K9IVB Version Of Sam Wetterlin Calibration Source

This is a brief response to a Yahoo Group Softrock 40 Post referring to one of Sam's original designs.

I have Modified the PCB to fit my needs and posted a link on OSH Park website for sharing the Gerbers or ordering boards.

I have been quite busy and will not get time to assemble my boards until mid September.

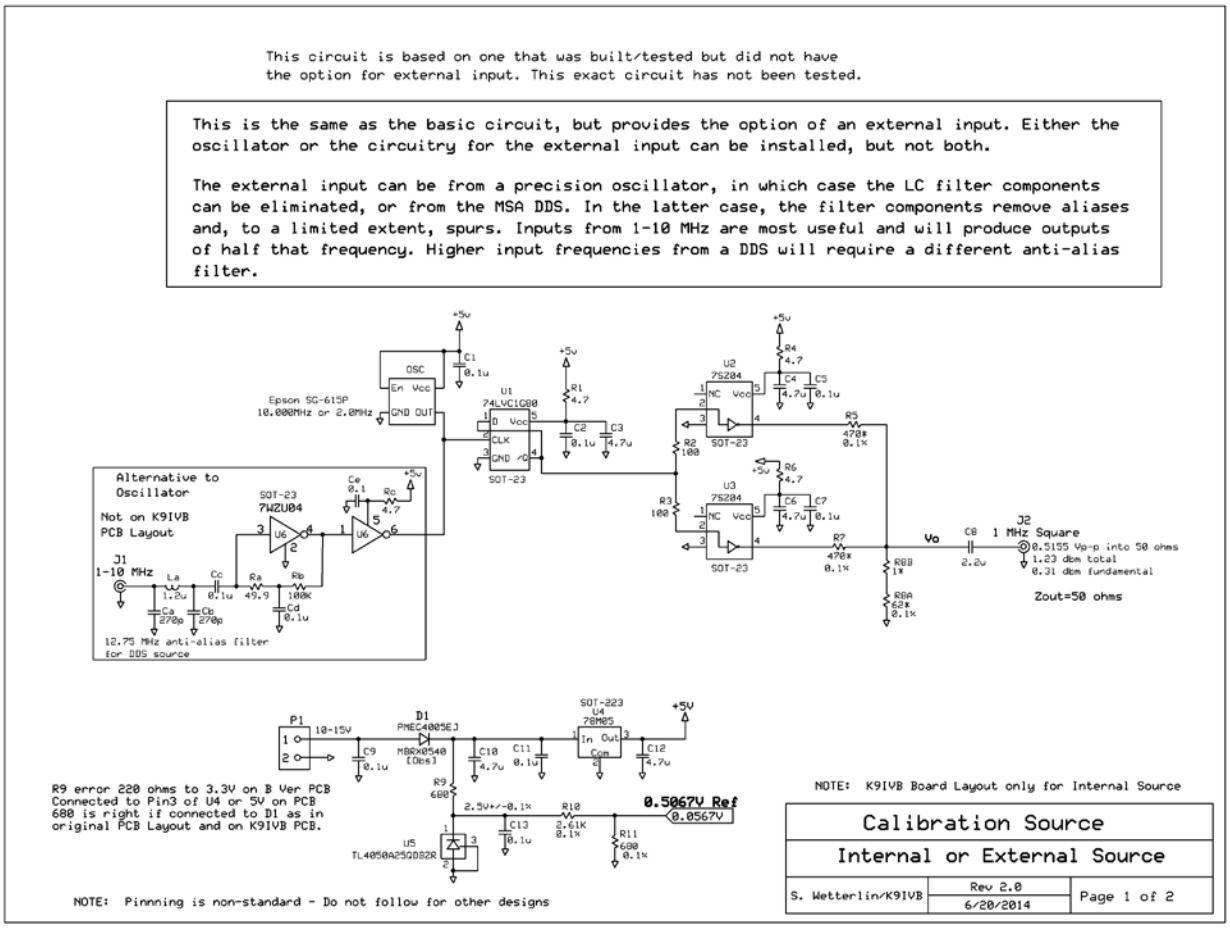
After finishing my build I will update this document.

