SGS-THOMSON MICROELECTRONICS

APPLICATION NOTE

ELECTRONIC IGNITION WITH VB020 AND L497

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INTRODUCTION

The VB020 is a monolithic high voltage integrated circuit which combines a vertical power darlington with built-in protection circuits for coil current limiting and collector voltage clamping. The device interfaces directly with a microprocessor which controls the dwell angle.

This application note shows how it is possible to use the VB020 in an electronic ignition system not employing a microprocessor.

The IC used, the L497, is a more conventional electronic ignition controller for breakerless ignition systems using a Hall effect sensor.

OPERATING PRINCIPLE

The schematic of fig.1 shows how the two ICs are connected to control both the coil current, providing the required stored energy and the dwell angle, for low power dissipation.

The L497 was designed to drive an external Darlington and in a standard application circuit the current control is performed monitoring the coil current through a sensing resistor on the emitter of the Darlington. When the voltage drop across the sensing resistor reaches the internal comparator threshold value the dwell angle control circuit is enabled. Meanwhile the coil current is kept constant forcing the

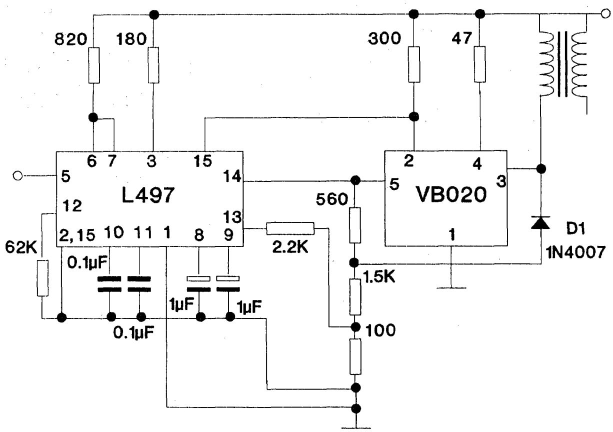

Fig. 1 - Schematic of electronic ignition with VB020 and L497.

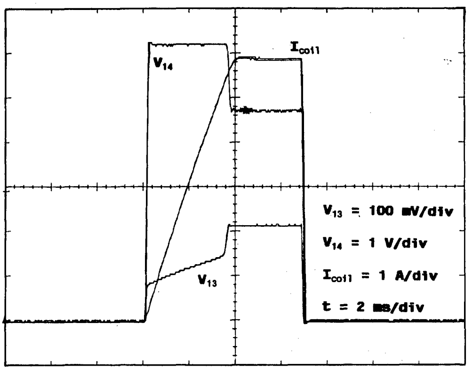

Fig. 2 - V_{13}, V_{14} and I_{coil} waveforms.

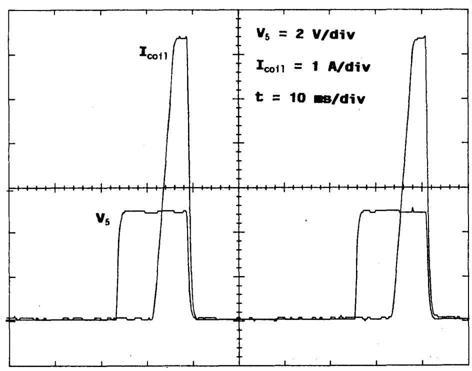

Fig. 3 - Duty-cycle = 30%; frequency = 20 Hz.

Darlington into the active region until the high-low transition of the input signal causes the spark to occur. The collector voltage is clamped to a value that is externally fixed by a resistive network. The internal dwell angle control circuit calculates the conduction time for the output Darlington in relation to the speed of rotation, to the supply voltage and to the characteristics of the coil, thus avoiding excessive power dissipation in the Darlington itself.

By linking together the L497 and the VB020 it is possible to avoid both the coil current sensing and the collector voltage clamping networks because the VB020 has internal built-in protection circuits which perform these functions. The dwell angle control is performed by supplying the L497 with the feedback signal shown in fig.2. The diode, D1, keeps the voltage at pin 13 of the L497 under the internal comparator threshold voltage until the VB020 begins to regulate the coil current. At this point

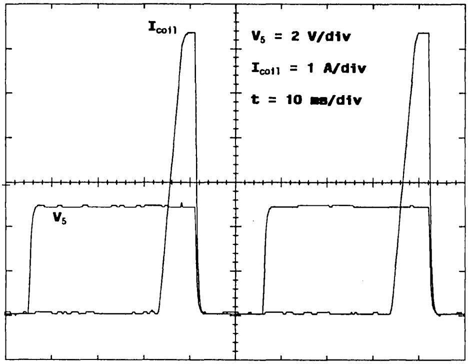

Fig. 4 - Duty-cycle = 70%; frequency = 20 Hz.

