



# THE DATASHEET OF MAX701ESA+T



## General Description

The MAX700/MAX701/MAX702 are supervisory circuits used to monitor the power supplies in microprocessor ( $\mu$ P) and digital systems. The  $\overline{\text{RESET}}$ /RESET outputs of the MAX700/MAX701/MAX702 are guaranteed to be in the correct state for  $V_{CC}$  voltages down to +1V (Figure 4). They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V-powered circuits.

The MAX702 is the simplest part in the family. When  $V_{CC}$  falls to 4.65V,  $\overline{\text{RESET}}$  goes low. The MAX702 also provides a debounced manual-reset input. The MAX701 performs the same functions but has both  $\overline{\text{RESET}}$  and RESET outputs. Their primary function is to provide a system reset. Accordingly, an active reset signal is supplied for low supply voltages and for at least 200ms after the supply voltage reaches its operating value.

In addition to the features of the MAX701 and MAX702, the MAX700 provides preset or adjustable-voltage detection so thresholds other than 4.65V can be selected, and adjustable hysteresis. All parts are supplied in 8-pin PDIP and narrow-SO packages in commercial and extended temperature ranges.

## Applications

- Computers
- Controllers
- Intelligent Instruments
- Critical  $\mu$ P Power Monitoring

## Features

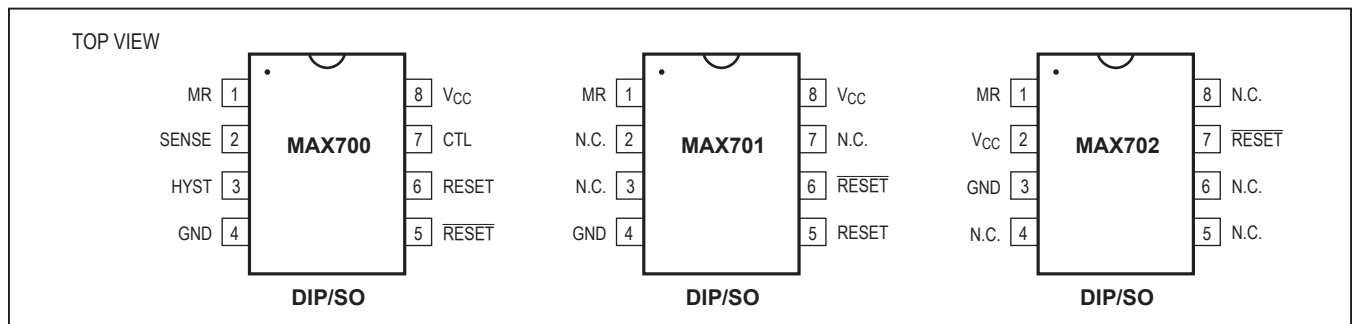
- Min 200ms  $\overline{\text{RESET}}$  Pulse on Power-Up, Power-Down, and During Low-Voltage Conditions
- Reset Threshold Factory Trimmed for +5V Systems
- No External Components or Adjustments with +5V-Powered Circuits
- Debounced Manual-Reset Input
- Preset or Adjustable-Voltage Detection (MAX700)
- Adjustable Hysteresis (MAX700)
- 8-Pin PDIP and Narrow-SO Packages

## Ordering Information

| PART*            | TEMP RANGE     | PIN-PACKAGE |
|------------------|----------------|-------------|
| <b>MAX700C/D</b> | 0°C to +70°C   | Dice        |
| MAX700CPA        | 0°C to +70°C   | 8 PDIP      |
| MAX700CSA        | 0°C to +70°C   | 8 Narrow SO |
| MAX700EPA        | -40°C to +85°C | 8 PDIP      |
| MAX700ESA        | -40°C to +85°C | 8 Narrow SO |
| <b>MAX701C/D</b> | 0°C to +70°C   | Dice        |
| MAX701CPA        | 0°C to +70°C   | 8 PDIP      |
| MAX701CSA        | 0°C to +70°C   | 8 Narrow SO |
| MAX701EPA        | -40°C to +85°C | 8 PDIP      |
| MAX701ESA        | -40°C to +85°C | 8 Narrow SO |
| <b>MAX702C/D</b> | 0°C to +70°C   | Dice        |
| MAX702CPA        | 0°C to +70°C   | 8 PDIP      |
| MAX702CSA        | 0°C to +70°C   | 8 Narrow SO |
| MAX702EPA        | -40°C to +85°C | 8 PDIP      |
| MAX702ESA        | -40°C to +85°C | 8 Narrow SO |

