1S2 calibration, as correction next to the original manual

1: powersupply

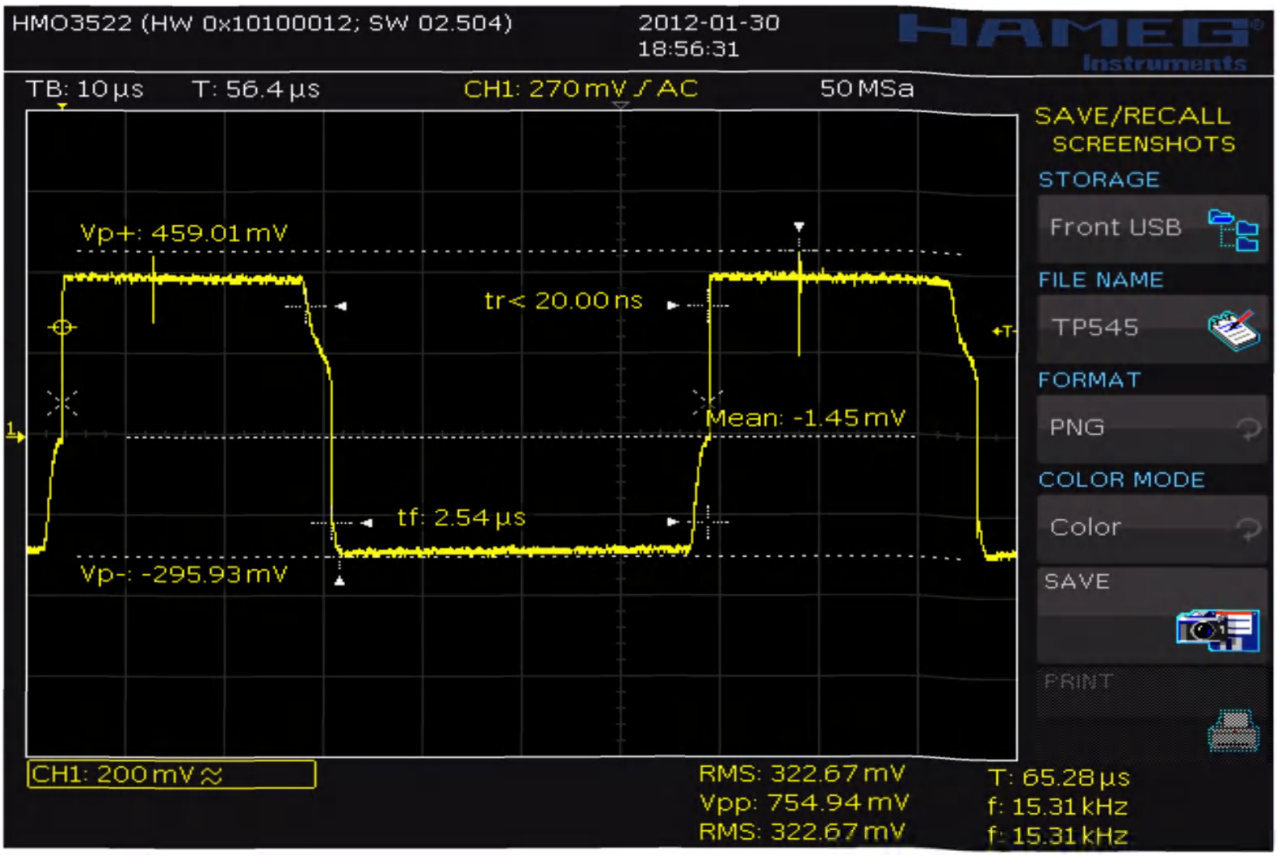
- TP829: + 19V 10 mV rimple
- TP869: – 19V R867 10 mV rimple
- TP889: –136V R887 5 mV rimple