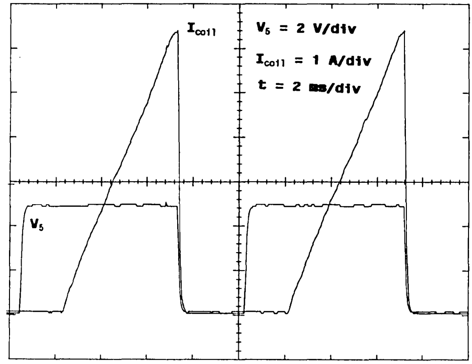

Fig. 5 - Duty-cycle = 70%; frequency = 100 Hz.

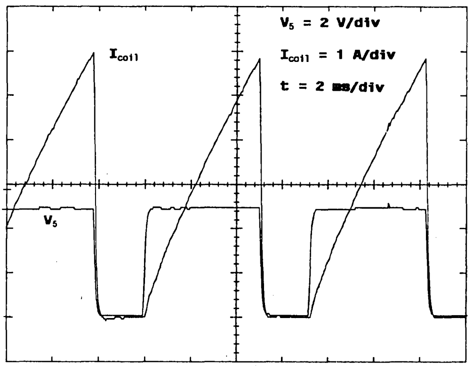

Fig. 6 - Duty-cycle = 70%; frequency = 140 Hz.

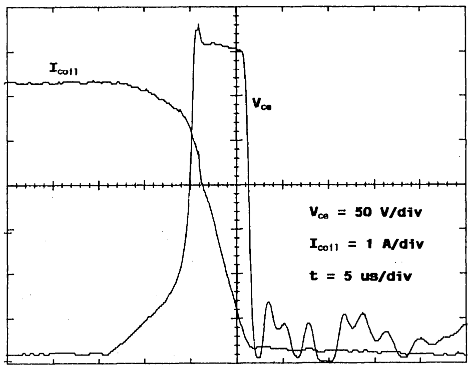

Fig. 7 - Turn-off in normal operating mode.

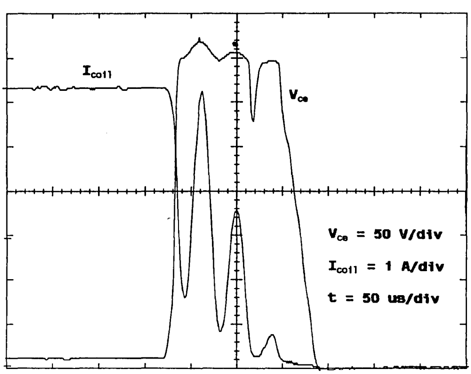

Fig. 8 - Turn-off with open gap.

D1 is turned-off and the voltage on pin 13 can reach the threshold voltage of the internal comparator enabling the dwell control circuit. Figures 3 to 8 show the system performance (V_{in}, I_{coil}) under various conditions and fig. 9 shows the conduction angle versus r.p.m. for a four cylinder engine.

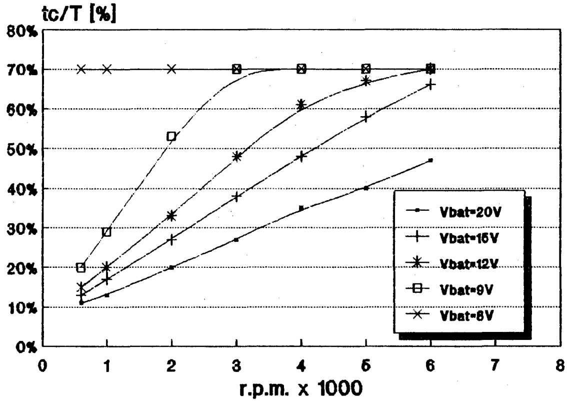

Fig. 9 - Conduction angle versus r.p.m.

CONCLUSION

The VB020 can be used in electronic ignition systems without using a microprocessor.
The overall cost of the system can be competitive with the solution using a Darlington because the current limiting and voltage clamping function performed by the VB020 are trimmed on silicon avoiding the need for additional adjustment.

REFERENCES

[1] F. Pellegrini, "L482 Development Report", SGS-THOMSON internal report, August 1982.
[2] M. Paparo, "L497 Development Report", SGS-THOMSON internal report, July 1985.
[3] "Automotive Products" Data-book, SGS-THOMSON microelectronics