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A Repair Case of Philips V24E

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Abstract: ***A patient monitor is a device or system that measures and controls a patient's physiological parameters, such as blood pressure, electrocardiogram, and blood oxygen saturation, and compares these parameters with known set values. If any values are exceeded, an alarm is triggered. Medical professionals can use patient monitors to collect vital sign information, analyze and diagnose their condition, and develop scientifically sound treatment plans. Patient monitors are widely used in hospital intensive care units and general wards. This article shares a case study of repairing the power board of a Philips V24E patient monitor.***

Keywords: Monitor power supply; Philips.

1. BASIC STRUCTURE

The power supply module, system controller module, graphics display module, and multi-parameter module are included.

2. BASIC PRINCIPLES

Medical monitors primarily employ analog- to-digital (A/D) and digital-to-analog (D/A) conversion technologies, as shown in Figure 1. Human blood pressure, blood oxygen, and other signals are acquired by electrodes and sensors and converted into electrical signals. These signals are then converted into digital signals via A /D conversion and sent to a microcomputer. The microcomputer then sends these data to the digital-to-analog (D/A) converter interface for analysis and processing to obtain the required data, which is then displayed on the screen.

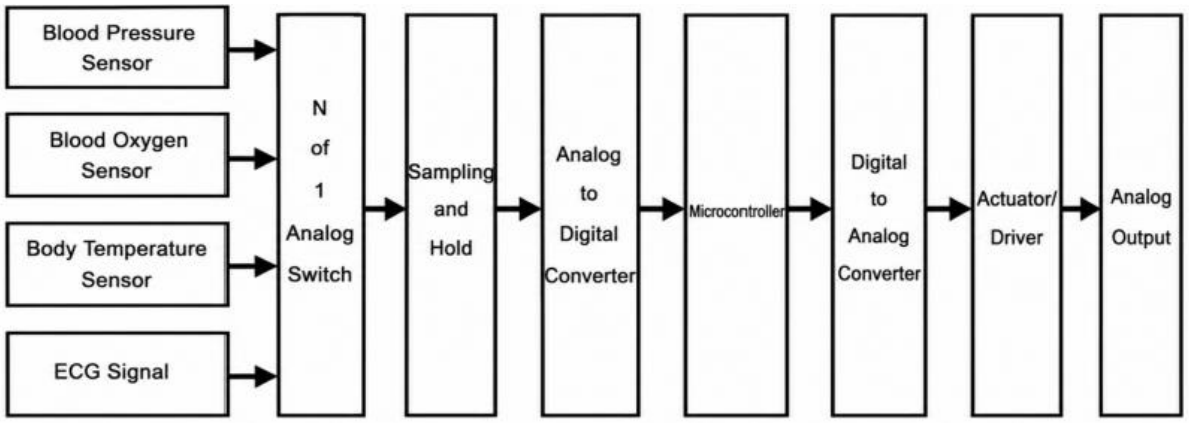

Figure 1: Circuit diagram of a medical monitor

3. FAULT PHENOMENON

When the monitor is turned on, the screen is black, no indicator lights are on, and there is no alarm sound. When the non-invasive blood pressure module is turned on, no air is pumped, indicating that the monitor cannot be turned on.

4. REPAIR PROCESS

1) The power cord output voltage was measured with a multimeter and found to be 220V, indicating that the power cord was not faulty.

2) Disassemble the device and check the power plug and socket for any poor soldering, short circuits, open circuits, etc. After inspection, the power plug was determined to be normal.

3) Check the power board for any damaged fuses; upon inspection, the fuses were found to be normal.
4) When connected to 220V AC power and the monitor switch was pressed, the 5.1V, 12V, and 61.2V power indicator lights on the power board were found to be flashing, suggesting a problem with the power board.

5) When the capacitor is powered on, a 450V capacitor is measured with a multimeter in DC mode. The two pins show a voltage of approximately 320V. When the output pin corresponding to J1 is measured, the output is not constant.

6) The voltage across pins 1 and 2 of the 1M0565R chip was measured at 320V, indicating that the internal switching transistor was not conducting. Possible causes include: ① The 1M0565R power management chip is faulty; ② The chip is not working. Circuit observation revealed that the transformer's auxiliary winding charges a 50V, 47μF capacitor, which in turn supplies power to the 1M0565R chip. If the capacitor is damaged, it cannot provide a continuous and effective voltage to the chip, causing it to malfunction and affecting the output.

7) The waveform obtained by connecting an oscilloscope to the two ends of VCC (the two ends of the capacitor) is shown in Figure 3. As can be seen from the figure, the voltage across VCC will drop sharply to below 10V. According to the datasheet, the cutoff voltage of the 1M0565R chip is 10V and the operating voltage is 12V. When the voltage reaches 12V, the power management chip starts to work and the circuit outputs voltage. When the voltage is lower than 10V, the power management chip stops working and the circuit has no voltage output, resulting in unstable voltage output.

8) Replace the 50V, 47μF capacitor, and connect an oscilloscope to the VCC terminals while the circuit is powered on. The waveform obtained is shown in Figure 4. It can be seen that the voltage waveform is stable, without sudden drops, and the minimum voltage is greater than 10V. The voltage indicator light on the power board is constantly on, and the output is stable.

9) The monitor was installed and tested, and all functions were found to be working properly. Repair is complete.