2: tunnel diode bias

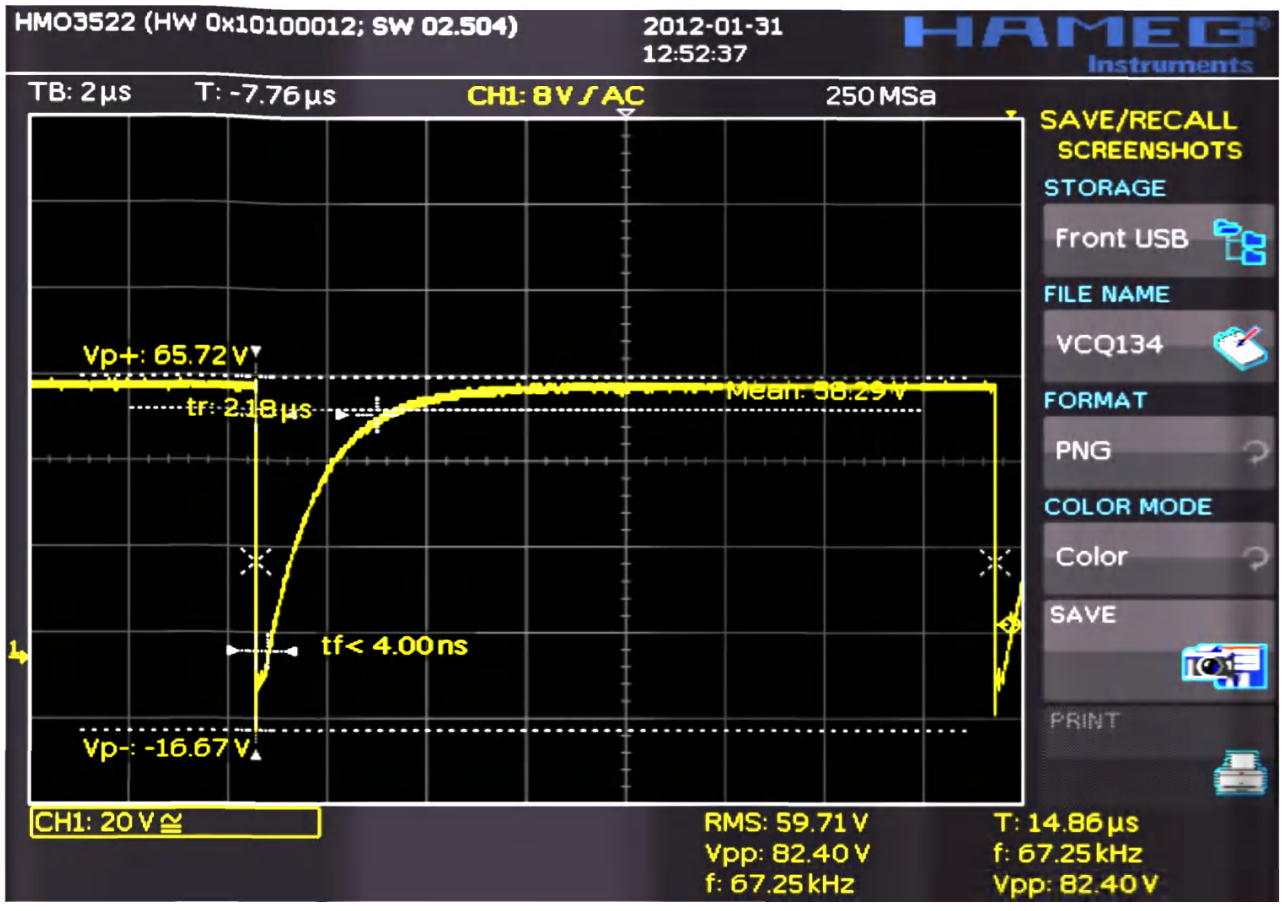
Display mode NORMAL
patch from HORIZ OUT to 547(or other 5XX) 10x horizontal in

- UHF sync or trigger sense clockwise
- adjust trace for 10,4 cm length on screen 547
- turn until trace disappears (in mid position)
- TP545 : R544 Control TD bias until trace re-appears
- On TP545 there is a squarewave, (10 uS long from +200mV to +800mV)
- turn 30 degrees CCW (reacts with step 3 after this)
- some scopes have real trouble triggering on this, especially if AVALANGE VOLT is way off. Start with a slow timebase to capture the transients, find a stable trigger and choose step by step a faster timebase. This is the most important part.
- If you have this right you can adjust avalanche Volts a bit until you get a trace again. But use a scope and measure the ramp at R134/C136/C134. Adjust it for 65Vpeak. Do not turn it blind.

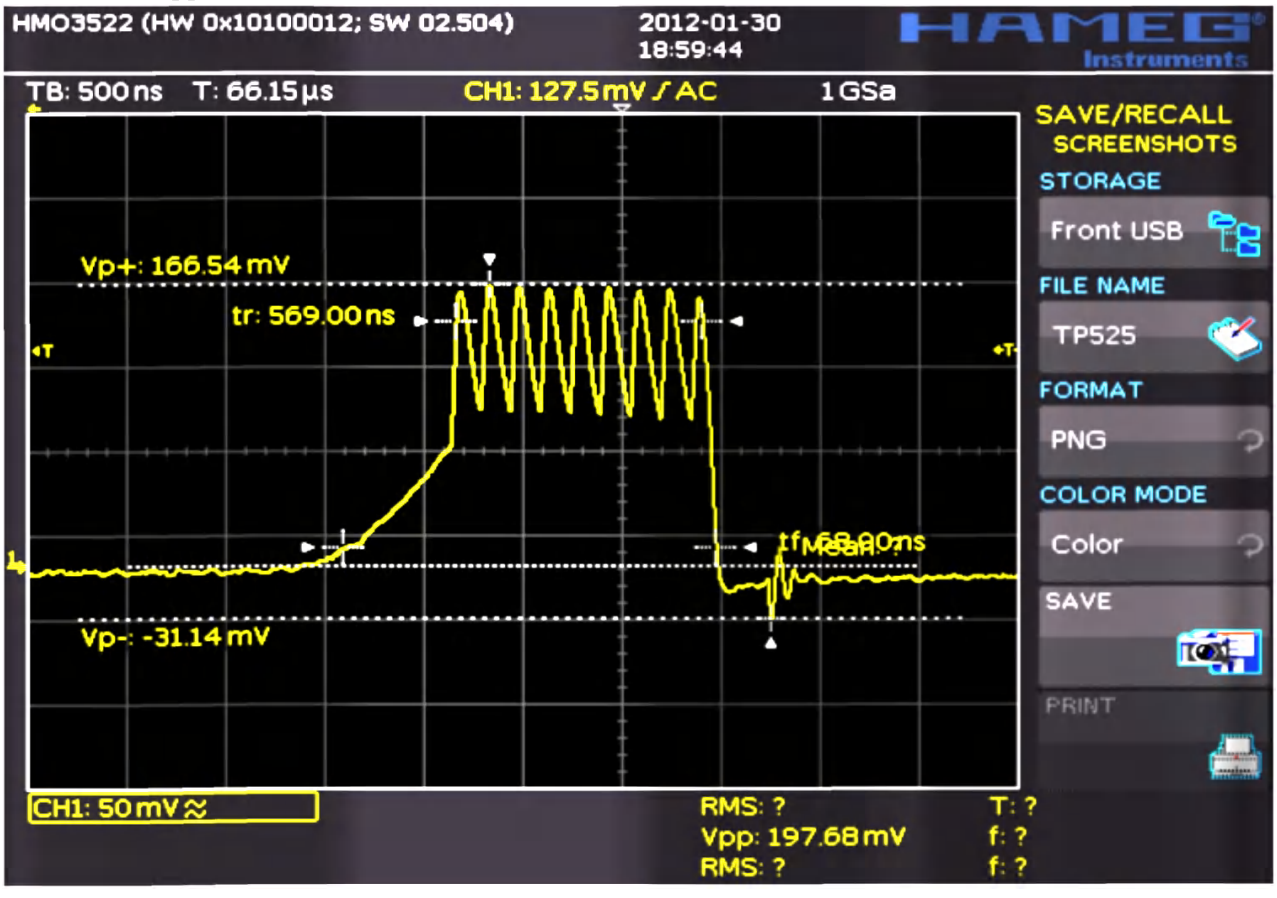
Signal at TP545 down here:



