SGS-THOMSON MICROELECTRONICS

APPLICATION NOTE

INPUT / OUTPUT PROTECTION FOR AUTOMOTIVE COMPUTER

A. BREMOND

In cars, the number of functions carried out by electronic components has greatly increased during the last 10 years.

These functions require ever more complex calculations obliging car module designers to use µC. The sensitivity of µC input/output (linked to the high reliability required by the automotive market), forces the computer to be efficiently protected.

PROTECTION : AGAINST WHAT ?

In the car electrical network overvoltages may occur in two ways.

- Firstly on the battery supply rail which can be solved by a good load dump protection.
- Secondly by various computer inputs/outputs. In this case the energy involved is not as high as on the supply rail side but the characteristics of the sensor and the µC port have to be taken into account (notably when filtering is needed).

PROTECTION BY CLAMPING DEVICES

Figure 1 shows both the symbol and the electrical characteristics of a clamping device. This kind of devices suppresses positive overvoltages when they exceed the breakdown voltage V_{BR}.
For negative voltages the suppressor clamps at 0.6V (as a rectifier diode V_F).

Fig. 1 : Clamping device - Symbol and characteristics

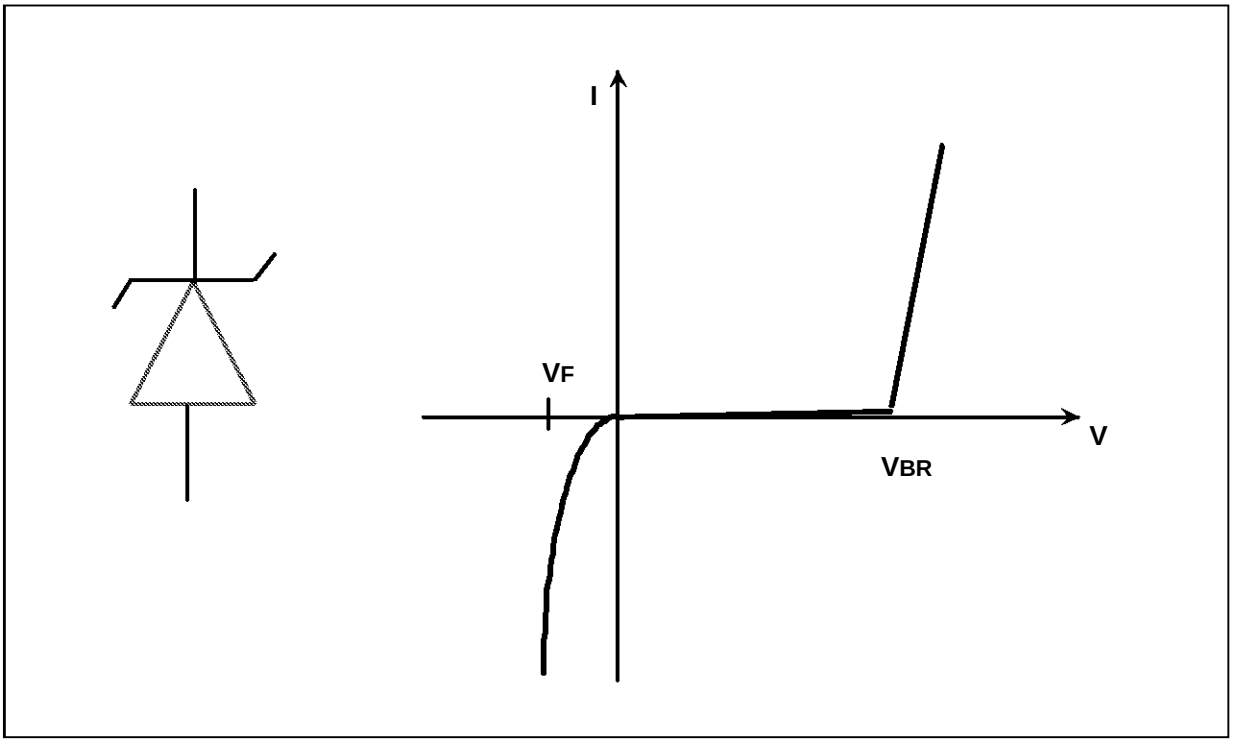
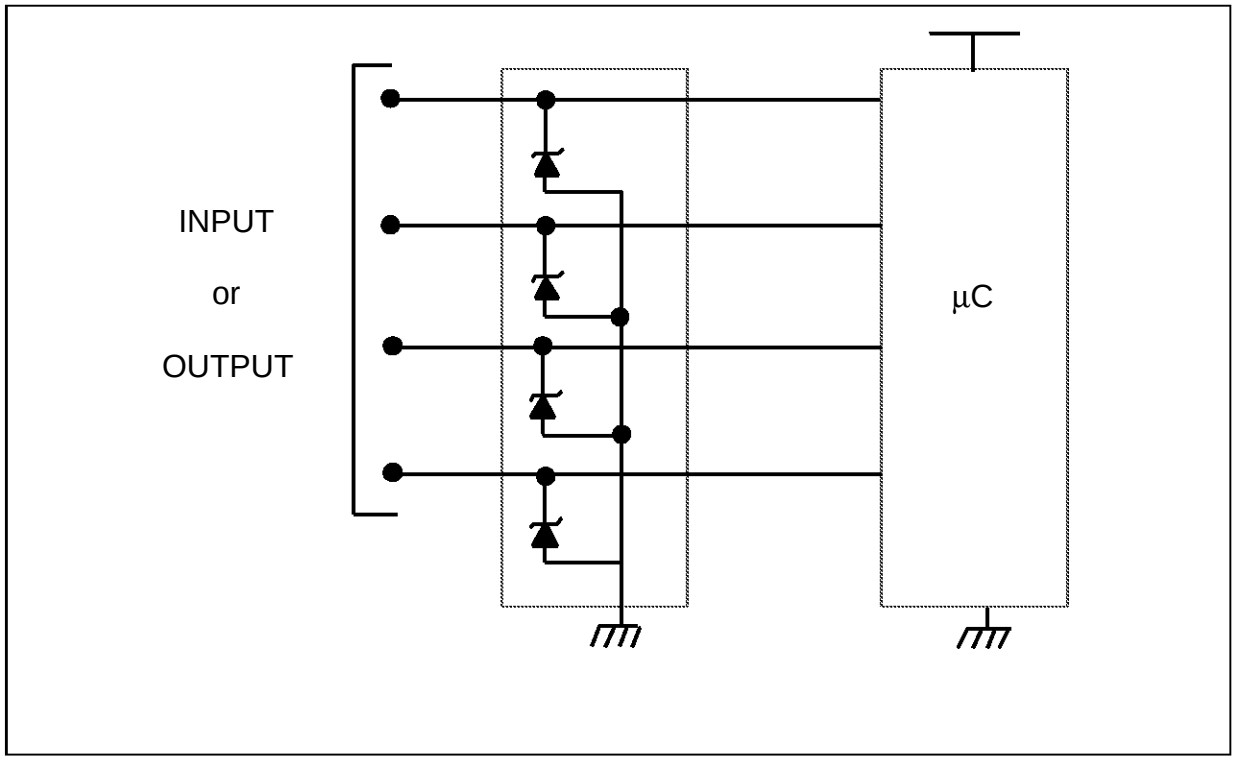


Figure 2 shows a circuit using an input/output clamping protection array. Two types of clamping array devices are today available depending on the energy involved.

- If only ESD can occur the ESDA series is required.
- If EOS strikes (1) occur, a component from the ITA series is needed.

(1) more energetic than the ESD surges.

Fig. 2 : Input / Output protection by clamping device



PROTECTION BY DIODE ARRAY

Figure 3 shows the topology of the protection by diodes to the ground and to the supply rail.

The result of this protection circuit when positive or negative surges occur is similar to the previous one. The only difference is where the surge energy is absorbed.

