

# Motorola E-Field Sense the Possibilities Contest

## EF3389

### 1 **What the E sensor water leak detector does**

- 1.1 Every one has or knows of someone that had the hose break on the washing machine or a leaky water heater and flooded everything.
- 1.2 This project senses water on the floor. Once it senses water it can sound an alarm or turn off a water valve. Thus saving you a lot of grief.
- 1.3 This can be used to detect a water leak under a washing machine, a water heater or any other place a water leak may occur. Since the means of implementing the alarm or water valves is endless, it is left up to the reader to implement a workable solution for them.

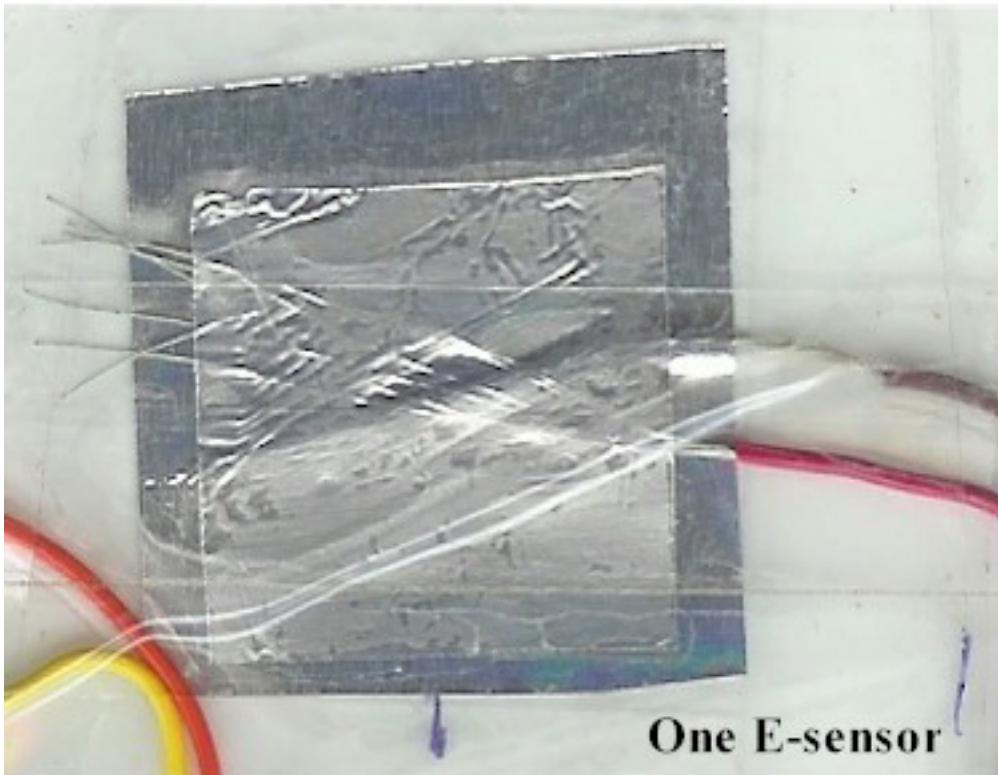
### 2 **How it does it work**

- 2.1 The E sensor does not use floats or conductive pads. The mechanical type of sensors get dirty and stick. The resistive type can have a false alarm if it gets dirty. The **E** sensor senses an **Electrostatic** field between two plates. This electrostatic field is a function of the size and distance between the plates. It is commonly associated with a capacitor. The E sensor measures how much current flows between the two plates. It is the water acting as a second plate of a capacitor that the sensor detects and measures. Since only a field is sensed, this sensor needs no moving parts and does not have to contact the water.

### 3 **Sensor theory**

- 3.1 The Motorola E sensor measures the AC current between a sensor plate and the ground plate. Just like a resistor, a voltage is applied and the current is proportional to the resistance. ( $E = RI$ ) The Motorola E sensor measures the AC current through the capacitance. by putting out a known AC voltage and measuring the AC current flow( $z = e/i$ ). The resulting current is then proportional to the capacitance. Each individual electrode is measured sequentially.

