Sensitive gate 1A triacs in TO92

Introduction

In the domestic and commercial arenas, there are many electrical appliances which require some form of intelligent electronic control of small AC mains loads. Since cost will always be a major consideration in most of these markets, the chosen control method will be the one which offers the required functionality at the lowest cost.

The most likely candidate as the power controller is the triac because of the simplicity of the control circuits which use them. It is easy to achieve variable power control or ON-OFF switching of 50Hz or 60Hz mains loads with very few components. Because there are no moving contacts, this "solid state" control allows spark-free switching with excellent longterm reliability.

Triac requirements

In many applications, the control electronics or integrated circuit will be powered directly from the mains via a capacitor and/or a dropper resistor. The load on this power supply must be as low as possible to minimise power dissipation in the dropper. This restriction imposes a limit on the current available to drive the triac. This is especially true when several triacs are controlled at the same time.

A very sensitive triac gate is therefore essential in order to minimise the burden on the drive circuit and its power supply. This must be provided by an economical, low current device which is most suited to low power mains loads.

Philips solution

Philips Semiconductors' wide range of triacs includes sensitive gate 1A types in the popular, low cost TO92 package. These feature a high surge capability of 16A @ 50Hz full cycle. Gate current (I_{GT}) options include 3mA and 5mA. Direct triggering from ICs, or any low power drive circuit, is possible without the need for an intermediate drive current amplifier.

Table 1 summarises the available types and their important specifications. The table also includes a brief competitor cross reference to assist in the selection of Philips part numbers as alternatives.

Thermal considerations

The typical junction-to-ambient thermal resistance of the TO92 package in free air is 150K/W. Continuous load currents can be up to 0.5A RMS when the triac is operated in free air. This is equivalent to a load power of 115W on 230V mains. Higher currents are possible on a discontinuous basis. Continuous currents in excess of 0.5A will require additional heatsinking in the form of a clip-on heatsink.

Applications

Applications for these triacs can be found wherever a small motor, heater, or solenoid must be controlled.

Washing machines and dishwashers contain several low power loads including:

Hybrid cam timer,
Powder dispenser,
Rinse aid dispenser,
Hot and cold water inlet solenoid valves,
Door lock.

Refrigeration. Fridge freezers with intelligent control of temperature and defrost cycles can contain the following 1A triac-controlled loads:

Refrigerant solenoid zone valves,
Defrost heaters,
Ventilation/recirculation fan,
Ventilation flap valves,
Lamp.

Extractor fans. "Timer" versions incorporate delayed shut-off after the switch has been turned off. The timing facility is provided by a dedicated low power IC which controls the motor via a sensitive gate TO92 triac.

Rice cookers. Many of these incorporate a low power lid heater which is controlled by a 1A triac. The heater prevents condensation forming during the keep warm cycle. This avoids condensation dropping down onto the cooked rice & making it wet again.

Trigger for larger less sensitive triacs. A 1A sensitive gate triac can be used to turn on a high current less sensitive triac from a low current drive circuit.

Vacuum cleaners. Some vacuum cleaners incorporate edge cleaning brushes. The small motor which drives these is controlled by a 1A triac.

Figure 1 shows just one example of a low power triac drive circuit. Negative gate current is used in order to avoid the less sensitive quadrant IV. The triac operates in quadrants II & III.

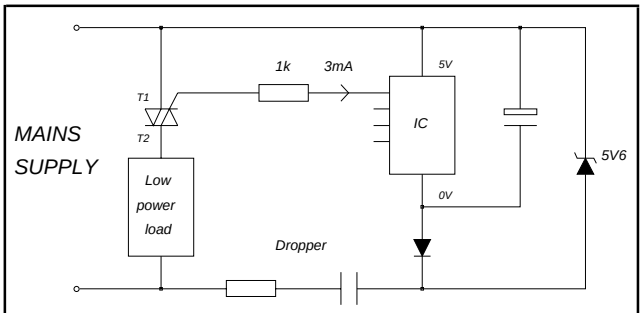


Fig. 1. Cost effective control of small loads using an IC & sensitive gate triac.

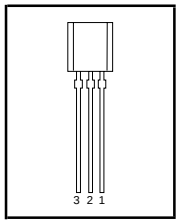
Summary of advantages

Philips 1A sensitive gate triacs in TO92 provide the following advantages:

1. The most cost effective solution for low power loads,
2. A high surge capability of 16A @ 50Hz full cycle,
3. Guaranteed gate triggering from low power drive circuits,
4. They occupy a very small area on the PCB.

TO92 pinning

PIN	DESCRIPTION
1	main terminal 2
2	gate
3	main terminal 1



Leadform options are available upon request.

Selection guide

Where an "x" appears in the cross reference type numbers, this denotes a wildcard. For example, where Lx01E3 is quoted, this stands for L201E3, L401E3 and L601E3.

Type number	V_{DRM} max (V)	$I_{T(RMS)}$ (A)	I_{TSM} @ 20ms (A)	I_{GT} max (mA) Quadrant:		Typical competitor part numbers.
				I,II,III	IV	
BT131 series	500 - 600	1	16	3	7	MAC97xx Z0103xA Lx01E3, Lx01E5 SM08x43
BT132 series D	500 - 600	1	16	5	10	BCR1AM MAC97-x Z0107xA, Z0109xA Lx01E6, Lx01E8 SM1x43

Table 1. Philips 1A triacs in TO92.

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