Fig. 3 : Circuit of protection by diodes and characteristics

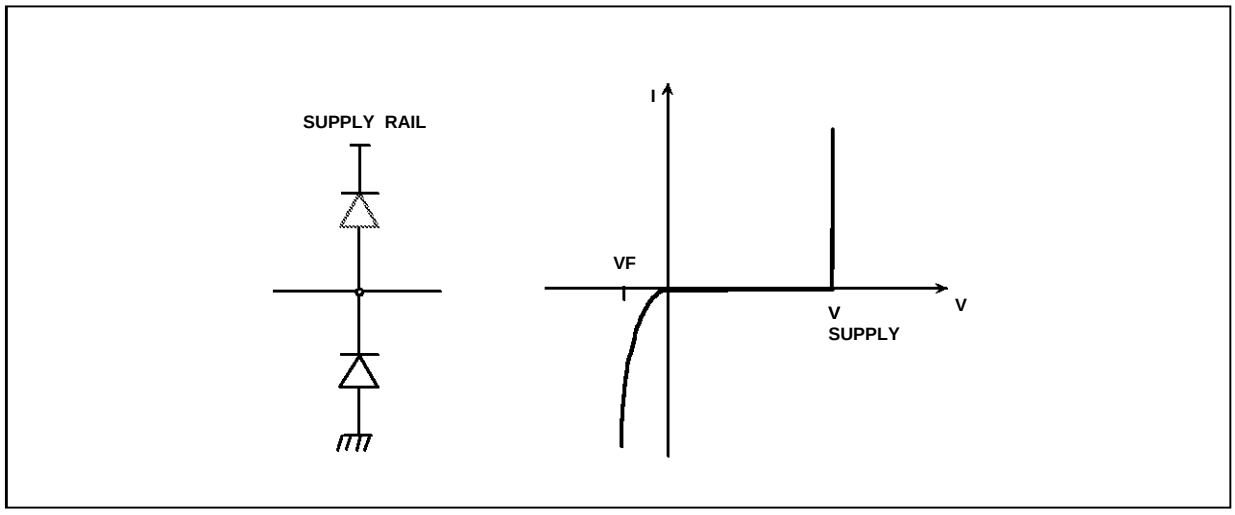
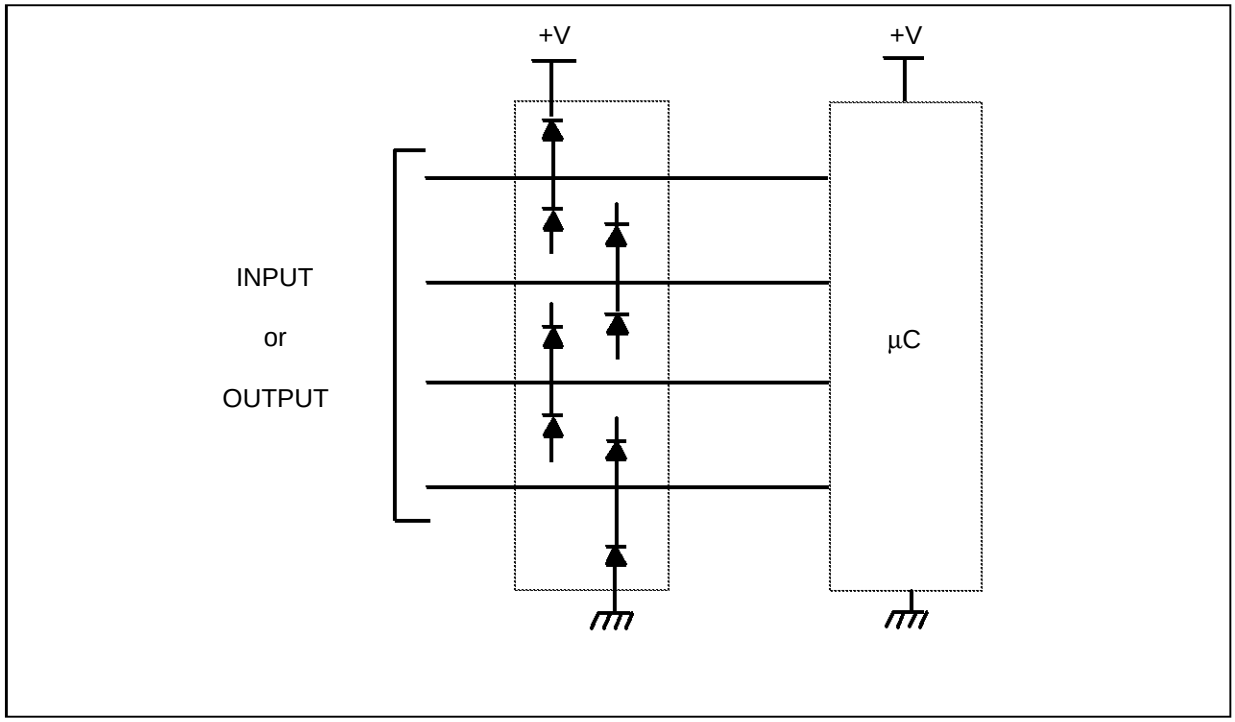


