

## LTZ1000ACH, output voltage sensitivity to small changes in R1

*Measurements to determine how sensitive the circuit output voltages are to small variations in resistor value, for example from temperature and aging.*

These results are for “R1” in the data-sheet schematics, all component values are as per the datasheet. Measurements were done by adding a 1.2ohm resistor in series with the 120ohm resistor ie the resistance could be switched between 120R0 and 121R2. This was repeated 25 times, each with about a minute stabilizing time and a minute of measurements. Each time, the output voltage change was recorded using a 7.5 digit DMM.

#	120R	121R2	Difference			dV/dR
	Output [ $\mu$ V]	Output [ $\mu$ V]	[ $\mu$ V]	dV (ppm)	dR (ppm)	ppm/ppm
1	0	-93	-93	-13.007	10000	-0.001301
2	-4	-96	-92	-12.867	10000	-0.001287
3	-4	-94	-90	-12.587	10000	-0.001259
4	-2	-94	-92	-12.867	10000	-0.001287
5	3	-90	-93	-13.007	10000	-0.001301
6	0	-91	-91	-12.727	10000	-0.001273
7	-1	-92	-91	-12.727	10000	-0.001273
8	0	-93	-93	-13.007	10000	-0.001301
9	-1	-94	-93	-13.007	10000	-0.001301
10	1	-91	-92	-12.867	10000	-0.001287
11	-1	-93	-92	-12.867	10000	-0.001287
12	0	-90	-90	-12.587	10000	-0.001259
13	5	-90	-95	-13.287	10000	-0.001329
14	1	-91	-92	-12.867	10000	-0.001287
15	1	-90	-91	-12.727	10000	-0.001273
16	1	-90	-91	-12.727	10000	-0.001273
17	2	-90	-92	-12.867	10000	-0.001287
18	2	-89	-91	-12.727	10000	-0.001273
19	2	-87	-89	-12.448	10000	-0.001245
20	4	-88	-92	-12.867	10000	-0.001287
21	6	-86	-92	-12.867	10000	-0.001287
22	3	-86	-89	-12.448	10000	-0.001245
23	4	-86	-90	-12.587	10000	-0.001259
24	4	-86	-90	-12.587	10000	-0.001259
25	3	-86	-89	-12.448	10000	-0.001245
Average:			-91.4	-12.783217	10000	<b>-0.001278</b>

### Results comments:

- Changing the R1 value from 120R00 to 121R2 changed the output by an average of -91.4 $\mu$ V
- This is equivalent to -12.78 ppm voltage change over a 10000 ppm resistance change
- This is equivalent to 1ppm resistance change causing -0.00128 ppm voltage change
- This is equivalent to a -0.128ppm voltage change for 100ppm resistance change.
- In the LTZ1000 data-sheet, the value is stated as 1ppm voltage change per 100ppm resistance change, I.e there is a factor -7.87 difference between these measurements and the data-sheet value.
- If the measurements are correct, it means the R1 is much less critical than the data-sheet indicates.

PS: the measurements have been repeated with three different LTZ1000ACH on different boards, all showing very similar results. Similar measurements have been done on all the resistors in the LTZ1000ACH circuit and R1 and R3 show significant differences to the data-sheet while R4/R5 and R2 measurements are fairly similar to the data-sheet data.

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