This is the signal you want at the collector of Q134 Avalanche voltage. Look for this if you have no trace or can not get the signal for TP525.



3:internal trigger level



- TP525, square with small ramps on top, 0,2uS/div 5mV/div 10:1 probe
- UHF sync or trigger sense CCW
- R523 int trigger level : 8-12 ramps
- UHF sync or trigger sense CW, number of ramps must stay the same. (interaction with R544 from step 2)

4: UHF sync sensitivity
Mode: UHF SYNC
UHF sync or trigger sense CCW still at TP525

- Turning this knob should give changes in period time and/or change the number of ramps. They increase when you turn the UHF sync or trigger sense CW.
- Optimize for max peaks and longest base period time using R481 UHF sync sensitivity.

5: manual scan
Display mode: MAN

- TP673 , 10:1, 500mV/div DC, in normal mode you see a negative going ramp, see picture on schematic. in manual mode you adjust it by hand.
- rotate MANUAL SCAN from CW to CCW, this should be a 7Volt deviation
- rotate MANUAL POSITION CONTROL complete CCW, this will also give 7Volt.
- If you rotate them both you get 14V deflection.

6: Sweep duration
Display mode: NORMAL
centre tip potmeter **magnifier control**: 10:1, 5mS/div, 2V/div DC, trace shows -1V (+/-0,1V)

- R787 Sweep length : 9,4 V and about 12 mS. Figure 7-10 in manual.
- Use TP783 while adjusting R787, this shows the picture (5V/div, 5mS/div) for the upgoing ramp -0,9 tot + 9,4V like the text tells.

7: Single sweep

- TP783, resolution HIGH, ramp should now be 800mS. I measured 1 second.
- Mode: SINGLE SWEEP: press start, every time pressed so see one sweep, so one ramp.

8: Inverter zero
Display mode: NORMAL
manual scan: CW
mode: EXT TRIG
UHF sync: CCW
magnifier X 100
variable CW
DISTANCE
resolution NORMAL
Dielectric :PRESET en CW

- 50 ohm terminator in top thru
- place start trace at 1cm gratitude
- short magnifier variable control mid contact to gnd
- R681: 0V between point AE and AH but TP674 can be used for this.
- Remove short and put magnifier **variable** to **cal** position