\*Devices in PDIP and SO packages are available in both leaded and lead(Pb)-free packaging. Specify lead free by adding the + symbol at the end of the part number when ordering.

## Pin Configurations



**Absolute Maximum Ratings**

|  |                          |   |                 |
|--|--------------------------|---|-----------------|
| V <sub>CC</sub> .....  | -0.3V to +15.5V          | Rate of Rise, V <sub>CC</sub> .....     | 100V/μs         |
| Voltage (with respect to GND) at RESET, RESET,<br>HYST, CTL, SENSE ..... | -0.3V to V <sub>CC</sub> | Power Dissipation, Any Package .....    | 380mW           |
| Operating Temperature Range  |                          | Storage Temperature Range .....         | -55°C to +150°C |
| C Suffix .....   | 0°C to +70°C             | Lead Temperature (soldering, 10s) ..... | +300°C          |
| E Suffix .....   | -40°C to +85°C           |   |                 |

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Electrical Characteristics**

(V<sub>CC</sub> = +5V, CTL = GND on MAX700, T<sub>A</sub> = +25°C, unless otherwise noted.)

| PARAMETER  | CONDITIONS   | MIN                   | TYP  | MAX  | UNITS |    |
|--|--|-----------------------|------|------|-------|----|
| V <sub>CC</sub> Monitor Voltage Range (MAX700 Only)          | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> , CTL = V <sub>CC</sub>                      | 3                     |      | 15   | V     |    |
| Min V <sub>CC</sub> for Valid Reset Output, Declining Supply | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> , V <sub>RESET</sub> ≤ 0.4V when sinking 1mA | 1.5                   | 1    |      | V     |    |
| Supply Current   |  |                       | 100  | 200  | μA    |    |
| Reset Threshold  | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>  | Power-up              | 4.50 | 4.65 | 4.75  | V  |
|  |  | Power-down            | 4.50 | 4.62 | 4.75  |    |
| Internal Hysteresis  | HYST not connected   |                       | 30   |      | mV    |    |
| Reset Output Pulse Width                                     |  | 200                   | 350  | 500  | ms    |    |
| RESET Fall Time  | MAX700/MAX701 only, C <sub>LOAD</sub> = 100pF  |                       | 200  |      | ns    |    |
| V <sub>CC</sub> Pulse Duration Guaranteeing                  | 5V to 4V V <sub>CC</sub> pulse   | No reset              |      | 10   | 1     | μs |
|  |  | Reset                 | 100  | 10   |       |    |
| MR Input Threshold   |  |                       | 0.7  |      | V     |    |
| MR Pullup Current  |  |                       | -5   | -30  | μA    |    |
| <b>MAX700</b>  |  |                       |      |      |       |    |
| RESET Output Low   | I <sub>SINK</sub> = 3.2mA, V <sub>CC</sub> = 5V  |                       |      | 0.4  | V     |    |
|  | I <sub>SINK</sub> = 1.6mA, V <sub>CC</sub> = 3V  |                       |      | 0.4  |       |    |
| RESET Output High  | I <sub>SOURCE</sub> = 3.2mA, V <sub>CC</sub> = 4.25V   | V <sub>CC</sub> - 0.4 |      |      | V     |    |
|  | I <sub>SOURCE</sub> = 1.6mA, V <sub>CC</sub> = 3V  | V <sub>CC</sub> - 0.4 |      |      |       |    |
|  | I <sub>SOURCE</sub> = 0.5mA, V <sub>CC</sub> = 1.5V  | V <sub>CC</sub> - 0.4 |      |      |       |    |
| RESET Output Low   | I <sub>SINK</sub> = 16mA, V <sub>CC</sub> = 4.25V  |                       |      | 0.4  | V     |    |
|  | I <sub>SINK</sub> = 1.6mA, V <sub>CC</sub> = 3V  |                       |      | 0.4  |       |    |
|  | I <sub>SINK</sub> = 0.4mA, V <sub>CC</sub> = 1.5V  |                       |      | 0.4  |       |    |
| RESET Output High  | I <sub>SOURCE</sub> = 3.2mA, V <sub>CC</sub> = 5V  | V <sub>CC</sub> - 0.4 |      |      | V     |    |
|  | I <sub>SOURCE</sub> = 1.6mA, V <sub>CC</sub> = 3V  | V <sub>CC</sub> - 0.4 |      |      |       |    |

