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(54) **CHARGE TRANSFER CAPACITANCE MEASUREMENT CIRCUIT**

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(51) **Int. Cl.^{7}** **G01R 27/26**

(52) **U.S. Cl.** **324/678**; 324/658

(58) **Field of Search** 324/678, 658, 324/661, 663, 665, 676, 679

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(57) **ABSTRACT**

Pulse circuits for measuring the capacitance to ground of a plate may be used in control equipment to provide an indication of the proximity of a person or object to be sensed. Pulse circuits are disclosed that are made from sets of three or more electrical switching elements arranged so that each of the switching elements has one side electrically connected to either a supply voltage or to an electrical ground. These arrangements are compatible with existing integrated circuit fabrication technology. In addition, the circuitry can be configured as a proximity sensing switch that requires only a two wire connection to a host apparatus.

39 Claims, 14 Drawing Sheets
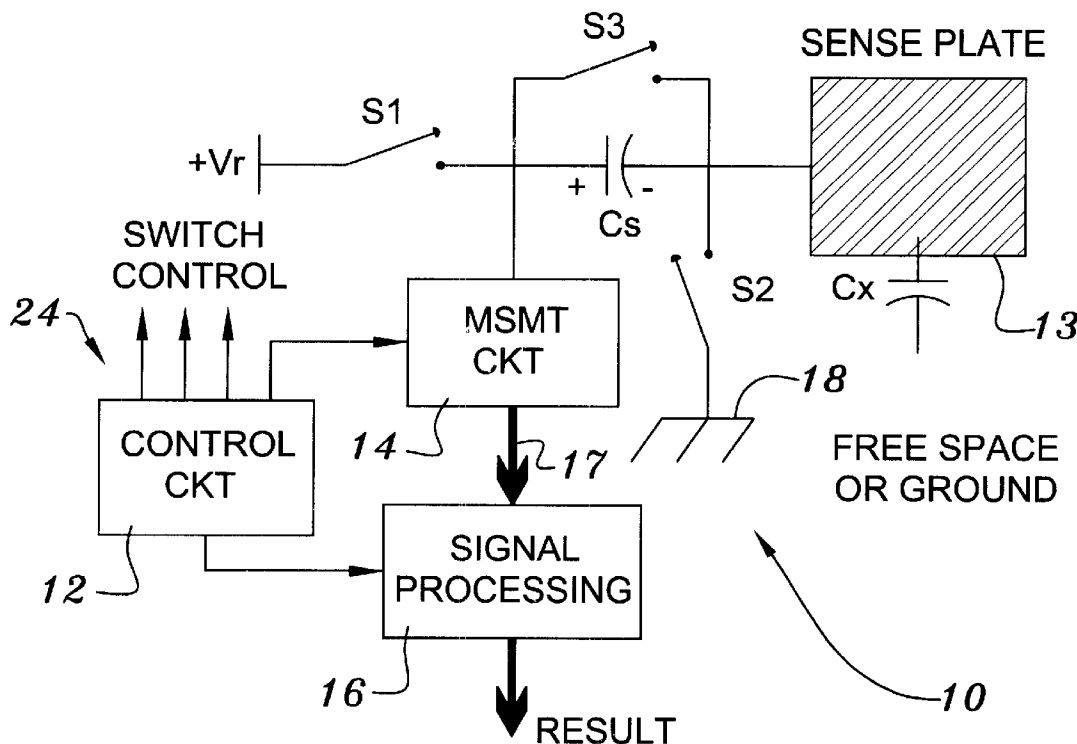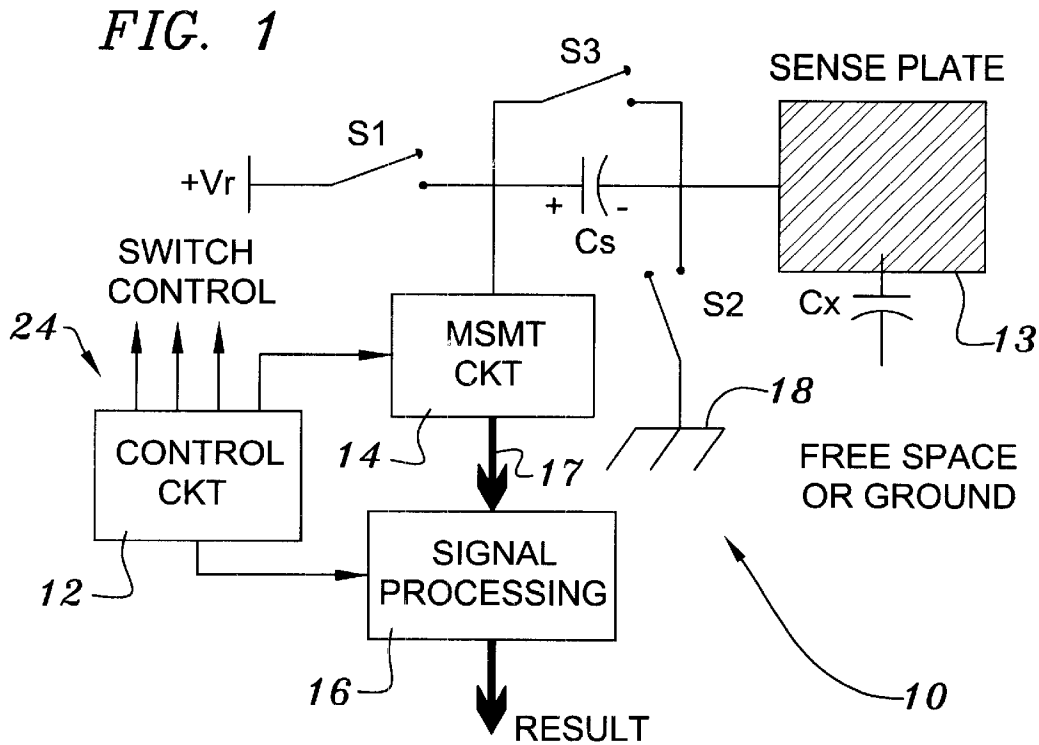
FIG. 1

STEP	S1	S2	S3	FUNCTION
A	-	X	X	RESET ALL
B	-	-	-	DEADTIME
C	X	-	-	CHARGE-TRANSFER
D	-	-	-	DEADTIME
E	-	X	-	HOLD
F	-	X	-	MEASURE

