A Zener Diode tester

Zener diodes are a common cause of faults in electronic equipment, so it's helpful to have a means of checking them. This simple meter, devised by Michael Dranfield, is a useful addition to your test armoury

Unlike most semiconductor devices, zener diodes cannot be checked with a multimeter. A zener diode may seem to be OK when forward biased, but may stabilise at the wrong voltage or not at all. We recently had a Samsung SI3240 VCR in with tuning problems, and found that the voltage across the 33V stabilising device was only 25V. In this case the cause of the problem was easy to diagnose, and there was no other damage. Things can be more tricky when the faulty zener diode is part of a switch-mode power supply: the whole power supply might blow up at switch on, especially where DC coupling is used throughout. We've had this happen with the Ferguson FV31 VCR and ICC5 chassis.

The tester described in this article applies a current-limited, high-voltage supply across the zener diode under test, showing the breakdown voltage on a liquid-crystal display with an accuracy of 0·1V.

Circuit Description

The circuit of the tester is shown in Fig. 1. It employs a single-transistor oscillator that runs at approximately 3kHz. Mains transformer T1 is used in reverse: its centre-tapped 4·5-0-4·5V winding is the oscillator transistor's load, the 0-240V winding stepping up the voltage to feed bridge rectifier BR1. When pushbutton switch PB1 is pressed, a voltage starts to build up across the rectifier's reservoir capacitor C4. This build up continues until the zener diode being tested starts to conduct. The conduction point is the diode's zener breakdown voltage, and is displayed directly by the LCD panel. R2 limits the current flowing through the diode to about 5mA.

The display device is a digital LCD voltmeter module that's available from Maplin. It has a maximum read out of 199·9V, which is not a problem since zener diodes with a higher breakdown voltage are rarely used. R3 and R4 calibrate the meter: the LCD module has a built-in preset for fine adjustment.

Approximately 350V is developed across C4. If the unit is run without a zener diode in circuit the display will over-range, displaying a one. No damage will be done to the display, but if you wish you can limit the test voltage at approximately 200V by connecting a 1·2MΩ resistor across C4.

Construction

Circuit layout is not critical. I etched my own board, but you could build the unit using tagstrip or Veroboard. The prototype unit is housed in a very professional-looking instrument case with a display window and a PP3 battery compartment. The case costs about £8 + VAT from Farnell while the Maplin GW01B display unit costs £11·95.

Setting Up

Initial setting up is easy. Insert a known good zener diode with a breakdown voltage of say 9·1V. Connect a digital multimeter across the zener diode. Switch on and adjust the preset on the LCD panel so that the reading is exactly the same as that displayed by the multimeter. Don't rely on the zener diode alone for calibration, as most zener diodes have a ±5% tolerance and the breakdown voltage can also vary with temperature.

In view of the high voltage present, in-circuit testing is not recommended. Although the input impedance is very high, touching the test terminals with your finger could still make you jump!

Use

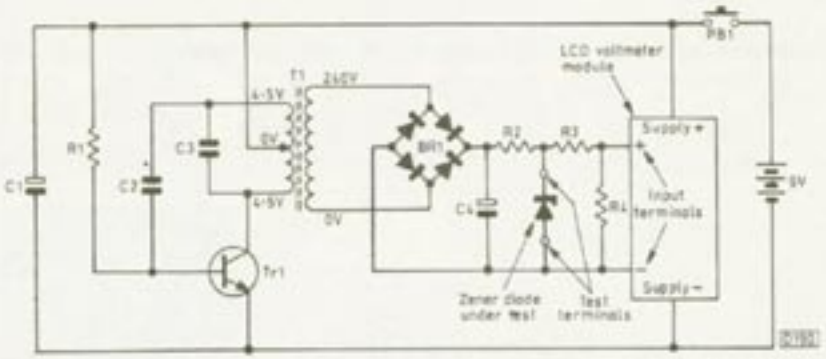
Insert the suspect zener diode in the test socket. Push the button and hold it for a few seconds, until the reading stabilises. This is the diode's working voltage. If the meter reads 0·7V the zener diode is connected the wrong way round, with forward bias applied.

Happy testing! ■

Components required

Tr1	2SC1815
C1	100µF, 25V
C2	0·047µF, 250V polyester
C3	0·047µF, 250V polyester
C4	2·2µF, 400V
BR1	400V, 1A bridge rectifier
R1	10kΩ
R2	10kΩ
R3	4·7MΩ
R4	4·7kΩ
T1	Farnell 432-684
PB1	Farnell 140-690 miniature pushbutton switch
LCD	Maplin GW01B digital LCD voltmeter

Case, Farnell 465-963
Test sockets Farnell 145-299 (red), 145-300 (black).
PP9 battery.



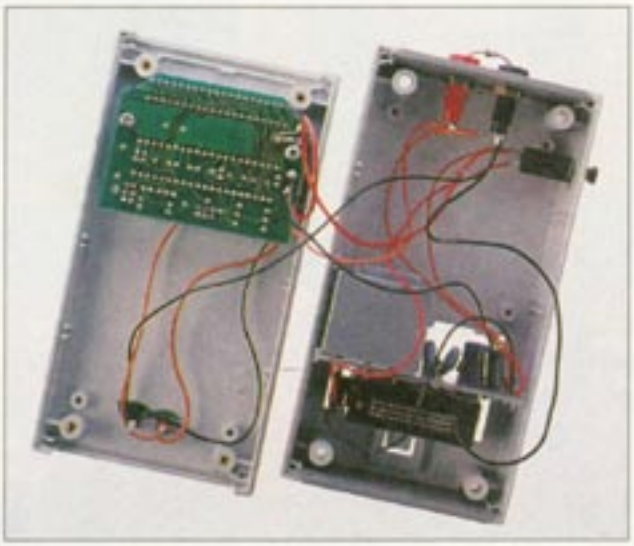


Fig. 1: Circuit diagram of the tester. Do not connect the negative side of C4 to the battery's negative terminal, as the LCD panel won't work in this condition.

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