

TRIAC & MICROCONTROLLERS : THE EASY CONNECTION

Ph. Rabier

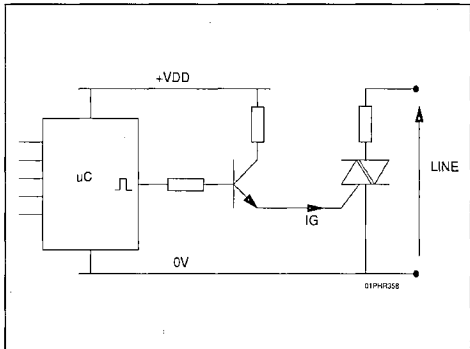
The aim of this note is to show how to connect an SGS-THOMSON triac and an SGS-THOMSON microcontroller.

I - CONVENTIONAL SOLUTION

For many years the triac has been used to switch load on the AC mains and thanks to the low cost of microcontrollers (μC) this solution is widely used in the appliance market.

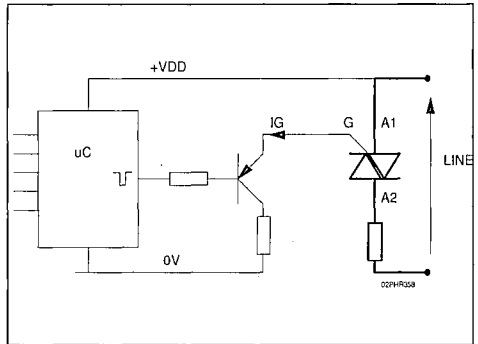
All the system use a buffer transistor between the output port of the microcontroller and the triac as shown in the figure 1.

Figure 1 : Drive in the 1st and 4th quadrants.



Because of the low sensivity of the triac in the 4th quadrant this type of drive is often unpractical, and is replaced by the topology of the figure 2 :

Figure 2 : Conventional drive in the 2nd and 3rd quadrants.



To save cost, manufacturers want to use fewer and fewer components and of course want to remove the buffer transistor, but a problem arises.

Due to the low output current of the microcontroller, the triac had to be very sensitive and consequently was not able to withstand for example the static dv/dt , and the commutation.

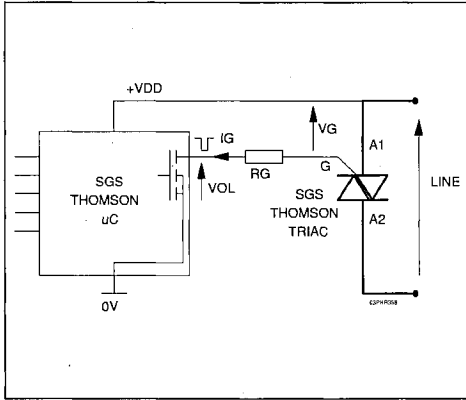
II - NEW SGS-THOMSON SOLUTION

Two parameters have been improved :

- The sensitivity of the triacs.
- The output capability of the microcontrollers in terms of sunk current.

A microcontroller is now able to drive one standard triac or several sensitive triacs, without buffer transistors (see figure 3).

Figure 3 : An easy connection



Where : V_{DD} supply voltage
 V_{OL} output low voltage of the microcontroller
 V_G gate - anode 1 voltage at I_G

With : $V_{DD} = +5 V$
 $V_{OL} = 1.3 V$
 $V_G = 1.5 V$
 $I_G = 20 mA$

Therefore : $R_G = 110 \text{ Ohms}$

Figure 4 shows the output capability of a range of controllers and the sensitivity of the triacs.

Figure 4 : Triac and microcontroller characteristics.

MICROCONTROLLERS & OUTPUT CAPABILITIES	TRIAC	SENSITIVITY	GATE PARAMETERS	CONNECTION
ST621x SERIES ST622x SERIES $I_{OL}=20mA \text{ AT } V_{OL}=1.3V$ $I_{VSS}=100mA$	T & TW SERIES	$I_{GT}=5mA$	$V_G = 1.5V$ AT $I_G = 10mA$	1 PORT/TRIAC
	Tx05 SERIES			
	S & SW SERIES	$I_{GT}=10mA$	$V_G = 1.5V$ AT $I_G=20mA$	1 PORT/TRIAC
	Tx10 SERIES			
	C SERIES	$I_{GT}=25mA$	$V_G = 1.5V$ AT $I_G = 50mA$	2 PORTS IN PARALLEL/TRIAC
	CW SERIES	$I_{GT}=35mA$	$V_G = 2V$ AT $I_G = 70mA$	3 PORTS IN PARALLEL/TRIAC
B & BW SERIES	$I_{GT}=50mA$	$V_G = 2V$ AT $I_G = 100mA$	4 PORTS IN PARALLEL/TRIAC	

To take into account of the dispersion on R_G , V_{DD} and on the temperature variation, we generally choose about:

$$I_G = 2 \cdot I_{GT} \quad (I_{GT} = \text{Specified gate trigger current})$$

$$t_p > 20\mu s$$

Where t_p is the pulse duration of gate current.

EXAMPLE :

For +5V supply voltage and a LOGIC LEVEL triac with $I_{GT} = 10 mA$, we have :

III - CONCLUSION

Use SGS-THOMSON sensitive triacs driven by an SGS-THOMSON microcontrollers and remove the buffer transistors.

This can be achieved thanks to the high current capability of our microcontrollers which are compatible with our new sensitive triacs (T410, T, TW, S, SW series).

Furthermore a non sensitive triac can be driven by several output ports in parallel.