LOOP

FIG. 2

FIG. 3

FIG. 4

FIG. 5

MSMT CKT

18

SENSE PLATE

14

S1

Cs

S2   Cx

13

+Vr

FREE SPACE OR GROUND
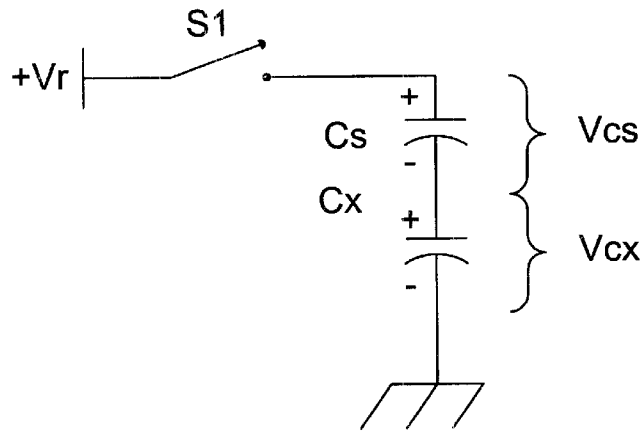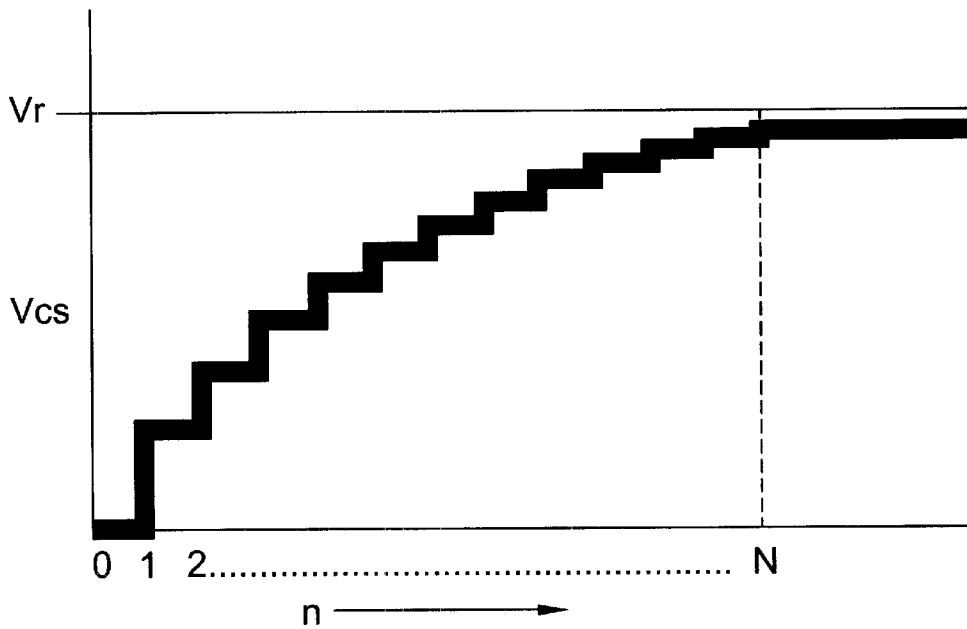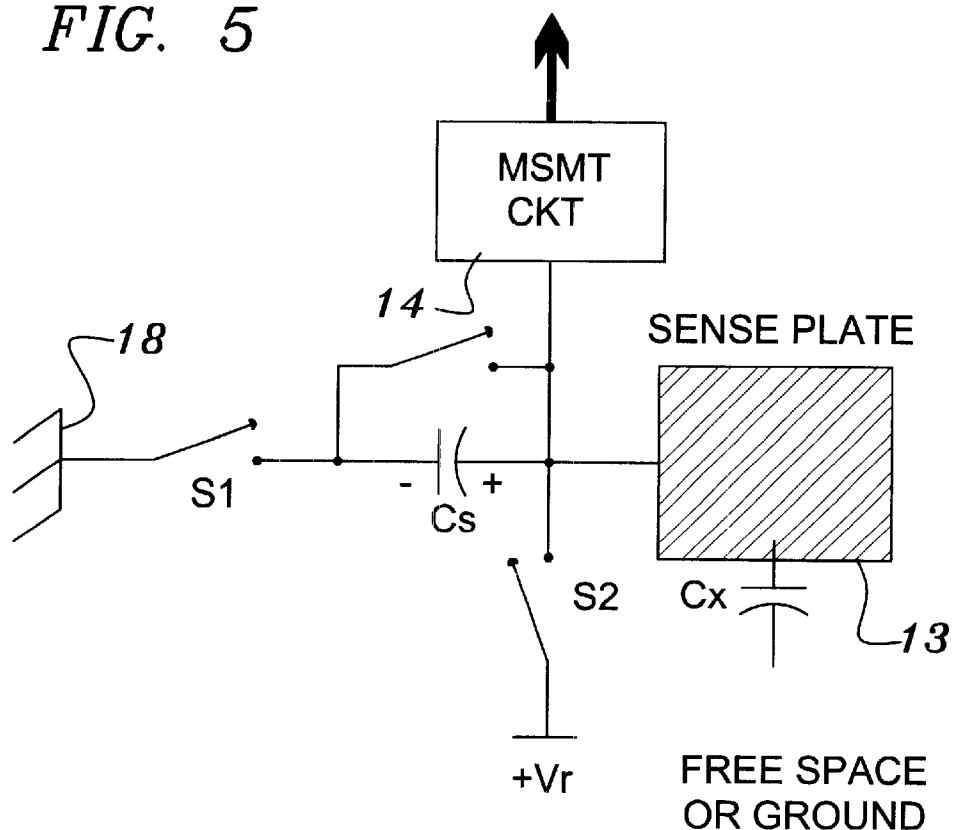
STEP	S1	S2	S3	FUNCTION
A	X	-	X	RESET ALL
B	-	-	-	DEADTIME
C	-	X	-	CHARGE