**Electrical Characteristics (continued)**(V<sub>CC</sub> = +5V, CTL = GND on MAX700, T<sub>A</sub> = +25°C, unless otherwise noted.)

| PARAMETER   | CONDITIONS  | MIN                   | TYP  | MAX  | UNITS |
|---|---|-----------------------|------|------|-------|
| <b>MAX701</b>   |   |                       |      |      |       |
| RESET Output Low  | I <sub>SINK</sub> = 16mA, V <sub>CC</sub> = 5V        |                       |      | 0.4  | V     |
| RESET Output High   | I <sub>SOURCE</sub> = 3.2mA, V <sub>CC</sub> = 4.25V  | V <sub>CC</sub> - 0.4 |      |      | V     |
|   | I <sub>SOURCE</sub> = 1.6mA, V <sub>CC</sub> = 3V     | V <sub>CC</sub> - 0.4 |      |      |       |
|   | I <sub>SOURCE</sub> = 0.5mA, V <sub>CC</sub> = 1.5V   | V <sub>CC</sub> - 0.4 |      |      |       |
| RESE $\bar{T}$ Output Low   | I <sub>SINK</sub> = 3.2mA, V <sub>CC</sub> = 4.25V    |                       |      | 0.4  | V     |
|   | I <sub>SINK</sub> = 1.6mA, V <sub>CC</sub> = 3V       |                       |      | 0.4  |       |
|   | I <sub>SINK</sub> = 0.4mA, V <sub>CC</sub> = 1.5V     |                       |      | 0.4  |       |
| RESE $\bar{T}$ Output High  | I <sub>SOURCE</sub> = 3.2mA, V <sub>CC</sub> = 5V     | V <sub>CC</sub> - 0.4 |      |      | V     |
| <b>MAX702</b>   |   |                       |      |      |       |
| RESE $\bar{T}$ Output Low   | I <sub>SINK</sub> = 3.2mA, V <sub>CC</sub> = 4.25V    |                       |      | 0.4  | V     |
|   | I <sub>SINK</sub> = 1.6mA, V <sub>CC</sub> = 3V       |                       |      | 0.4  |       |
|   | I <sub>SINK</sub> = 0.4mA, V <sub>CC</sub> = 1.5V     |                       |      | 0.4  |       |
| RESE $\bar{T}$ Output High  | I <sub>SOURCE</sub> = 3.2mA, V <sub>CC</sub> = 5V     | V <sub>CC</sub> - 0.4 |      |      | V     |
| <b>MAX700 ONLY (CTL = V<sub>CC</sub>, unless otherwise noted)</b> |   |                       |      |      |       |
| SENSE Input Threshold   | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> | 1.25                  | 1.29 | 1.35 | V     |
| SENSE Input Current   |   |                       | 0.1  |      | nA    |
| HYST Input On-Resistance  |   |                       | 0.5  |      | kΩ    |
| CTL Input Threshold   |   |                       | 2    |      | V     |
| CTL Pulldown Current  |   |                       | 30   | 100  | μA    |