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## Code sample

```
/* Motorola E-Field Sense the Possibilities Contest */
/* EF3389 */

#define ELECTRODES_SEE_WATER 2 /* Turn off water when count is greater than this number */
#define MAX_SENSOR_PLATE_CURRENT 10 /* This current value or > means water on sensor plate */

#pragma DATA_SEG RAM /* program directive */
char electrode_count, /* This represents the sensor plate being measured */
error_count; /* This represents how many sensor plates saw water */

#pragma DATA_SEG DEFAULT
/* this is processor dependent */
/* This routine measures the current of the selected sensor plate */
char input_electrode(char electrodeX)
{
char x;
x = (electrodeX);
return(x);
}
/* this is processor & and how it is used dependent */
```

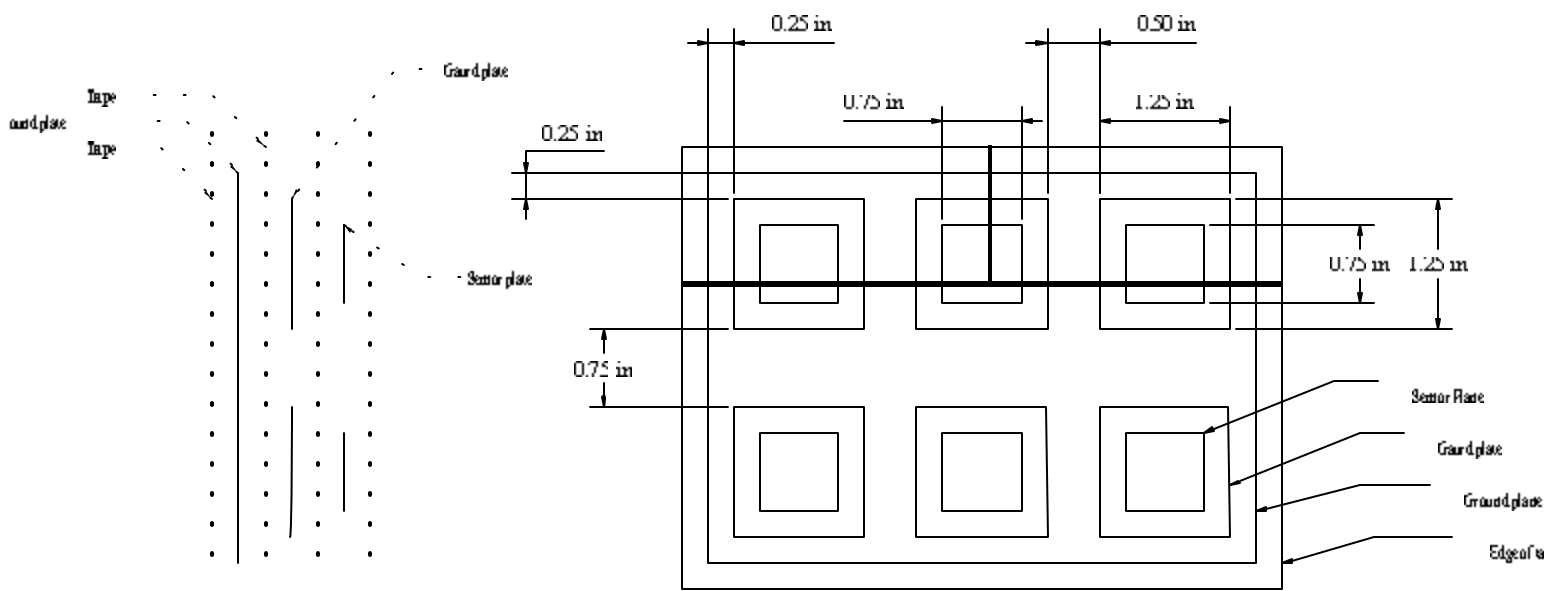
```

/* This routine turns off the water */
void water_off(void)
{

/* enter this function at .25 sec rate (This time is not critical) */
void leak_function(void)
{
unsigned int sensor_current;
if(electrode_count == 0)          /* start cycle */
{
