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.
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>
<thead>
<tr>
<th>MICROCONTROLLERS &amp; OUTPUT CAPABILITIES</th>
<th>TRIAC</th>
<th>SENSITIVITY</th>
<th>GATE PARAMETERS</th>
<th>CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST621x SERIES</td>
<td>T &amp; TW SERIES</td>
<td>$I_{GT} = 5mA$</td>
<td>$V_G = 1.5V$ at $I_G = 10mA$</td>
<td>1 PORT/ TRIAC</td>
</tr>
<tr>
<td>ST622x SERIES</td>
<td>S &amp; SW SERIES</td>
<td>$I_{GT} = 10mA$</td>
<td>$V_G = 1.5V$ at $I_G = 20mA$</td>
<td>1 PORT/ TRIAC</td>
</tr>
<tr>
<td></td>
<td>Tx05 SERIES</td>
<td>$I_{OL} = 20mA$ at $V_{OL} = 1.3V$</td>
<td>$I_{VSS} = 100mA$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tx10 SERIES</td>
<td>$I_{GT} = 25mA$</td>
<td>$V_G = 1.5V$ at $I_G = 50mA$</td>
<td>2 PORTS IN PARALLEL/ TRIAC</td>
</tr>
<tr>
<td>C SERIES</td>
<td>$I_{GT} = 35mA$</td>
<td>$V_G = 2V$ at $I_G = 70mA$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW SERIES</td>
<td>$I_{GT} = 50mA$</td>
<td>$V_G = 2V$ at $I_G = 100mA$</td>
<td>3 PORTS IN PARALLEL/ TRIAC</td>
<td></td>
</tr>
<tr>
<td>B &amp; BW SERIES</td>
<td>$I_{GT} = 50mA$</td>
<td>$V_G = 2V$ at $I_G = 100mA$</td>
<td>4 PORTS IN PARALLEL/ TRIAC</td>
<td></td>
</tr>
</tbody>
</table>
Example:
For +5V 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 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)
- $t_p > 20$ µs

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.
## REVISION HISTORY

Table 2. Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Description of Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>May-1992</td>
<td>1</td>
<td>First Issue</td>
</tr>
<tr>
<td>5-Apr-2004</td>
<td>2</td>
<td>Stylesheet update. No content change.</td>
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