## Pin Description

| PIN    |         |            | NAME            | FUNCTION  |
|--------|---------|------------|-----------------|---|
| MAX700 | MAX701  | MAX702     |                 |   |
| 1      | 1       | 1          | MR              | Input for Manual Pushbutton Reset. Has internal 5 $\mu$ A pullup. Low input activates the RESET/RESET outputs.  |
| 2      | —       | —          | SENSE           | The voltage-sense input when CTL = V <sub>CC</sub> . Its threshold is 1.29V. SENSE always remains connected to the internal comparator. So, when V <sub>CC</sub> is being monitored internally (CTL = GND), SENSE should be left open circuit.  |
| 3      | —       | —          | HYST            | Normally NOT used when voltage is monitored through V <sub>CC</sub> (CTL = GND). When monitoring through SENSE (CTL = V <sub>CC</sub> ), HYST allows hysteresis to be added, reducing noise and spurious reset activity (Figure 3). HYST turns on 5 $\mu$ s before the RESET/RESET outputs are activated, and its on-resistance to GND is typically 1k $\Omega$ . |
| 4      | 4       | 3          | GND             | Ground  |
| 5      | 6       | 7          | RESET           | Goes low when V <sub>CC</sub> falls below 4.65V, or when CTL = V <sub>CC</sub> on the MAX700 goes low when SENSE falls below 1.29V.   |
| 6      | 5       | —          | RESET           | Inverted Version of RESET   |
| 7      | —       | —          | CTL             | When CTL = GND, V <sub>CC</sub> is monitored by the reset circuit. When CTL = V <sub>CC</sub> , V <sub>CC</sub> is ignored and SENSE is monitored, allowing the threshold to be set with external resistors.  |
| 8      | 8       | 2          | V <sub>CC</sub> | Chip Power and +5V Sensing Input (When CTL = GND on MAX700)   |
| —      | 2, 3, 7 | 4, 5, 6, 8 | N.C.            | No Connection   |

