Experiments with "front-face co-planar ground electrodes"

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Intent: to investigate whether good shielding effectiveness could be achieved using only a single layer PVDF device, by applying additional grounded electrodes around the active signal electrode.

Procedure: "dummy" patterns were built up using copper foil tape, applied each side onto standard copier paper. For electrical testing, it was unnecessary to use piezo substrate. The patterns were mounted in identical fashion, a fixed distance away (145 mm) from a source of electrical noise (a light box, containing 4 fluorescent strip lights, driven from 240 V 50 Hz mains supply). The magnitude of the strongest frequency component (50 Hz) was recorded for each, with and without the ground electrode connected. This basic test gave an indication of relative shielding effectiveness.

Patterns: see following page for outline drawings. Pattern A was simple 19 x 30 mm rectangle, with descending (non-overlapping) 6 mm wide conductors. Pattern B used same "active signal electrode", with conductor track now centered, and an added grounded border surrounding the entire pattern. Initial test of Pattern B suggested a benefit in increasing the border width, so Pattern C was built by simply adding copper to Pattern B. Detailed results only recorded for C. Finally, Pattern D used narrower signal conductor tracks (3 mm), and an interdigital arrangement of active area. Note: active area of Pattern D was intentionally smaller than the others.

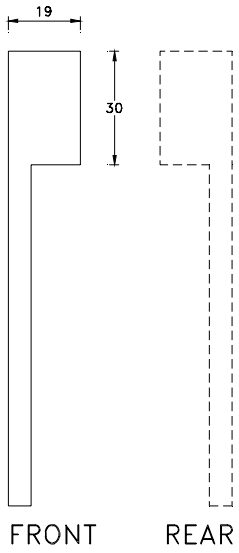
Results:

Pattern	signal electrode area (inc. lead) sq mm	front ground electrode area sq mm	capacitance pF @ 1 kHz	magnitude, ground not connected (dBV @ 50 Hz)	magnitude, ground connected (dBV @ 50 Hz)
A	1110	(540)	118	-18.23	-23.25 (-5.02)
B	1110	2813	131		-31.47
C	1110	4001	131	-16.55	-34.40 (-17.85)
D	726	4443	91	-16.99	-38.69 (-21.70)

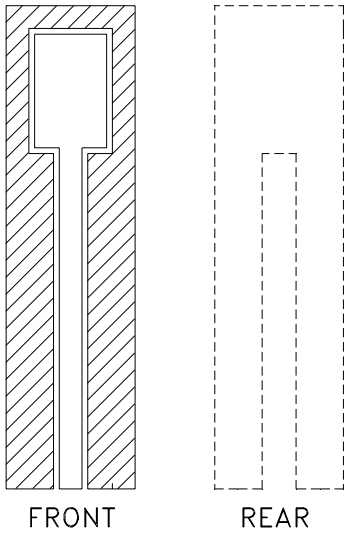
Conclusions:

Patterns A, C and D all picked up similar level of e/m noise (120 to 150 mV rms) when only the signal electrode was connected to signal analyser (ground clip of probe not connected to anything). Connecting both rear and front ground electrodes brought differing levels of reduction. The "unshielded" Pattern A showed 69 mV rms, while Pattern D showed around 6 times less noise (11.6 mV rms) in absolute terms. Pattern D was most effective also in relative terms, probably due to the higher ground/signal area ratio.

Although the added front-face ground electrode does not remove e/m interference completely, it can certainly make a significant difference. The relative improvement in noise reduction (over an unshielded element) is approximately proportional to the ratio of the areas of the added front ground electrode to the signal electrode.



A



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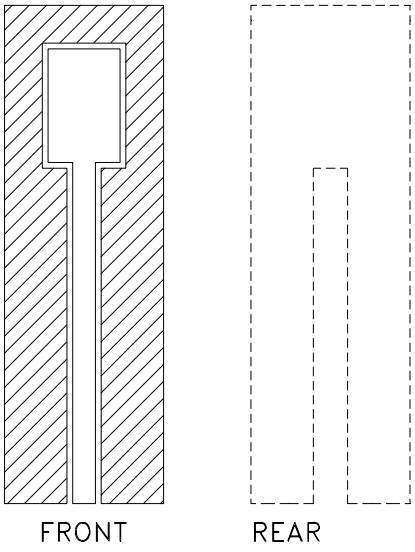
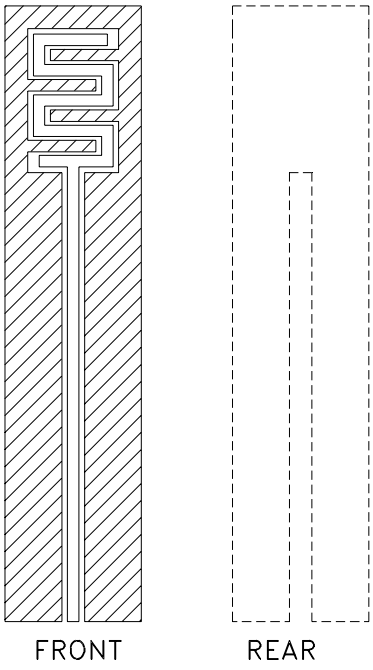


C



D

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