SGS-THOMSON MICROELECTRONICS

APPLICATION NOTE

TRANSIL OR VARISTOR

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1. INTRODUCTION

Transils and Metal Oxide Varistors (MOVs) are protective components (suppressors).

Table 1 lists their major characteristics and properties.

Table 1. Comparison of the major characteristics of Transils and Varistors

Parameter	Varistor	Transil
Voltage range (V) [1]	14 to 1200	5 to 500
Leakage current @ 25ºC, V=V_{RM} [2]	Typ. 50µA, Max 200µA	Typ. 0.05µA, Max. 5µA
Capacitance value	200 to 500pF All voltages	200 to 500pF [4] @ V = 0 2 to 5 times less @ V=V_{RM}
Temperature coefficient	-0.05% / ºC	1% / ºC
Operating temperature	-40ºC to 115ºC	-40ºC to 150ºC
Response time	Around 10ns	A few ns
Clamping factor [3]	1.7 to 3	1.12 to 3
Power dissipation		
1 overload (20µs duration)	1 to 150J	0.1 to 0.7J
10 overloads (20µs duration)	0.4 to 60J	0.1 to 0.7J
Continuous operation	0.3 to 1.3W	1 to 2W

NOTES

1) Varistors are available for lower voltage, but their electrical performance is much worse
2) V_{RM} = Voltage stand-off
3) Clamping factor = V_{CL}, clamping voltage (for Transil at I_{pp}) / V_{BR}, avalanche voltage (@ 1mA)
4) These values must be divided by 2 for bidirectional Transils

2. IMPORTANT PARAMETERS

2.1 Clamping

See figures 1 and 2.

The clamping factor characterises the degree of protection offered by the component. As the Transil operates by the mechanism of volume avalanche in the silicon, it limits the voltage (for a given current) to a value lower than that of the Varistor.

2.2 Overload current

2.2.1 Short overloads (< 100µs)

As a general rule the Varistor can stand much higher short-duration currents than the Transil.

2.2.2 Long (> 1ms) or repetitive overloads

As long as its structure, mounting and thermal resistance are taken into consideration, the Transil is better suited to this type of operation, due to the

Figure 1. Comparison of clamping behaviour

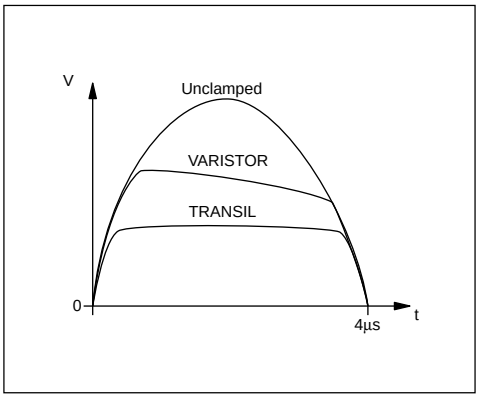


Figure 2. Camp voltage versus overload current

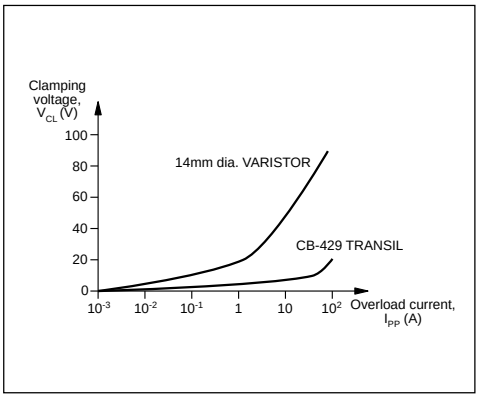


Figure 3. Overload capacity vs. No. of overloads

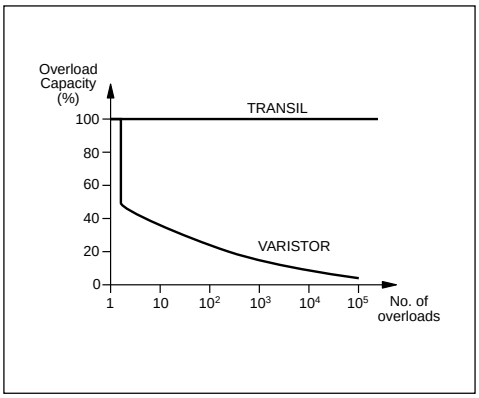
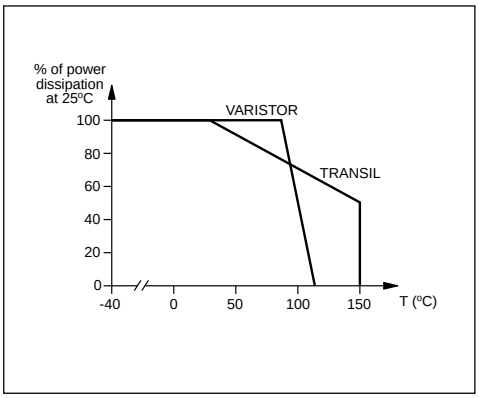


Figure4. Temperature characteristics



poor medium-power dissipation performance of the Varistor.

2.3 Reliability in overload conditions

See figure 3. After each overload, the structure of the Varistor is changed slightly, leading to a reduction in voltage and an increase in the leakage current. The performance of the Transil on the other hand does not vary depending on the number of overloads experienced (providing the specified maximum amplitude is not exceeded).

2.4 Temperature characteristics

See figure 4. The Varistor maintains 50% of its performance at 85°C, but is not usable above 115°C. The Transil maintains 50% of its performance at 150°C.

CONCLUSIONS

The Transil operates very well as a clipper, and has good long term reliability. It is suited to the clamping and protection of components (e.g. transistors, microprocessors).

The Varistor is a low-cost component which can withstand very high level surge currents for short times. It is best adapted to the protection of electrical equipment (e.g. transformers and motors) from high-level transients.