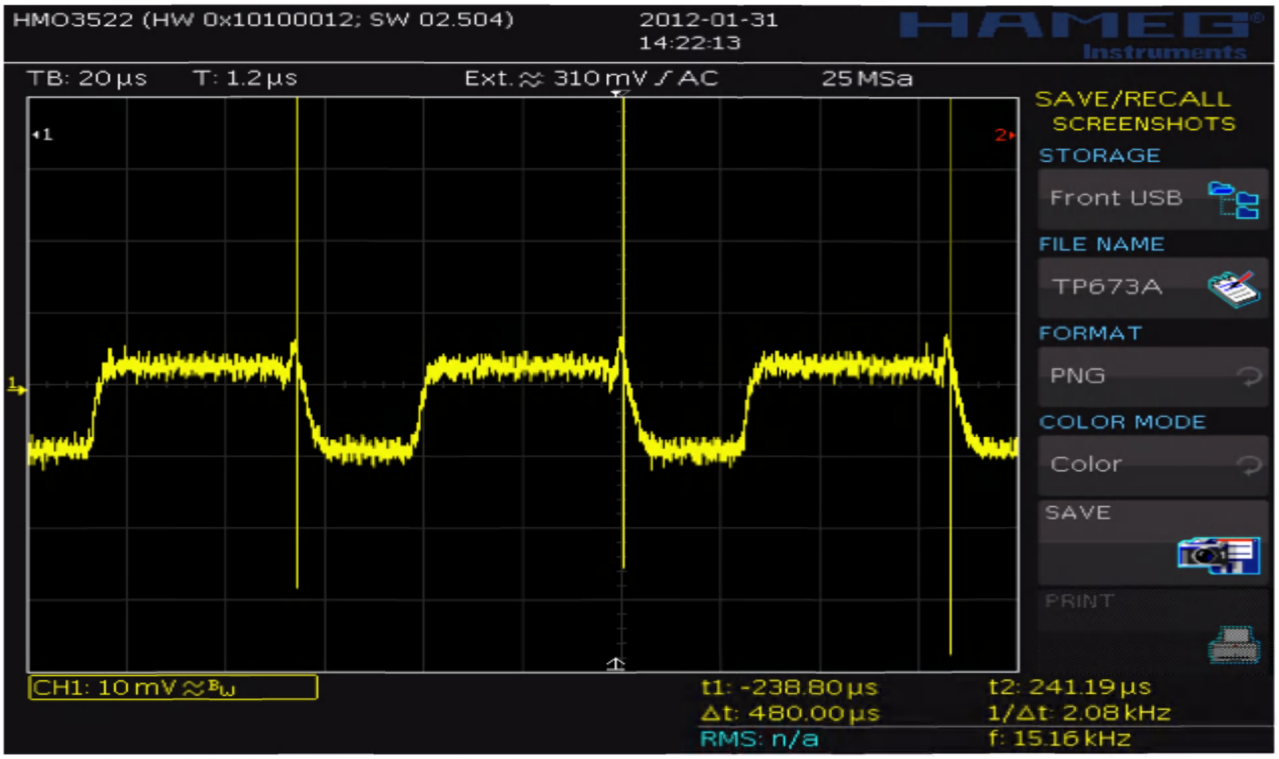
9: comprator firing level

mode : MANUAL

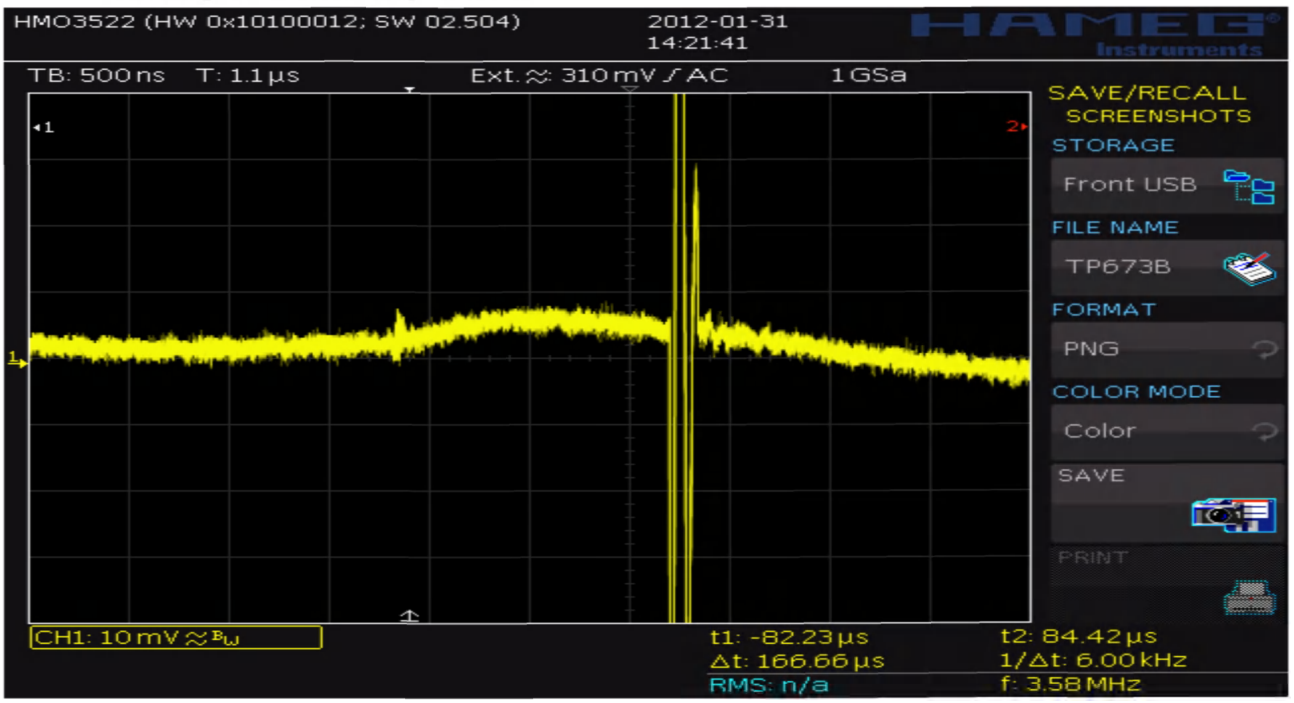
manual scan: CCW

range 1KM, 10 uS, TIME

- TP673: 10:1, AC 20uS/div
- TP545: 1:1 to external trigger DSO
- R677 CCW, then CW until spike appears on most right side square
- turn CW until it jumps a bit to the left, turn CCW until it jumps back to the right.



