Application note

Triac and microcontrollers: The easy connection

Introduction

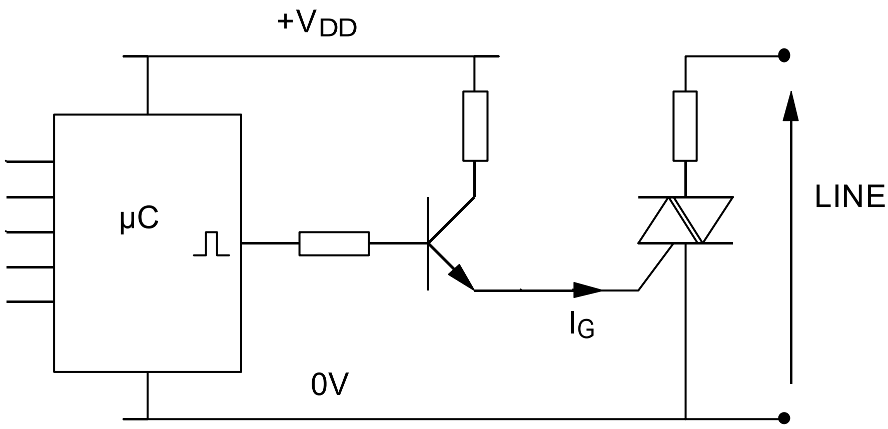
The aim of this note is to show how to connect an ST Triac and an ST microcontroller.

1 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.

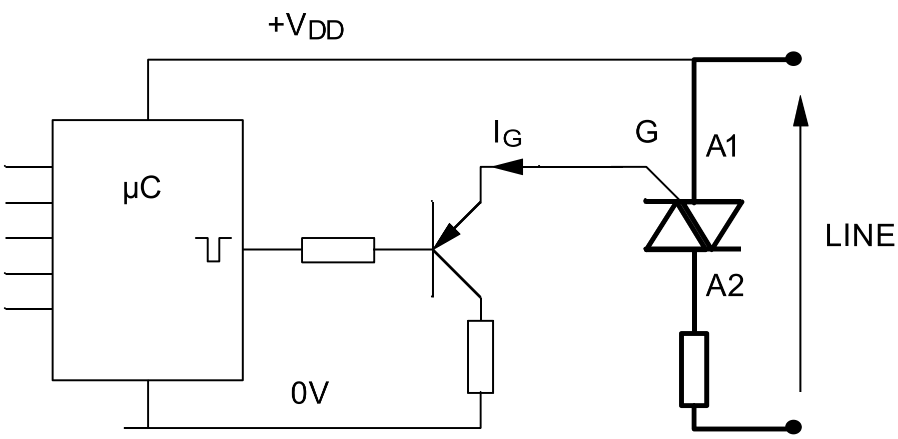
All the system uses a buffer transistor between the output port of the microcontroller and the Triac as shown in the Figure 1.

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



Because of the low sensitivity of the Triac in the fourth 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.

2 New ST 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

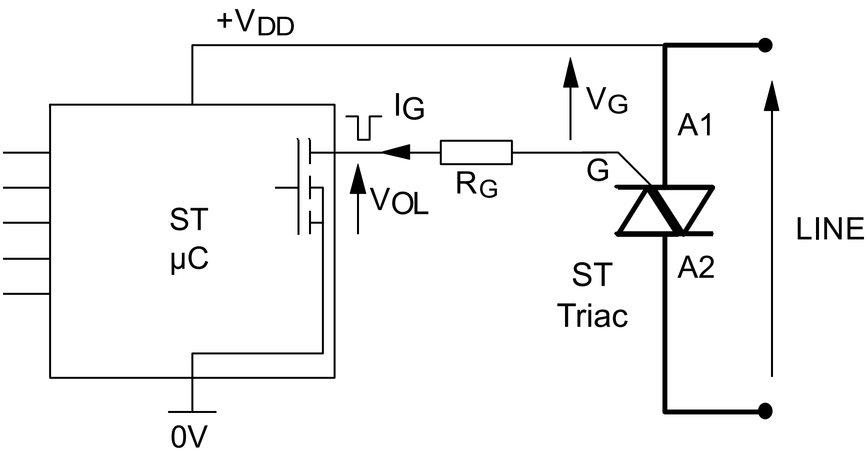


Table 1. Triac and microcontroller characteristics

Microcontrollers and output capabilities	Triac	Sensitivity	Gate parameters	Connection
STM32 series I_{OL} 20 mA (1) ΣI_{IO} = 100 mA (1)	T and TW series Tx05 series	I_{GT} = 5 mA	V_G = 1.5 V at I_G = 10 mA	1 port / Triac
	S and SW series Tx10 series	I_{GT} = 10 mA	V_G = 1.5 V at I_G = 20 mA	1 port / Triac
	C series	I_{GT} = 25 mA	V_G = 1.5 V at I_G = 50 mA	2 port in parallel / Triac
	CW series	I_{GT} = 35 mA	V_G = 2.0 V at I_G = 70 mA	3 port in parallel / Triac
	B and BW series	I_{GT} = 50 mA	V_G = 2.0 V at I_G = 100 mA	4 port in parallel / Triac

1. *Maximum values depend on the STM32 reference considered. You can refer to the datasheet absolute maximum ratings.*

Example:

For +5 V supply voltage and a logic level Triac with I_{GT} = 10 mA, we have:

$$R_G = \frac{V_{DD} - V_G - V_{OL}}{I_G}$$

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 Ω

To consider the dispersion of the R_G value, V_{DD} and on the temperature variation, we generally choose about:

- I_G = 2 . I_{GT} (I_{GT} = Specified gate trigger current)
- t_p > 20 µs

Where t_p is the pulse duration of the gate current.

3 Conclusion

Use ST sensitive Triacs driven by an ST 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.

Revision history

Table 2. **Document revision history**

Date	Revision	Changes
May-1992	1	First Issue
5-Apr-2004	2	Stylesheet update. No content change.
20-May-2025	3	Document reworked to improve readability. Table 1 content changes.

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