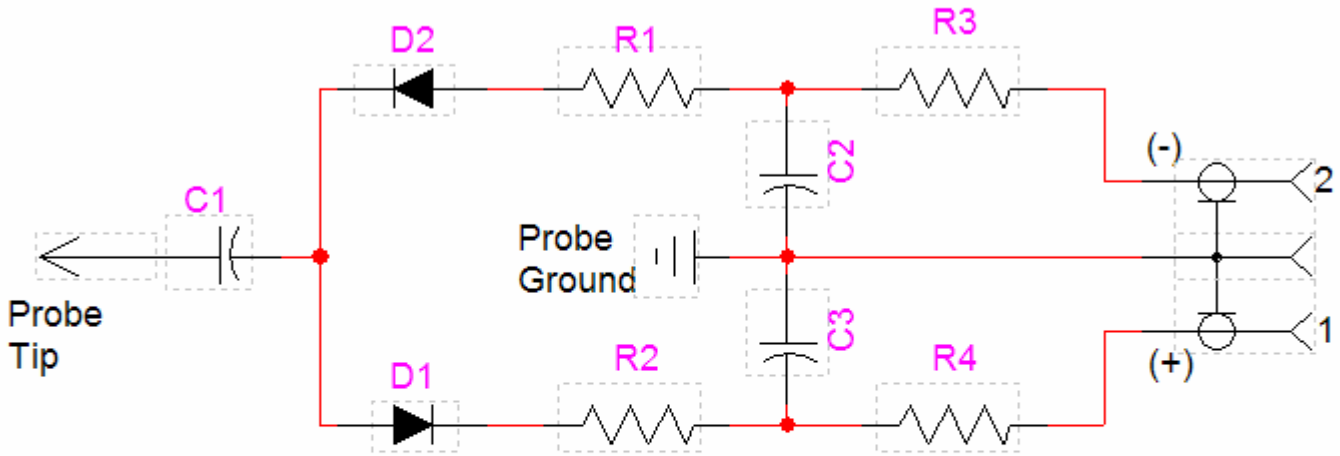
RF PROBE FOR BOONTON RF VOLTMETERS



C1 - 1000 pF / 50V Allows the response to start around 10 KHz.
D1, D2 - Diodes such as 1S2198N or
1SS99 zero bias Schottky diodes 5V PIV, 0.9 pF, 0.23V @ 1 mA
Germanium diodes are a second choice.
R1, R2 - 150 or 160 ohms (use equal values).
R3, R4 - 330 up to 1000 ohms (use equal values).
C2, C3 - 0.1 uF surface mount capacitors.
Use separate coax cables as shown. 50 or 75 ohm coax cables will do.

R1, R2 limit the inrush current
Diode leakage is critical below approx. 100 mVRMS. It reduces the DC output.

UPDATE January 2021

I realize that the 1S2198N and 1SS99 may be hard to get.
These are 5V reverse voltage. The forward drop at 100 uA should be about 100 mV.
I would recommend the **dual Schottky 1SS351** 5V, 0.69 pF (120 mV @ 100 uA) available at Digikey : 1SS351-TB-EOSCT-ND ($0.41 ea.)
Should do the job, but I haven't tried them. They have similar characteristics as the 1S2198N.

I have an easy way to measure these at 100 uAmps:
- Using a digital ohmmeter, select the ohms range that will generate 100 uA current.
  (set on 10K or 100K range)
- You may use another multimeter to measure 100 uAmps, to insure that the current is at the right value.
- Then set ***range hold***, to prevent autoranging.
- Connect the diode in forward mode and measure its voltage drop with the second multimeter, (Your first multimeter may display the correct voltage)
- Readings around 100 mV +/- 50% should be OK for the Boonton RF probes.

NOTE: high RF levels around your test bench (such as cell phones) may distort your readings !
Regarding the series resistors, values of 150 to 160 ohms should be OK. They don't seem to be critical, just make them the same.

