

TRIAC & MICROCONTROLLERS: THE EASY CONNECTION

INTRODUCTION

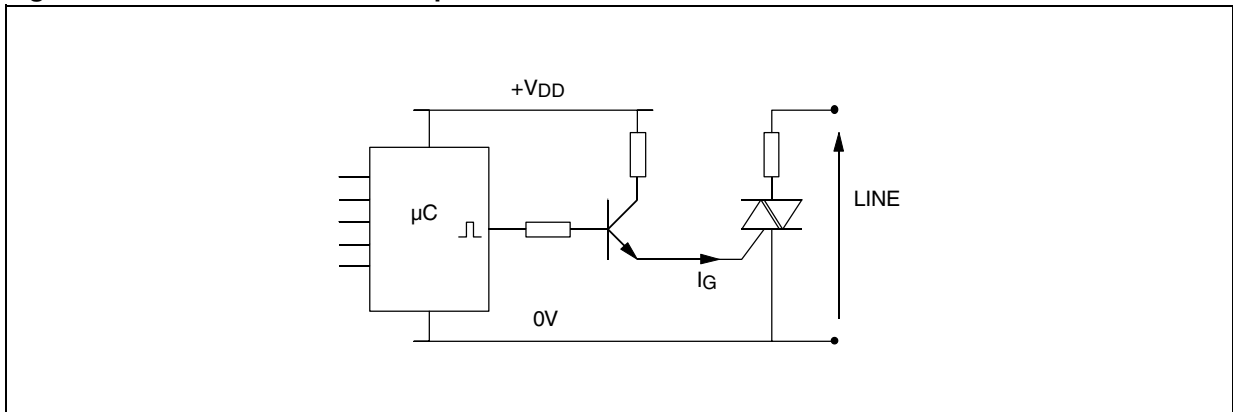
The aim of this note is to show how to connect an ST triac and an ST microcontroller.

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.

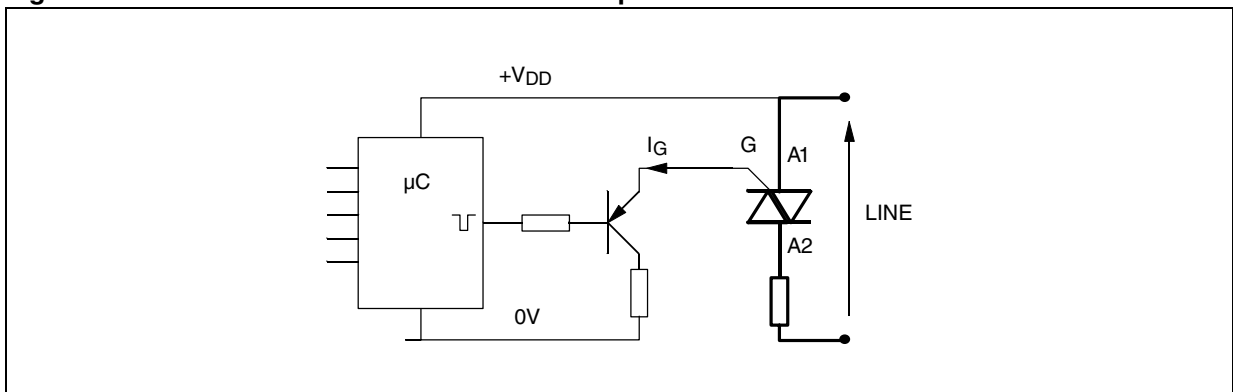
All the system use a buffer transistor between the output port of the microcontroller and the triac as shown in the Figure 1.

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.

AN442 APPLICATION NOTE

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.

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!

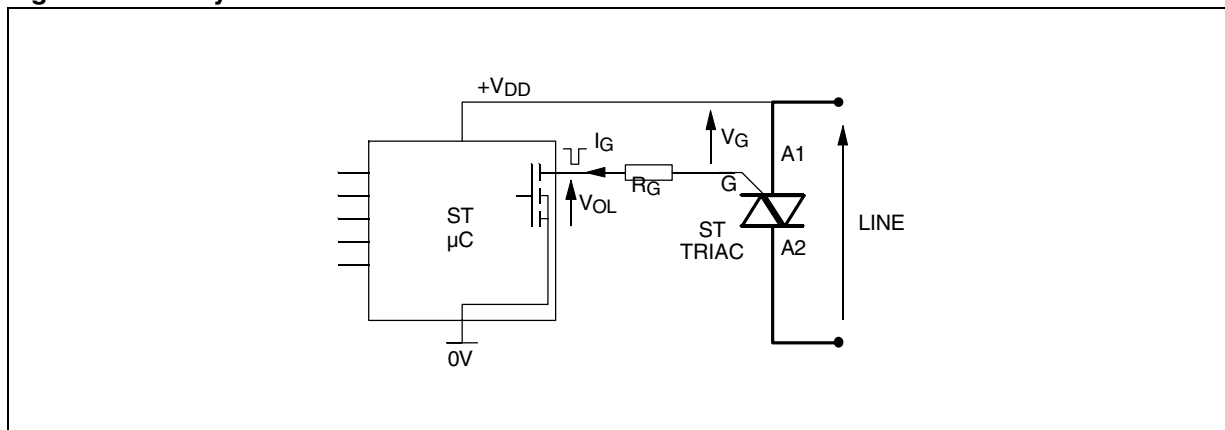


Table 1 shows the output capability of a range of controllers and the sensitivity of the triacs.

Table 1. Triac and microcontroller characteristics

MICROCONTROLLERS & OUTPUT CAPABILITIES	TRIAC	SENSITIVITY	GATE PARAMETERS	CONNECTION
ST621x SERIES ST622x SERIES $I_{OL} = 20mA$ at $V_{OL} = 1.3V$ $I_{VSS} = 100mA$	T & TW SERIES Tx05 SERIES	$I_{GT} = 5mA$	$V_G = 1.5V$ at $I_G = 10mA$	1 PORT/TRIAC
	S & SW SERIES Tx10 SERIES	$I_{GT} = 10mA$	$V_G = 1.5V$ at $I_G = 20mA$	1 PORT/TRIAC
	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

Example:

For +5V supply voltage and a LOGIC LEVEL triac with $I_{GT} = 10 \text{ mA}$, 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: $V_{DD} = 5 \text{ V}$
 $V_{OL} = 1.3 \text{ V}$
 $V_G = 1.5 \text{ V}$
 $I_G = 20 \text{ mA}$

Therefore: $R_G = 110 \Omega$

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

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

$t_p > 20 \mu\text{s}$

Where t_p is the pulse duration of gate current.

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.

AN442 APPLICATION NOTE

REVISION HISTORY

Table 2. Revision History

Date	Revision	Description of Changes
May-1992	1	First Issue
5-Apr-2004	2	Stylesheet update. No content change.

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a registered trademark of STMicroelectronics.
All other names are the property of their respective owners

© 2004 STMicroelectronics - All rights reserved

STMicroelectronics GROUP OF COMPANIES

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan -
Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States

www.st.com