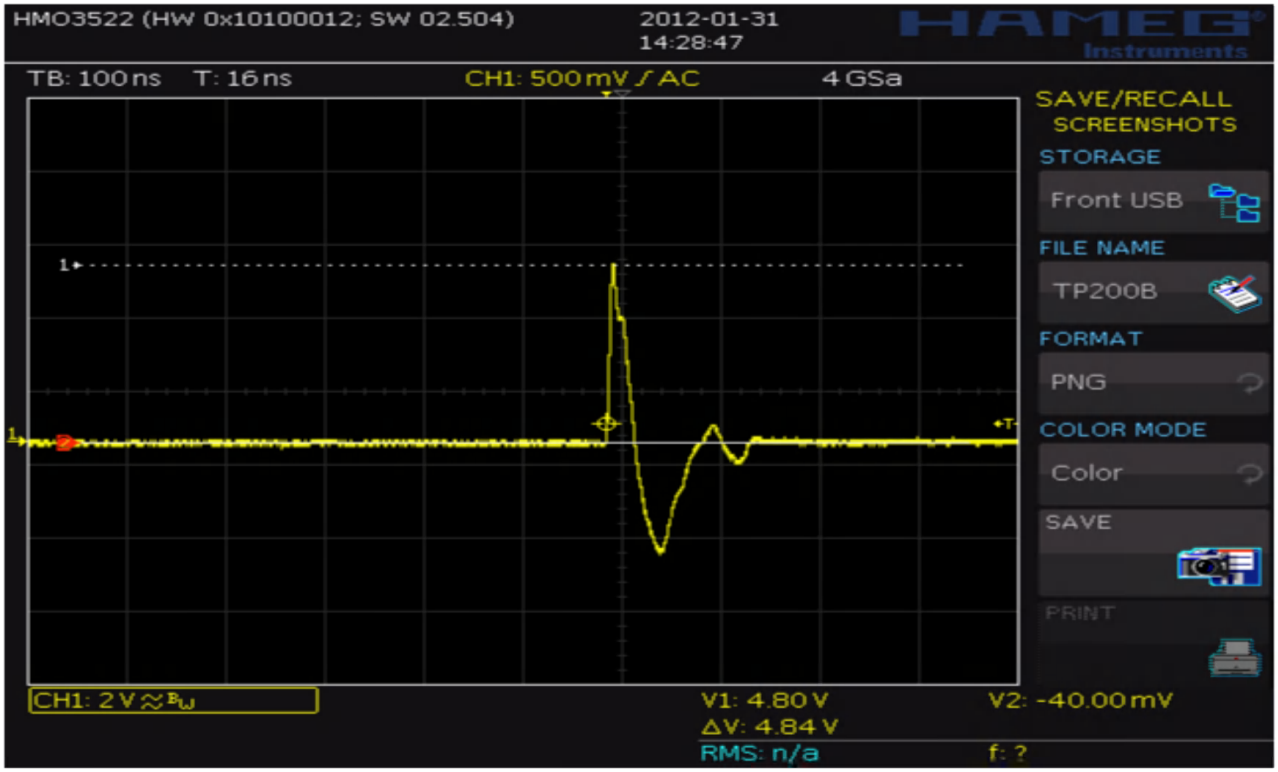
- Zoom in to see the spike and fine adjust :
- turn 10 degrees CCW until spike sits just right from the top of the bump you see while zooming in. look at the picture below.



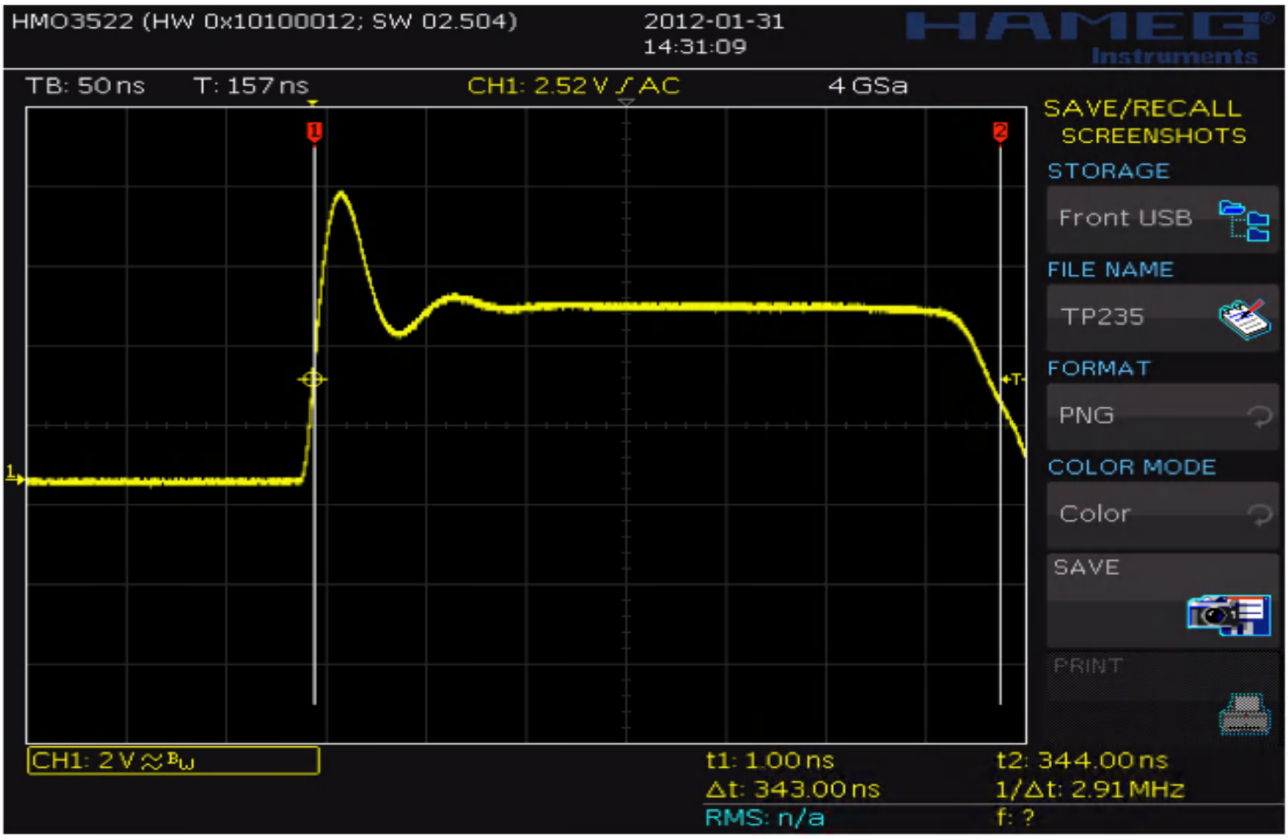
10: memory gate width

Display mode NORMAL

- TP200: 10:1, 100nS/div: spike 3V positive en 2,5V negative (much higher on +100MHz BW scope)