Measured data (all @ 100uA) ***THANKS Paul !***

BAT62	180mV
ITT	200mV (this is one of the original diodes in the 91-12F, the other one was defect but I suspect this one to be damaged too)
1N5711	270mV
1SS351	135mV (they seem vey sensitive in low range too (far better than BAT62) but I will have to re-adjust my 92BD)

Note that the BAT62 has a 40V Vr rating, which makes it suitable for measuring higher voltages, but it suffers at the low end.
The 1SS351 has a 5V Vr rating which makes it sensitive at the lower ranges, but it won't take voltages above 1 or 2 VRMS.
I guess this tradeoff comes from the physics of the semi-conductors used.
All probes using these diodes will be sensitive to ESD.
Make sure you connect the ground first.

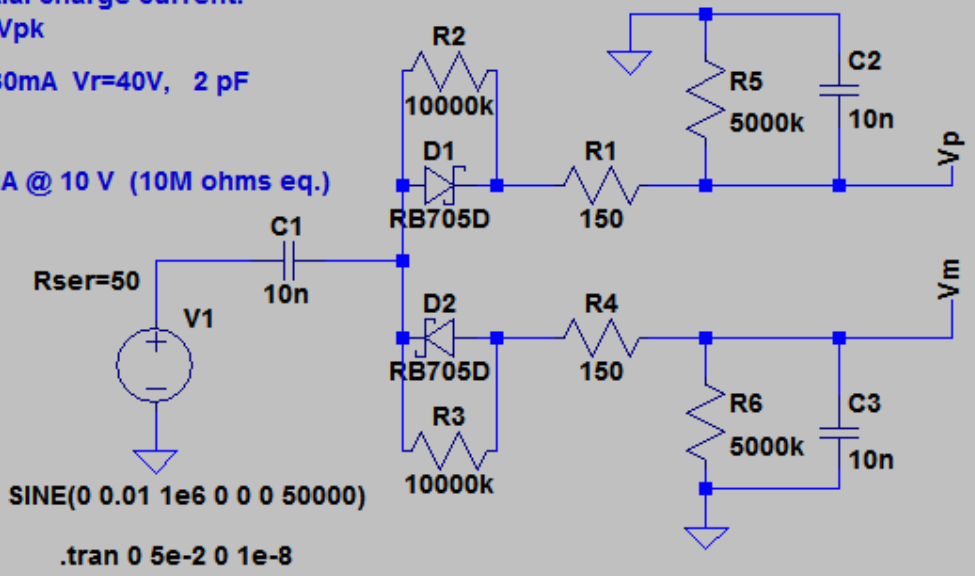
It should be interesting to measure the diode Vr at 100 uA / 10 uA too.
One should know the open circuit voltage obtained at the meter when set to supply 100 uA.
This sets the maximum Vr voltage that can be measured.

LT Spice Simulations

R2, R3 represent the diode reverse leakage.
Critical at low levels: 1 to 100 mVpk Input

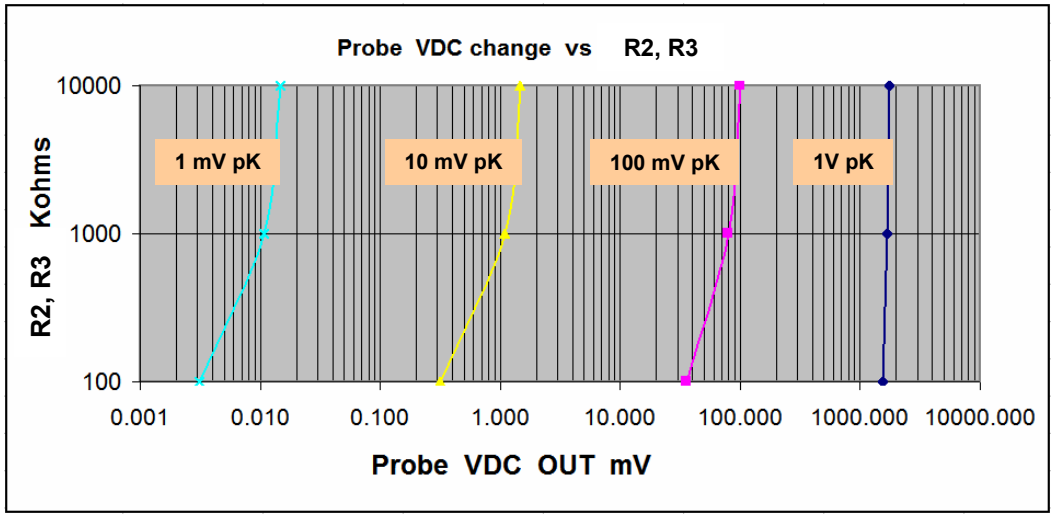
R1, R4 limit the initial charge current.
Small effect at 1 mVpk

Diodes RB705D 30mA Vr=40V, 2 pF
210 mV @ 100 uA
300 mV @ 1 mA
Max Reverse curr = 1 uA @ 10 V (10M ohms eq.)



