DESIGN PROJECT: POWER FAILURE DETECTOR

OBJECTIVES: The purpose of this assignment is to design a warning system for a microprocessor system that detects upcoming power failures early enough so that the microprocessor can save vital data into non-volatile memory.

EQUIPMENT:

Oscilloscope
LM 393 Comparator
Resistors

BACKGROUND:

Microprocessors (and computers in general), store data in Random Access Memory (RAM). However, when power is lost, data is also lost (volatile memory). In accidental power failures, there is usually enough time until power is totally lost, to save vital data in battery backed memory or flash memory (non-volatile memory). This is possible if the CPU receives an early warning of an upcoming power loss (black-out), or a power (voltage) drop (brown- out). In regulated power supplies, it is common to monitor the unregulated voltage at the input of the voltage regulator, and issue a warning when it drops below a safe level. During brown-outs (voltage is low, but not totally lost), the CPU may behave in an unpredictable fashion that may destroy data integrity, even in the backed-up memory. Therefore, it is customary to inhibit any CPU activities if the power supply is below the specified minimum value. This is usually done by activating hardware *RESET* line. Also, during power-up, hardware RESET is also issued so that the CPU is properly initialized.

It is our purpose to design a voltage monitoring system that generates the proper signals to a CPU.

SPECIFICATIONS:

Refer to the block diagram below. Assume *Low* = 0V, *High* = 5V. TRAP provides the early failure warning and $\overline{RESET}$ inhibits CPU activities (typical in an Intel 8085 CPU). The unregulated input voltage is typically 12V.

1) During normal operation TRAP is low and $\overline{RESET}$ is high.

2) TRAP goes high if V_{in} drops below 8.5V, and returns low if V_{in} rises above 10V.

3) $\overline{RESET}$ Goes low if V_{in} drops below 7V and returns high if V_{in} rises above 8V. $\overline{RESET}$ should be an open-collector output to allow for other reset sources.

DESIGN:

Use one LM 393 dual voltage comparator with open-collector outputs to design such a circuit. Typical pull-up resistor values are 4.7K. Power supply for the LM 393 should be V_{CC} =5V. Select the configurations and component values to meet the above demands. Use standard component values.

NOTE: The manufacturer of the LM 393 specifies that: $\left(\frac{V^+ + V^-}{2}\right) < (V_{CC} - 1.5V)$

TESTING:

Wire the circuit you have designed. Use the 5V and +25V (set to 12V) outputs from a single power supply unit. Vary the unregulated input voltage (12V), and check the triggering levels of each output. Verify that your design goals are satisfied.

REPORT:

In your report present experimental results and compare them with the expected results. Discuss any discrepancies, make comments and write conclusions.

REFERENCES: Current textbook for EEL 4309.