- TP235: measure at 50% amplitude 2V/div, 340nS pulse width (delta 30 nS)



vertical .5V/div
Display mode Normal
manual scan CW
mode: .25V int pulse
UHF sync midrange
magnifier X1
range 10 uS 1 KM
position 000
Time and Volts
resolution Normal

11:Bridge volts

- 10:1, 0.5V/div, DC
- measure between gnd and plus bridge volts RED, 2,4 to 3V
- measure between gnd and min bridge volts BLACK , 2,4 to 3 V

12 bridge balance

- 10:1 probe to X1 offset output jack, adjust OFFSET until you measure zero volt
- TP268, memory output DSO: 5V/div, 2mS/div
- R131 and R140 possible screw up all done before only do this if nothing else works and the unit is way off, final adjustment for these points are done at the end. But if you mess up now the pulsers won't work and you can not adjust them. Sort of endless loop problem because after the alignment for max Tr in the end when you have both good they redirect to do point 12 and 13 again ???
  These resistors regulate the heart of the system. A slewed pulse is fed to a Avalanche transistor. It's avalanche level is set by R131, that discharges a diode that is charged to a level by R140. This forms a fast pulse that bring the tunnel diodes in conduction. The pulse from TP545 is the time the avalanche transistor keeps going. If the level R131 is wrong he does not fire or keeps on going. TP525 has the cams that trigger the transistor during that period.
  That is, as far as I understand it ;-)
- rotate VERTICAL UNITS/DIV to .005 and adjust R360 bridge balance for no level change on DSO screen. Not all positions. Only the two extremes.

13: memory gate balance

- 10:1 probe at X1 OFFSET OUTPUT, check zero volt again
- TP268 again, R247 for no trace shift on the DSO when switching between p and volts

14:variable balance and offset range

- still 10:1 probe check zero volts at X1 offset
- TP268 just for monitoring: look at trace at 547 and adjust R396 to centre the trace on the 547 crt
- rotate VERT UNITS VARIABLE and adjust R388 for no trace shift on 547 crt
- centre trace again by R396

15: volts calibration

mode EXT TRIG

- terminate low thru
- connect 50 KHz squarewave generator, 2Vt to upper thru. Mark the positions from Avalance volt and snap off current. You might have to adjust them, a bit to get a nice square.

- connect trigger out from generator to ext trigger input connector 1S2
- 10:1 to VERT OUTPUT jack
- trigger 1S2 for a vertical transition near vertical centreline
- R356 adjust so there is 4V on the DSO

16 vertical gain
- adjust UHF SENSE or TRIGGER SENSE for stable picture on 547
- position display vertical to centre
- rotate front panel VERT GAIN for exact 4 divisions

17 ,18, 19 checks of accuracy, see manual for tables and Tek 184 settings, no adjustments here.

HORIZONTAL GAIN PART

Vertical unit/div .5V
Display mode NORMAL
manual scan CW
mode EST TRIG
UHF sync/trigger sense: CW
X1, 10uS/1KM
TIME/VOLTS
resolution: HIGH
need: square wave 5Vtt 1 KHz is OK
need: Tek 184 or other time mark generator
markers at 1uS and trigger at 1 uS

20: sampler ramp and timing
- 5Vtt square to the x10 horizontal input of 547 indicator scope
- you see two vertical dotted lines and adjust the 10-1 variable control of the 547 to get 5 divisions between the dotted lines. Do not move that knob after this step. I think a better way is to make a voltage divider in the plugin just before the output and adjust that while the scope potentiometer is turned for max deflection. That saves you time the next time you use the 1S2
- connect plugin horizontal out to scope horizontal in.
- Connect 184 time marker output to upper thru
- connect trigger out from the 184 to ext trigger input on 1S2
- terminate lower thru with 50 ohms
- now they want you to mess up R677 from step 9.
- Display mode NORMAL, resolution HIGH, adjust UHF SYNC for stable picture
- R588 sampler ramp timing , 1 marker/div
- resolution NORMAL: range .1uS/10m and 184 for 10nS signal
- C585B for one cycle/div
- range 1uS/100m, 184 at 0.1uS markers: check one marker/div, no adjustment possible

21, 22: just checks, no adjustments, see manual for tables

23: position calibration
range 10uS/1km
timemark generator 5uS markers, 10 uS trigger
- set first marker to 1cm division using the POSITION knob

- note reading from dial
- turn position 5 major turns CCW
- R661 place time mark at 1cm gratitude
- if the first step gives you f.i. 3.4 you should see a marker at 8.4. this makes the movement of the dial so that 1 major turn is 1 cm on the gratitude
- timemarkgenerator at 1 uS, position at 000, turn until the first marker hits the 1 cm division. Note the position. Every major turn there should be a next marker at the 1cm division line.

25: dielectric accuracy
not adjustable, see manual for test values.

vertical units 0.2
display mode: normal
manual scan CW
mode: int pulse 1V
X100, 1uS/100m TIME/P
resolution Normal

while adjusting the pulse, or better, step generators all things influence each other. You constant have to tweak avalanche, snap off, stability and C128 to get the best steprespons. First mark the start position so you can always find it back. If you lose pulse while heating op you can adjust R428 The manual does that with a heatgun, see point 30, I just did it by trial and error.

