Gate drives for thyristors.

Thyristors are turned on (assuming they are forward biased) by injecting a current into the gate (which comes back out the cathode).

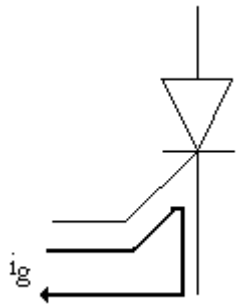
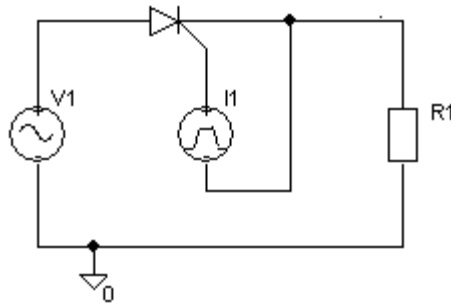


Figure 1: Flow of gate current in a Thyristor

Once the thyristor has latched on, it continues to conduct until either:

- Some external action interrupts the current flow in the device
- Sufficient current is pulled from the gate of the device such as to shut down the thyristor (Gate turn-off)

The key phase above is "once the thyristor has latched on". The latching of a thyristor into a stable ON state requires a certain minimum anode current called the *Latching Current* (this is specified on the manufacturer's data sheet). The thyristor in the circuit below shown in Figure 2 has a latching current of 100mA.



If R1 is very large, it may not be possible for the anode current to reach a level of 100mA. In such cases, when the gate is fired, the thyristor will conduct for as long as the gate pulse lasts but as soon as the gate pulse is removed, the thyristor will shut down again. This sort of problem can also arise if the load is inductive. In such cases, the inductance limits the rate of rise of load current and it could arise that the anode current will not quite have reached the latching current level before the gate current is removed. A perhaps obvious question arises here: Why not maintain gate current for longer and longer periods? The answer to this consists of two main parts:

- Continuous gate current increases power loss in the thyristor
- Continuous gate current is harder to deliver than short current pulses.

A common solution is to compromise by sending a stream of short current pulses to the gate over the desired conduction period. The idea behind this is that the thyristor

may not latch for the first one but it might latch for one of later ones as the load current gradually rises.

(Another related point is worth mentioning here: Holding current. Thyristors will maintain their latched on state so long as their anode current is greater than their (manufacturer specified), holding current level. Usually $I_{holding} < I_{Latch}$.

Pulse transformers.
The pulsed nature of Thyristor gate currents can allow designers to used pulse transformers to isolate the source of the gate signal (e.g. a microprocessor) from the main power circuit. Figure 3 shows a possible gate pulse circuit.

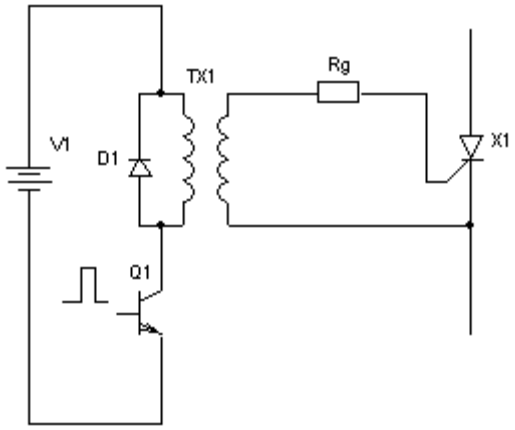


Figure 3

Pulse transformers can be made quite small. Figure 4 shows a surface mount pulse transformer which is less than $10mm^3$

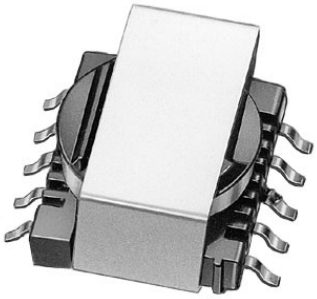


Figure 4: Surface mount pulse transformer