Vpk IN	VDC OUT	R2, R3
1.0	1.53 V	100K
1.0	1.675 V	1M
1.0	1.745 V	10M
0.1	35.7 mV	100K
0.1	80.4 mV	1M
0.1	99.5 mV	10M
0.01	315 uV	100K
0.01	1097 uV	1M
0.01	1460 uV	10M
0.001	3.14 uV	100K
0.001	10.7 uV	1M
0.001	14.7 uV	10M

The p-p voltage across the diodes is twice the input peak voltage



RF PROBE FOR BOONTON POWER METERS

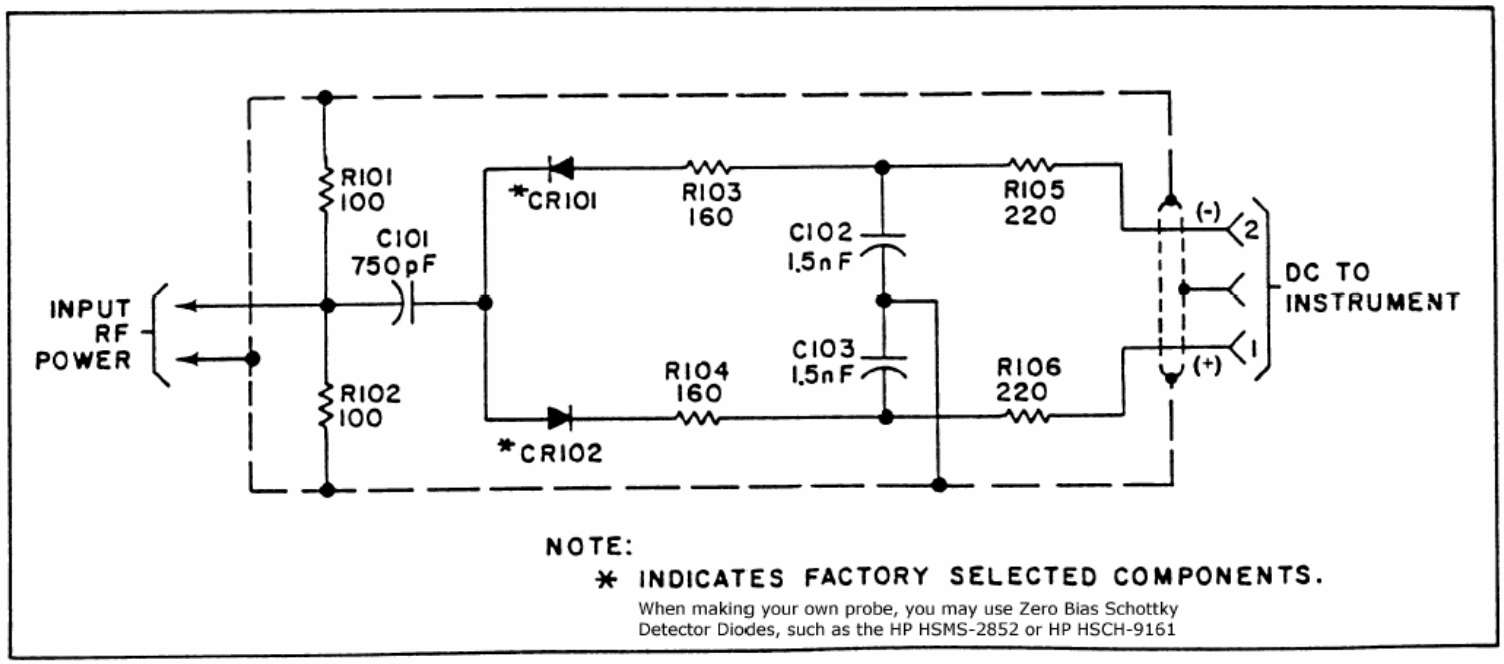
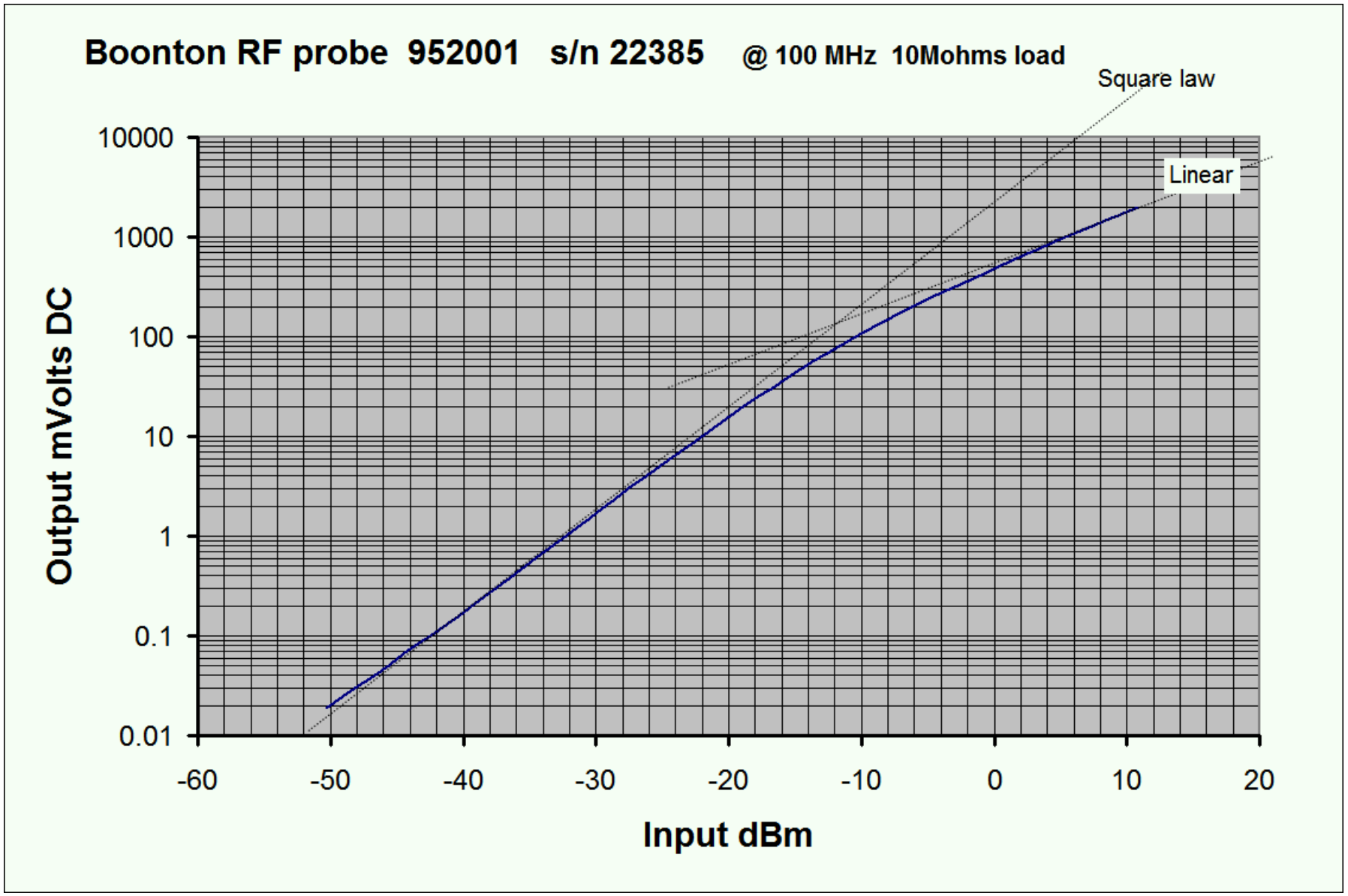


Figure 4-2 Typical Series 4200 Sensor, Schematic Diagram

Measured Response on my Boonton probe



Photos Boonton RF Voltmeters

From Jim VE6JF
Thanks !

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