Connect the 1V pulse source with thru channel, terminate unused channel with 50 ohm
- R411, frontpanel 1V stability for positive step
- R621, pulse position, place pulse on the gratitude if it is outside
- pull one end of through cable, base line level should not move
- R443 for correcting movements

27: check 1V pulse rise time.
- 0.2V, X100, variable vertical for 5 divisions of puls
- Tr must be < 1.1 nS at 10-90% points

28: 1.0V p calibration.
- 10:1 probe to VERT OUT connector 1S2
- set by R351, some explanation:
- I set the unit/div on 0.5 We know 50 ohm is zero, short is -1 and open is +1. So we want a step that is 2 division high with the terminator on. If we remove the terminator the short should be the baseline and without the terminator it should be 4 divisions. After this check it in the 0.2 position the terminated step is 5 positions.

29 check pulse jitter, max 20 pS no adjustments

30: 0.25V pulser stability and start level
X10, mode 0,25V, vertical 0.2 unit/div, p
connect .25V pulser to thru instead of 1V pulser
- set offset to see a trace, centre pulse
- 50ps stability control on front for positive step. Set it halfway between positions the step disappears.
- R439 to adjust if baseline jumps if through cable is disconnected
- if pulse races by when scope is hot, heat plates behind int puls connector with heat gun and

adjust R428 to return pulse to screen. (temp compensation)

- cool plates and re-adjust stability control
- have to do this several times to get it right.

31 pulse position

0.5V unit/div, dial .000, X100

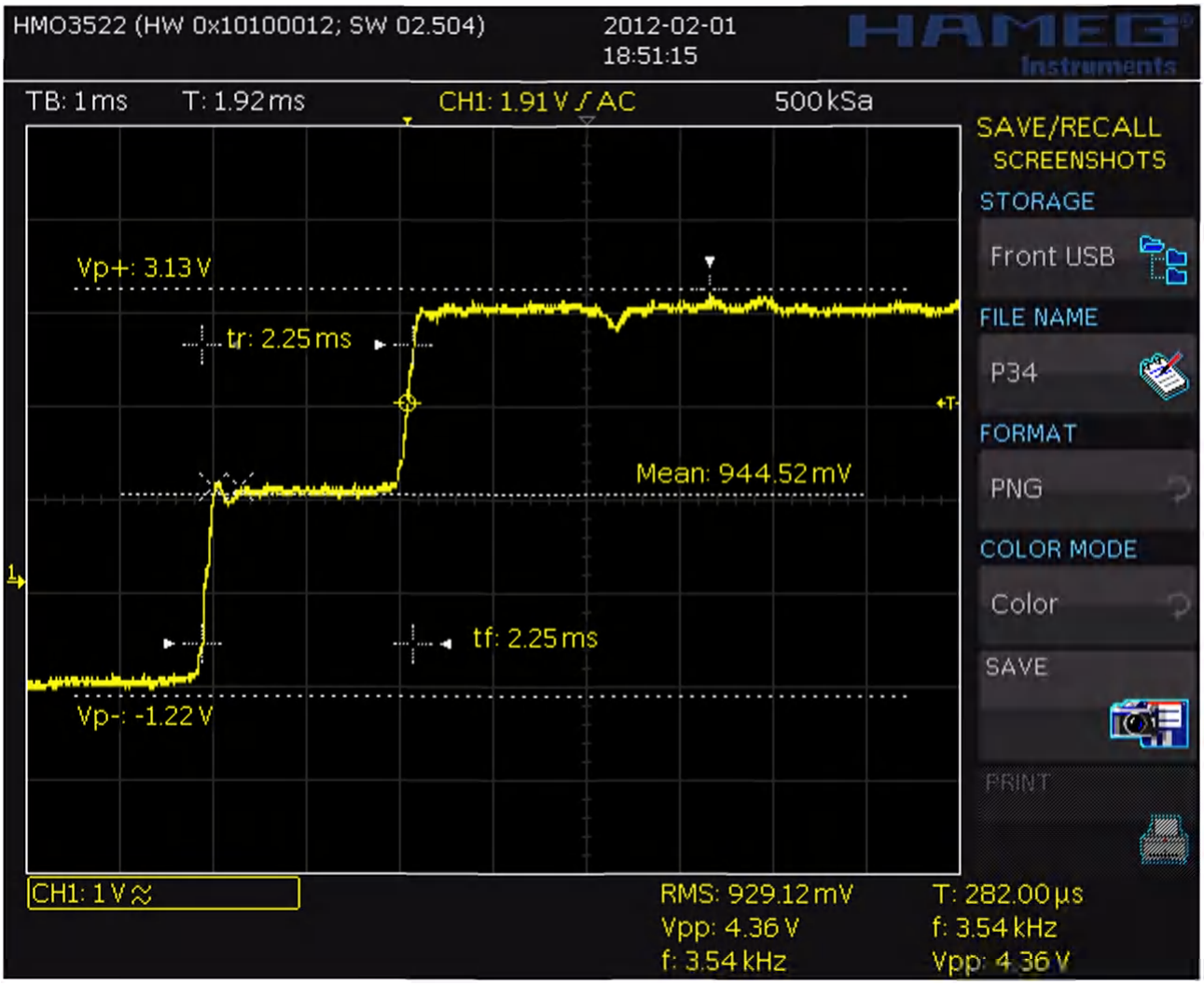
- start of trace at 0 cm line using horizontal position 547
- R621 pulse position , start of pulse rise at 1 cm line
- Range 1uS/100m, C615F, reposition pulse to same spot
- range .1uS/10m C615H, idem above
- this is a terrible job. I also needed R673 to get it done.