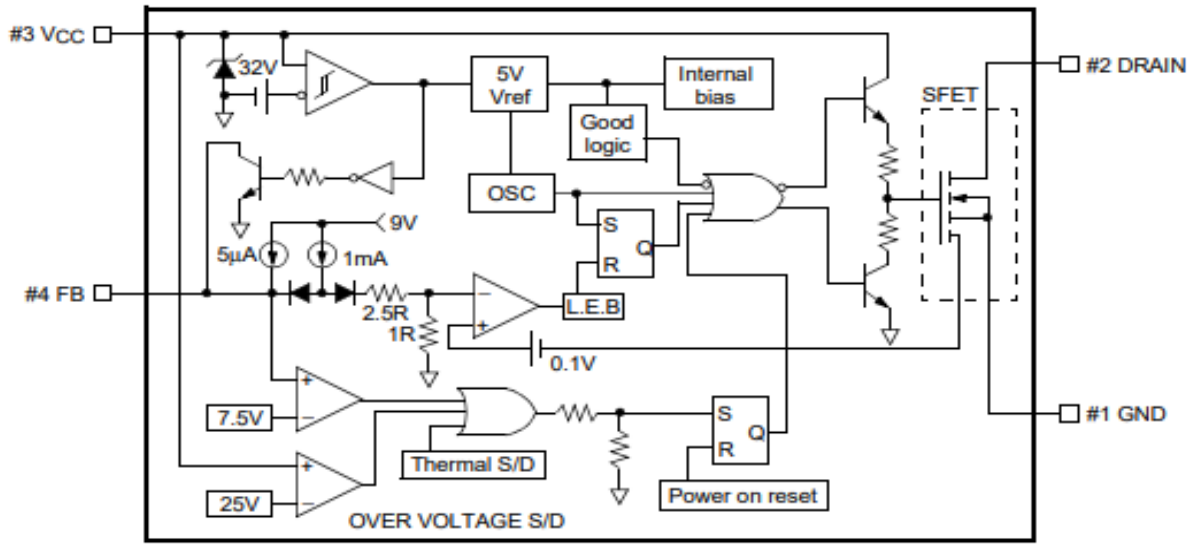

Figure 2: 1M 0565 R circuit diagram

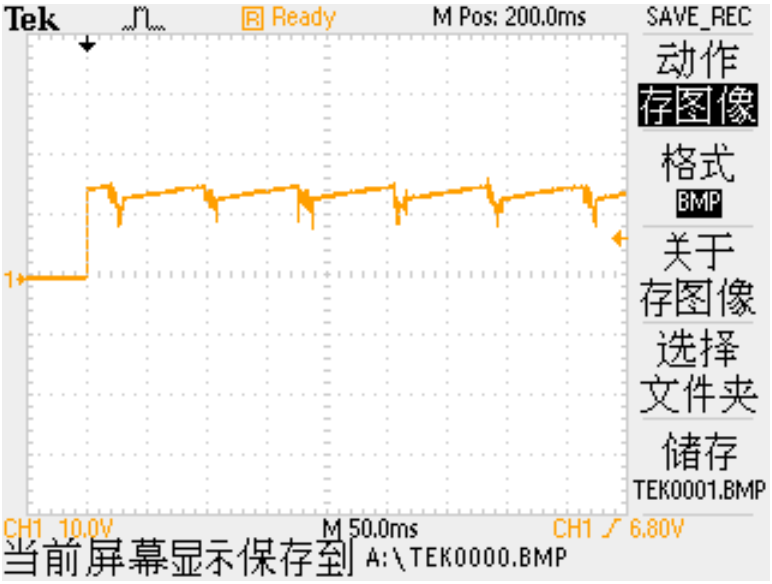

Figure 3: Capacitor terminal waveform (pre-repair)

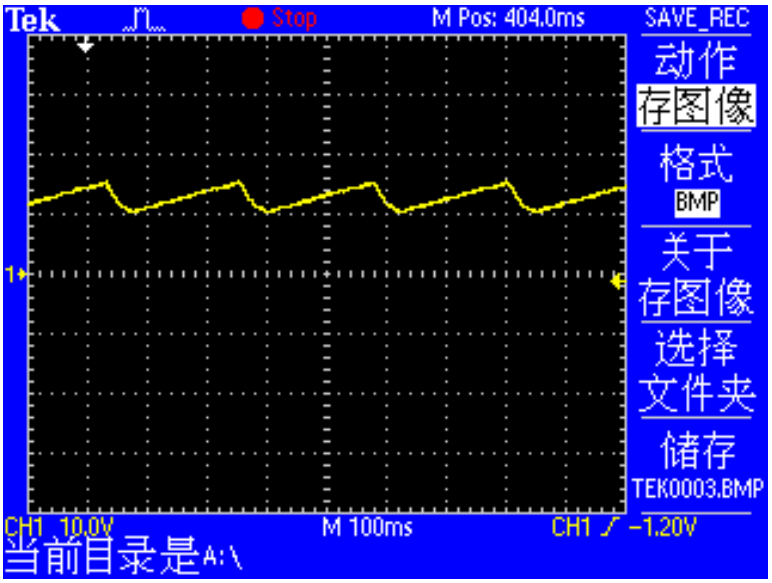

Figure 4: Capacitor terminal waveform (post-repair)

5. CONCLUSION

Patient monitors are used frequently in clinical settings, and their failure rate is relatively high. To ensure clinical needs, the failure rate of patient monitors can be reduced in the following ways: (1) Users should pay attention to the daily cleaning and maintenance of patient monitors; (2) Engineers from the medical engineering department or equipment department should conduct preventive maintenance and regular inspections of patient monitors to promptly identify and eliminate faults and improve work efficiency; (3) After acceptance and repair, and during regular inspections, patient monitors can be further tested using appropriate quality control equipment (electrical safety analyzers, vital signs simulators, etc.) to ensure the safety and accuracy of the instruments; (4) From the perspective of quality control, further strengthen the quality management of hospital medical equipment, ensure the normal operation of medical equipment, do a good job in the management of the entire life cycle of medical equipment, and improve the quality of medical care.

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