D	-	-	-	DEADTIME
E	X	-	-	TRANSFER
F	X	-	-	MEASURE
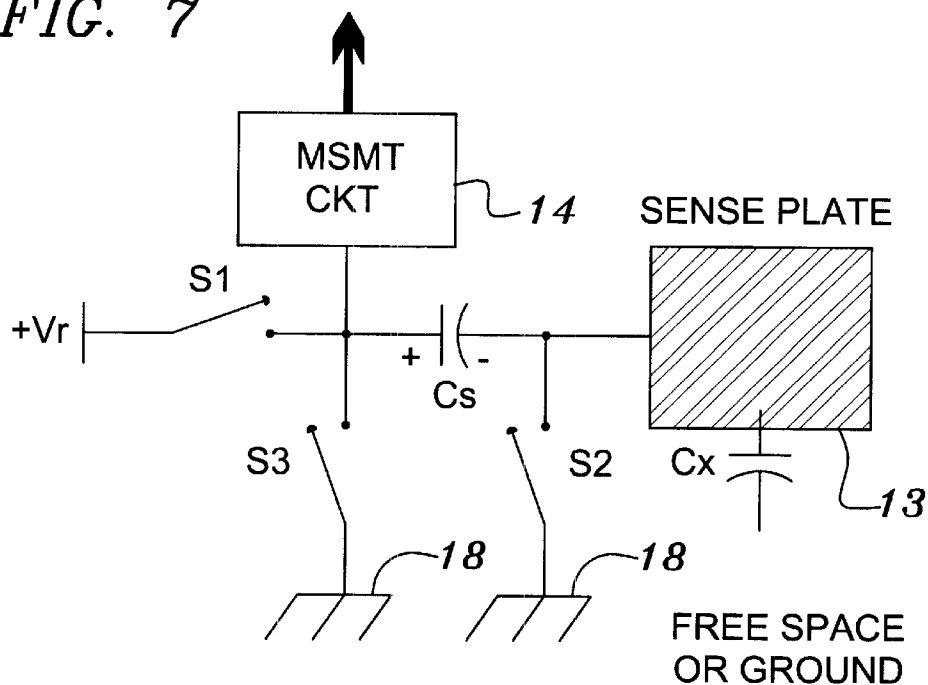
LOOP

FIG. 6

FIG. 7

STEP	S1	S2	S3	FUNCTION
A	-	X	X	RESET ALL
B	-	-	-	DEADTIME
C	X	-	-	CHARGE-TRANSFER
D	-	-	-	DEADTIME
E	-	X	-	HOLD
F	-	X	-	MEASURE (HOLD)

LOOP (B → E)

FIG. 8

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