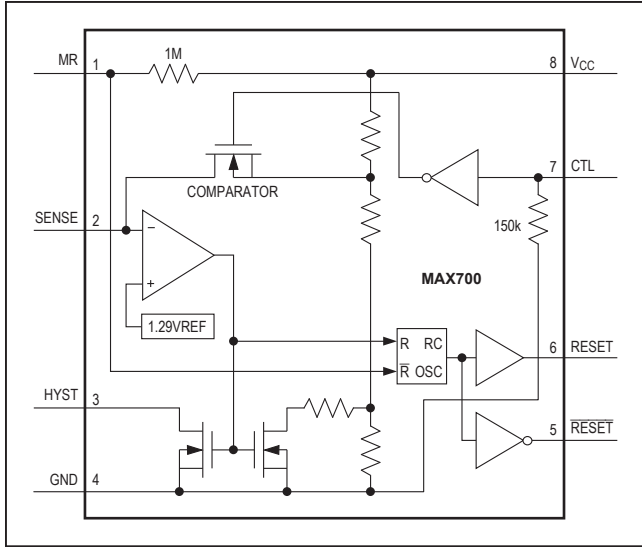


Figure 1. MAX700 Block Diagram

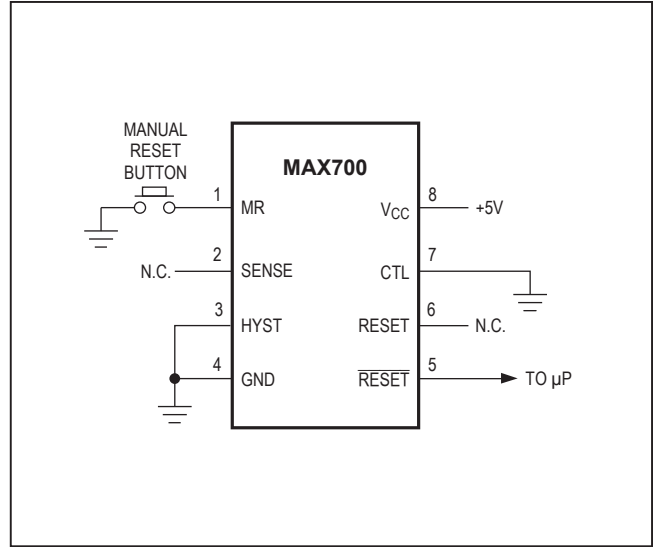


Figure 2. MAX700 Typical Connection Diagram

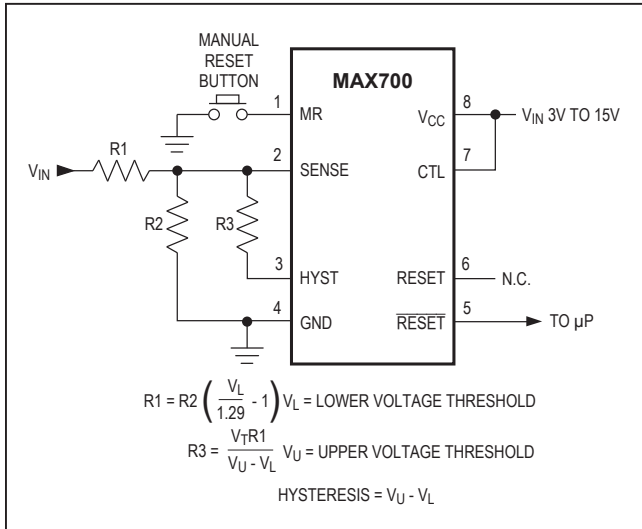


Figure 3. MAX700 Connected for External Senses and Hysteresis

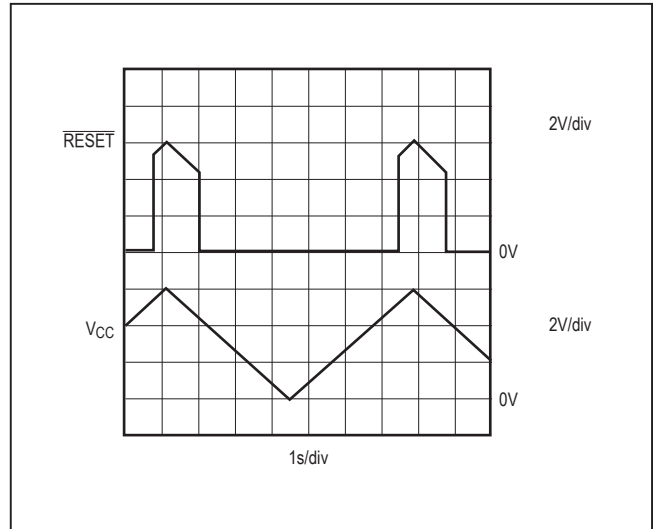


Figure 4. Typical MAX700/MAX701/MAX702 RESET Output vs. VCC

Figure 4 shows the  $\overline{\text{RESET}}$  output of the MAX700/MAX701/MAX702 in the correct state for VCC voltages down to 0V. Note the effect of the built-in hysteresis on the trigger level of  $\overline{\text{RESET}}$ .

### Package Information

For the latest package outline information and land patterns (footprints), go to [www.maximintegrated.com/packages](http://www.maximintegrated.com/packages). Note that a “+”, “#”, or “-” in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

| PACKAGE TYPE | PACKAGE CODE | OUTLINE NO.             | LAND PATTERN NO.        |
|--------------|--------------|-------------------------|-------------------------|
| 8 PDIP       | P8+2         | <a href="#">21-0143</a> | —                       |
| 8 Narrow SO  | S8+4         | <a href="#">21-0041</a> | <a href="#">90-0096</a> |

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION   | PAGES CHANGED |
|-----------------|---------------|---|---------------|
| 0               | 3/90          | Initial release   | —             |
| 1               | 11/05         | Added lead-free information to the <i>Ordering Information</i> table.             | 1             |
| 2               | 12/07         | Updated <i>Pin Description</i> table.   | 4             |
| 3               | 5/14          | No <i>I</i> V OPNs; removed automotive reference from <i>Applications</i> section | 1             |

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at [www.maximintegrated.com](http://www.maximintegrated.com).

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