Figure 4 shows an input/output protection by diode array circuit of the DA series.

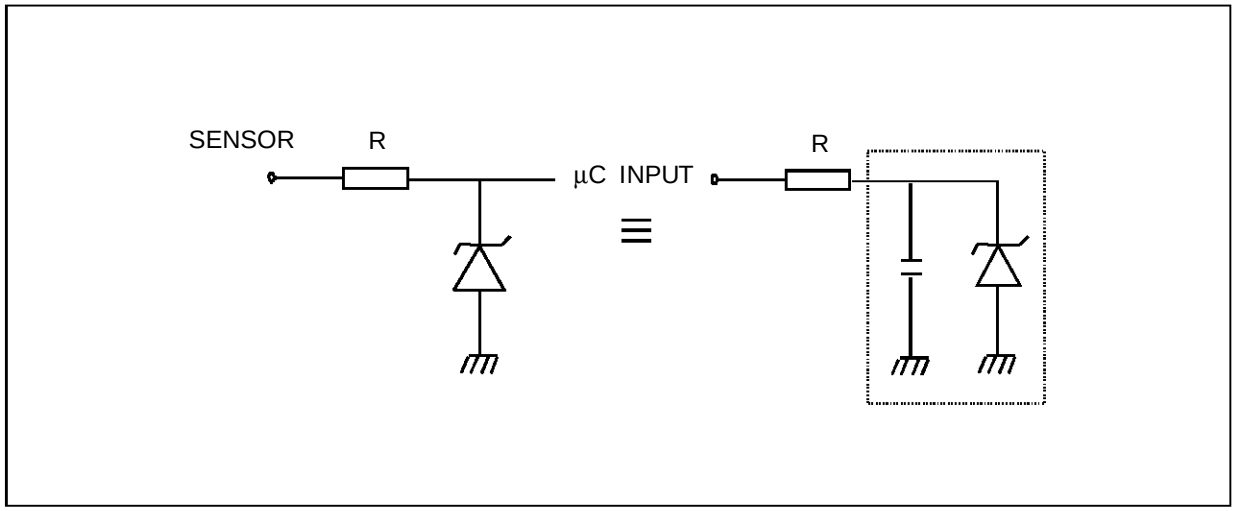
Fig. 4 : Input / Output protection by diode array circuit of the DA series



PROTECTION AND FILTERING

The circuit of figure 5 assumes both overvoltage protection and filtering functions. The protection is carried out by the clamping device while the filtering is made by coupling resistor R and the parasitic capacitance of the clamping device.

Fig. 5 : Input / Output protection and filtering



PROTECTION SUMMARY

The input/output protection and even the filtering can be carried out by the ESDA, ITA and DA protector series of SGS-THOMSON. Developed using the ASD™ concept, and available in surface mount packages, these devices offer both space saving and layout optimisation.