What Follows is the revised Schematic and BOM.

The OSH Park link is:

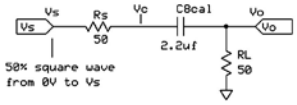
https://oshpark.com/shared_projects/u258Y6mg

Dick K9IVB



## Therory behind using DC output voltage to determine AC peak-to-peak output

The ideal square wave from the inverters, combined with their actual output impedance and the voltage divider at the output can be combined into a Thevenin equivalent voltage source driving a 50-ohm resistor to the output. (50-ohms is accurate so long as the inverter output impedance is in the range 0-30 ohms.)




DC Analysis: Average value of Vo will adjust so that current inflow through Rs during square wave peak will equal current outflow through Rs during square wave 0V value. Due to 50% duty cycle, the DC value of Vc will equal Vs/2. This value is independent of RL.

AC analysis: Vo will always equal Vs/2 because Rs=RL.

Therefore square wave peak-to-peak = DC value at Vc

## Calibration Procedure (Use any voltmeter with 5% or better accuracy and 1 mV resolution.)

Determine the DC voltage at Vo by measuring the difference between the voltage reference and Vo. Call that voltage Vdc. Vdc will also turn out to be the peak-to-peak square wave voltage for a 50-ohm load. The stated output levels assume Vdc=0.5155V. Determine the deviation of your Vdc from 0.5155V in millivolts. For each millivolt of deviation adjust all the output values stated in dbm by 0.017 dbm. (This is accurate for deviations of a few percent.)

The adjustment is positive if Vdc>0.5155; otherwise it is negative. Round results to nearest 0.1 dbm.

As a precaution against the possibility that a voltmeter may give an inaccurate DC reading due to the presence of an AC signal, the output can be shorted at the right side of C8.

| Calibration Source | | |
|---|---|---|
| Analysis and Calibration | | |
| SEW | Rev 1.0<br>7/7/2008 | Page 2 of 2 |