    electrode_count = 1;          /* set up to measure first electrode */
    error_count = 0;             /* clear error count */
}
if(electrode_count >= 9)         /* Is every electrode been measured */
{
    electrode_count = 1;          /* If yes then start over at zero */
    if( error_count >= ELECTRODES_SEE_WATER) /* If the number of electrodes that see water is greater
than a X */
        { water_off(); }        /* The number of electrodes is greater than required so turn off water */
    else
        { error_count = 0; }    /* The number of electrodes is less than required so clear count */
}
else
{
    sensor_current = input_electrode(electrode_count); /* Measure this electrode's capacitance. */

    if(sensor_current >= MAX_SENSOR_PLATE_CURRENT) /* Is the capacitance greater than the calibration
level */
        {error_count = error_count + 1; } /* This electrode sees water increment error count */
        electrode_count = electrode_count + 1; /* Set counter to next electrode */
}
}
}

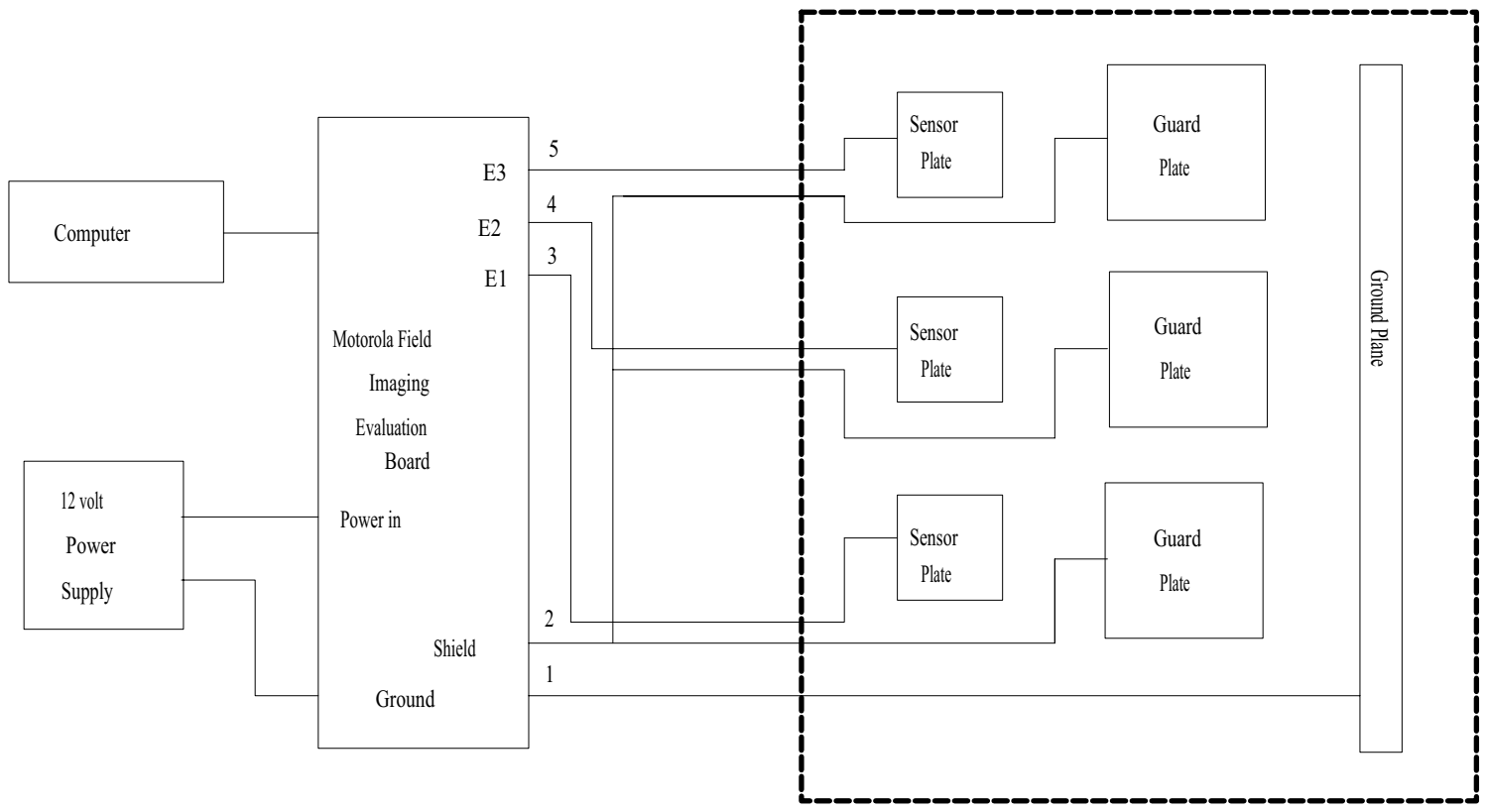
```



Sensor construction drawing

Water Leak Detector

EF3389



Three electrode sensor