 2
3	Trig. Out 1	4	Trig. Out 2
5	S/H Out1	6	S/H Out2
7	+12V: R3(1), R33(1)	8	-12V: R3(3), R33(3)

Note: On pots, (1) is CW, (2) is slider, (3) is CCW

Notes:

1.) Power: The circuit was developed with +/-12 V supplies, and +/-15 V should work fine also.

2.) The modulation inputs (Mod) are optional. Because of the passive mixing of this input, the Mod and Thresh controls interact, and the modulation depth is somewhat limited. Just leave out the components listed with a "*" if modulation is not desired. The connections from the Mod In connectors to R27 and R57 (terminals 1) are to be made on the front panel.

3.) With the recommended IC's this circuit has a very small droop rate of under 2 mV/sec and can sample at rates up to over 10 kHz. Good performance is still obtained if the LM2903 comparitors are replaced with with TL072 opamps. The CA3140 mosfet-input buffers can be replaced with low input-bias opamps. With OPA134's, the droop rate is increased to ~12 mV/sec. Expensive opamps with input bias currents under 10 pA make satisfactory substitutes, but at present the CA3140 is still in production and only costs around $1.

4.) The large polystyrene storage caps C3 and C7 may not fit well physically. You can mount them beneath the board or leave the leads long enough to allow enough sideways motion to get the chips in their sockets. The second board version has more space.