# Cal Source BOM

| REF Des | Value | Description | Mfg | Mfg # | Pkg | Mouser | Qty |
|---|---|---|---|---|---|---|---|
| 1 MHz Square | J2 | | | | | | |
| 1-10 MHz | J1 | | | | | | |
| C1, 2, 5, 7, 9, 11, 13, Ce | 0.1u | 0.1uF 50volts X7R +/- 10% | TDK | CGJ4J2X7R1H104K | 0805 | 810-CGJ4J2X7R1H104K | 8 |
| C3, 4, 6, 10, 12 | 4.7u | Multilayer Ceramic Capacitors MLCC - SMD/SMT 4.7UF 50V 10% 0805 | TDK | C2012X6S1H475K125AC | 0805 | 810-C2012X6S1H475KAC | 5 |
| C8 | 2.2uf | Multilayer Ceramic Capacitors MLCC - SMD/SMT 0805 2.2uF 50volts X7R 10% | TDK | C2012X7R1H225K125AC | 0805 | 810-C2012X7R1H225K | 1 |
| Ca, Cb | 270p | Multilayer Ceramic Capacitors MLCC - SMD/SMT 0805 270pF 50volts C0G 1% | Vishay | VJ0805A271FXACW1BC | 0805 | 77-VJ0805A271FXACBC | 2 |
| Cc, Cd | 0.1u | Multilayer Ceramic Capacitors MLCC - SMD/SMT 0805 0.1uF 50volts X7R 5% | AVX | 08055C104JAT2A | 0805 | 581-08055C104J | 2 |
| D1 | MBRX0540 | Schottky Diodes & Rectifiers 40 V 0.5A | Vishay | | SOD-323 | OBS | 0 |
| D1 | | Schottky Diodes & Rectifiers 40V 0.5A | NXP | PMEG4005EJ,115 | SOD-323 | 771-PMEG4005EJ-T/R | 1 |
| La | 1.2u | Fixed Inductors 1200 nH 2% | KOA | KQ1008TTE1R2G | 1206_1008 Combo | 660-KQ1008TTE1R2G | 1 |
| OSC P1 | Epson SG-615P | Standard Clock Oscillators 2MHz 5Volt 100ppm -20C to | Epson | SG-615P2.0000MC3:ROHS | | 732-SG615P2.0MC3RS | |
| R1, 4, 6, Rc | 4.7 | Thick Film Resistors 1/8W 4.7ohm 1% | Yageo | AC0805FR-074R7L | | 603-AC0805FR-074R7L | 4 |
| R2, 3 | 100 | Thick Film Resistors 1/8W 100ohm 1% | Yageo | AC0805FR-07100RL | | 603-AC0805FR-07100RL | 2 |
| R5, 7 | 470* 0.1% | Res 0.1% - SMD 0805 1/8W 470 ohms | Panasonic | ERA-6AEB471V | 0805 | 667-ERA-6AEB471V | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| R9, 11 | 680 | Thick Film Resistors 0805 680ohms 1% Tol | Panasonic | ERJ-6ENF6800V | 0805 | 667-ERJ-6ENF6800V | 2 |
| R10 | 2.61K 0.1% | Res 0.1% - SMD 0805 1/8W 2.61K ohms 25ppm | Panasonic | ERA-6AEB2611V | 0805 | 667-ERA-6AEB2611V | 1 |
| R11 | 680 0.1% | Res 0.1% - SMD 0805 1/8W 680 ohms | Panasonic | ERA-6AEB681V | 0805 | 667-ERA-6AEB681V | 1 |
| R8A | 62* 0.1% | Res 0.1% - SMD 0805 1/8W 62 ohms | Panasonic | ERA-6AEB620V | 0805 | 667-ERA-6AEB620V | 1 |
| R8B | 1* 0.1% | Thin Film Resistors - SMD CHIP RESISTOR - Precision 1 ohm .0.25% 25ppm | Bourns | CRT0805CY1R00ELF | 0805 | 652-CRT0805CY1R00ELF | 1 |
| Ra | 49.9 | Thick Film Resistors 0805 49.9ohms 1% Tol | Panasonic | ERJ-6ENF49R9V | 0805 | 667-ERJ-6ENF49R9V | 1 |
| Rb | 100K | Thick Film Resistors 1/8W 100K ohm 1% | Yageo | AC0805FR-07100KL | 0805 | 603-AC0805FR-07100KL | 1 |
| U1 | 74LVC1G80 | | | 74LVC1G80 | SOT23-5 Thin Leads | | |
| | | Flip Flops SNGL Pos Edge Trigrd DType FlipFlop | TI | 74LVC1G80DBVRG4 | SOT-23-5 / DVB | 595-74LVC1G80DBVRG4 | 1 |
| | | Flip Flops 3.3V D FF +EDGE TRIG | NXP | LVC1G80GW125 | SOT-353 / TSSOP-5 | 771-LVC1G80GW125 | |
| U2, 3 | 7SZ04 | | | | SOT23-5 Thin Leads | | |
| | | Inverters UHS Inverter | Fairchild | NC7SZ04M5X | SOT-23-5 | 512-NC7SZ04M5X | 2 |
| | | Inverters 1.65-5.5V CMOS Single | ON Semi | NL17SZ04XV5T2G | SOT-553-5 | 863-NL17SZ04XV5T2G | |
| U4 | 78M05 | Linear Voltage Regulators 5.0V 500mA Fxd Pos | TI | UA78M05CDCYR | SOT-223-4 | 595-UA78M05CDCYR | 1 |
| U5 | 2.5V Ref | Voltage References 2.5V 0.1% precision | TI | TL4050A25QDBZR | SOT-23-3 | 595-TL4050A25IDBZR | 1 |
| U6 [Ua] | 7WZU04 | | | | SOT-23 6 pin | | |
| | | Inverters 1.65-5.5V CMOS Dual Unbuffered | On Semi | NL27WZU04DFT2G | SC−88 / SOT−363 / SC−70 | 863-NL27WZU04DFT2G | |
| | | Inverters UHS Dual Unbuff Inv | Fairchild | NC7WZU04P6X | SC-70-6 | 512-NC7WZU04P6X | 1 |