32 .25V p calibration

This is the same thing as for the 1 V generator.

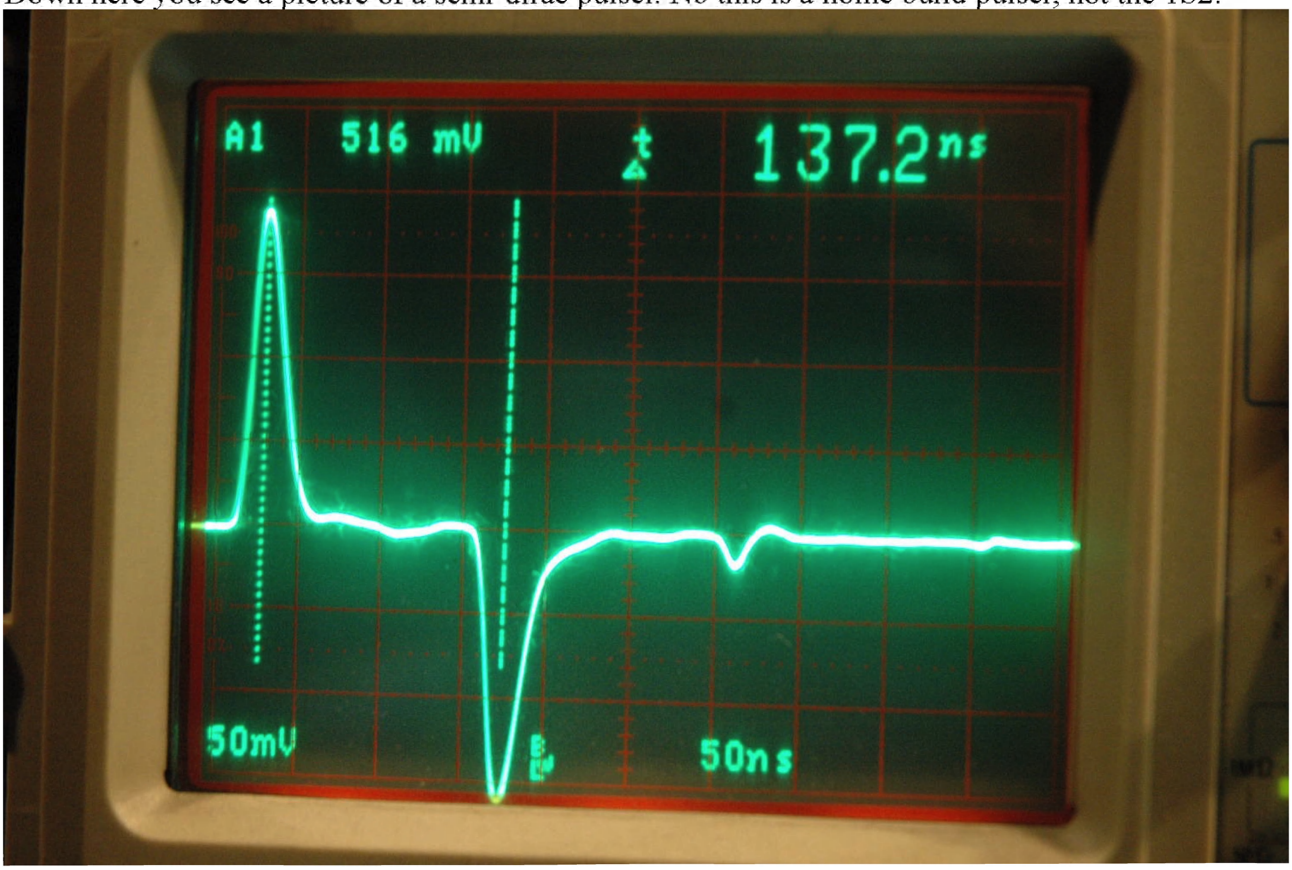
10:1 probe at vertical output jack

- R353 adjusts rho pulse for -1, 0 and +1
- using a piece of airline makes it more easy
- connect the 50 ohm terminator, set it at 0.2 and adjust the step for 5 division. Then mount the airline and zoom in so you see a good step response to the open. See the picture below. The voltage values here are made in the 0.5 unit/div. So the two divisions is rho=1



34: system risetime.
It could be there are two version of pulsers. Mine has a step response in both pulsers. But the picture7-30A in the manual shows as incident a semi-dirac pulse. And tell you to check the rise time by using a short. That gives a total different picture.

First the 1S2 like mine using a step. An open is 100% reflection but the voltage is in phase of the step so the response is a step up, as the picture above. Or a double high incident if no DUT line is attached.
A short is also a 100% reflection but now the voltage is out of phase so it cancels the incident that is a long step so you get a zero baseline.
So to check rise time I used a 50 ohm terminator and checked it with an open. Tweaking for best risetime cost a lot of time. Snap off current, avalanche voltage, the capacitor, dot separation. I combined all lot of steps here. By know you now all adjustments so use them. I marked all resistors and trimmers with a fine-liner before this.
But if you have a semi-dirac pulse you get a positive pulse for an open. So a double high pulse or in case of a attached DUT, you see a pulse some distance apart. In case of a short you see a negative pulse.
Down here you see a picture of a semi-dirac pulser. Nb this is a home build pulser, not the 1S2.



After this there are still a lot of tests and fine tuning points in the manual if needed. But if you come this far that must be no problem and you have to decide how accurate you want it to be. I did not study it very well, just finished it my own way by using the points I know and my previous experience on other samplers.

Good luck with your 1S2
february 2012
Fred Schneider, PA4TIM