

GENERAL DESCRIPTION

The SP809/SP810 are low power microprocessor (μ P) supervisory circuits used to monitor power supplies in μ P and digital systems.

They provide applications with benefits of circuit reliability and low cost by eliminating external components. If the VCC supply voltage falls below preset threshold then a reset signal is asserted for at least 140ms after VCC has risen above the reset threshold.

Both the SP809 and SP810 were designed with a reset comparator to help identify invalid signals, which last less than 140ms. The only difference between them is that they have an active-low $\overline{\text{RESET}}$ output and active-high RESET output, respectively. Low supply current (1 μ A) makes SP809/SP810 ideal for portable equipment.

The devices are available in 3 pin SOT-23 package.

APPLICATIONS

- **Portable Electronic Devices**
- **Electrical Power Meters**
- **Digital Still Cameras**
- **μ P Power Monitoring**

FEATURES

- **Ultra Low Supply Current 1 μ A (typ)**
- **Guaranteed Reset valid to VCC = 0.9V**
- **140ms Power-On Reset Pulse Width**
- **Internally Fixed Threshold
2.3V, 2.6V, 2.9V, 3.1V, 4.4V, 4.6V**
- **1.5% Voltage Threshold Tolerance**
- **3 Pin SOT-23 Package**

| Part Number | Output Type |
|-------------|-----------------------|
| SP809N | Open Drain Active Low |
| SP809 | Push-Pull Low |
| SP810 | Push-Pull Active High |

TYPICAL APPLICATION DIAGRAM

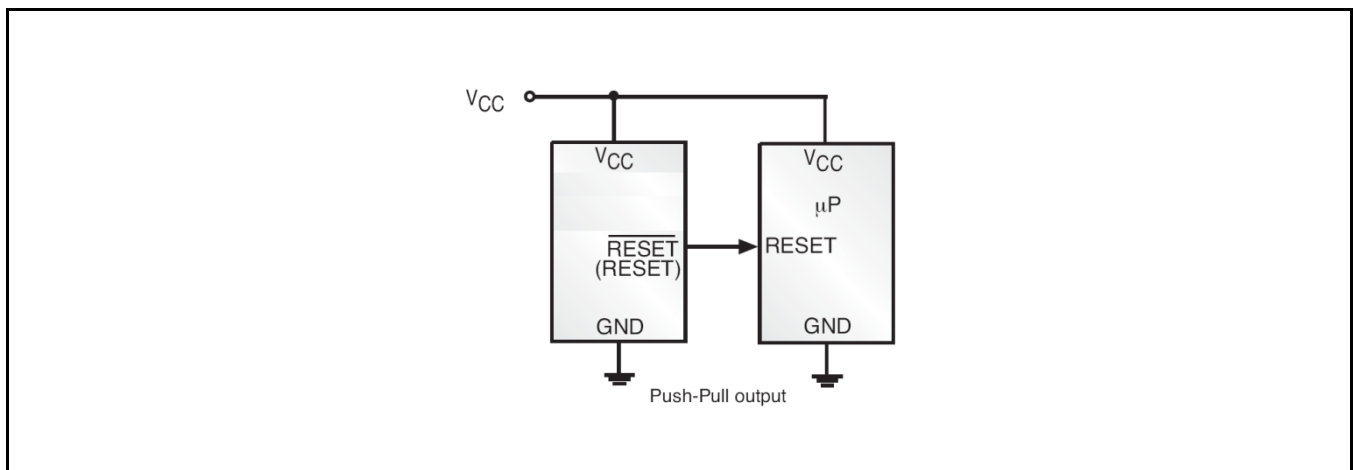


Fig. 1: SP809 / SP810 Application Diagram

ABSOLUTE MAXIMUM RATINGS

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC} -0.3V to 6.5V
 RESET, $\overline{\text{RESET}}$ -0.3V to $V_{CC}+0.3V$
 Output Current (RESET, $\overline{\text{RESET}}$) 20mA
 Power Dissipation ($T_A=70^\circ\text{C}$) 320mW
 Junction Temperature 125°C
 Storage Temperature -65°C to 150°C

OPERATING RATINGS

Input Voltage Range V_{CC} 0.9V to 6V
 Junction Temperature Range -40°C to 85°C

ELECTRICAL SPECIFICATIONS

Specifications with standard type are for an Operating Temperature of $T_A = 25^\circ\text{C}$ only; limits applying over the full Operating Temperature range are denoted by a “•”. Minimum and Maximum limits are guaranteed through test, design, or statistical correlation. Typical values represent the most likely parametric norm at $T_A = 25^\circ\text{C}$, and are provided for reference purposes only. Unless otherwise indicated, $T_A = 25^\circ\text{C}$.

| Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|-------------|------|-------|---------------|--|
| Operating Voltage Range V_{CC} | 0.9 | | 6.0 | V | |
| Supply Current I_{CC} | | 1.0 | 3.0 | μA | $V_{CC}=V_{TH}+0.1V$ |
| Reset Threshold V_{TH} | 2.265 | 2.3 | 2.335 | V | $T_A = +25^\circ\text{C}$ |
| | 2.254 | | 2.346 | | • $T_A = -40^\circ\text{C}$ to 85°C |
| | 2.561 | 2.6 | 2.639 | | $T_A = +25^\circ\text{C}$ |
| | 2.548 | | 2.652 | | • $T_A = -40^\circ\text{C}$ to 85°C |
| | 2.857 | 2.9 | 2.944 | | $T_A = +25^\circ\text{C}$ |
| | 2.842 | | 2.958 | | • $T_A = -40^\circ\text{C}$ to 85°C |
| | 3.054 | 3.1 | 3.147 | | $T_A = +25^\circ\text{C}$ |
| | 3.038 | | 3.162 | | • $T_A = -40^\circ\text{C}$ to 85°C |
| | 4.334 | 4.4 | 4.466 | | $T_A = +25^\circ\text{C}$ |
| | 4.312 | | 4.488 | | • $T_A = -40^\circ\text{C}$ to 85°C |
| | 4.531 | 4.6 | 4.669 | | $T_A = +25^\circ\text{C}$ |
| | 4.508 | | 4.692 | | • $T_A = -40^\circ\text{C}$ to 85°C |
| V_{CC} Reset Delay t_{TRIP} | | 20 | | μs | $V_{CC}=V_{TH}$ to $(V_{TH} - 0.1V)$, $V_{TH}=3.1V$ |
| Reset Active Timeout Period t_{RP} | 140 | 230 | 560 | ms | $T_A = +25^\circ\text{C}$ |
| | 100 | | 1030 | | • $T_A = -40^\circ\text{C}$ to 85°C |
| RESET Output Voltage V_{OH} | $0.8V_{CC}$ | | | V | $V_{CC}=V_{TH} - 0.1V$, $I_{SOURCE} = 1.2\text{mA}$ |
| RESET Output Voltage V_{OL} | | | 0.3 | | $V_{CC}=V_{TH} + 0.1V$, $I_{SINK} = 1.2\text{mA}$ |
| $\overline{\text{RESET}}$ Output Voltage V_{OH} | $0.8V_{CC}$ | | | V | $V_{CC}=V_{TH} + 0.1V$, $I_{SOURCE} = 1.2\text{mA}$ |
| $\overline{\text{RESET}}$ Output Voltage V_{OL} | | | 0.3 | | $V_{CC}=V_{TH} - 0.1V$, $I_{SINK} = 1.2\text{mA}$ |

Note 1: $\overline{\text{RESET}}$ output is for SP809; RESET output is for SP810.

BLOCK DIAGRAM

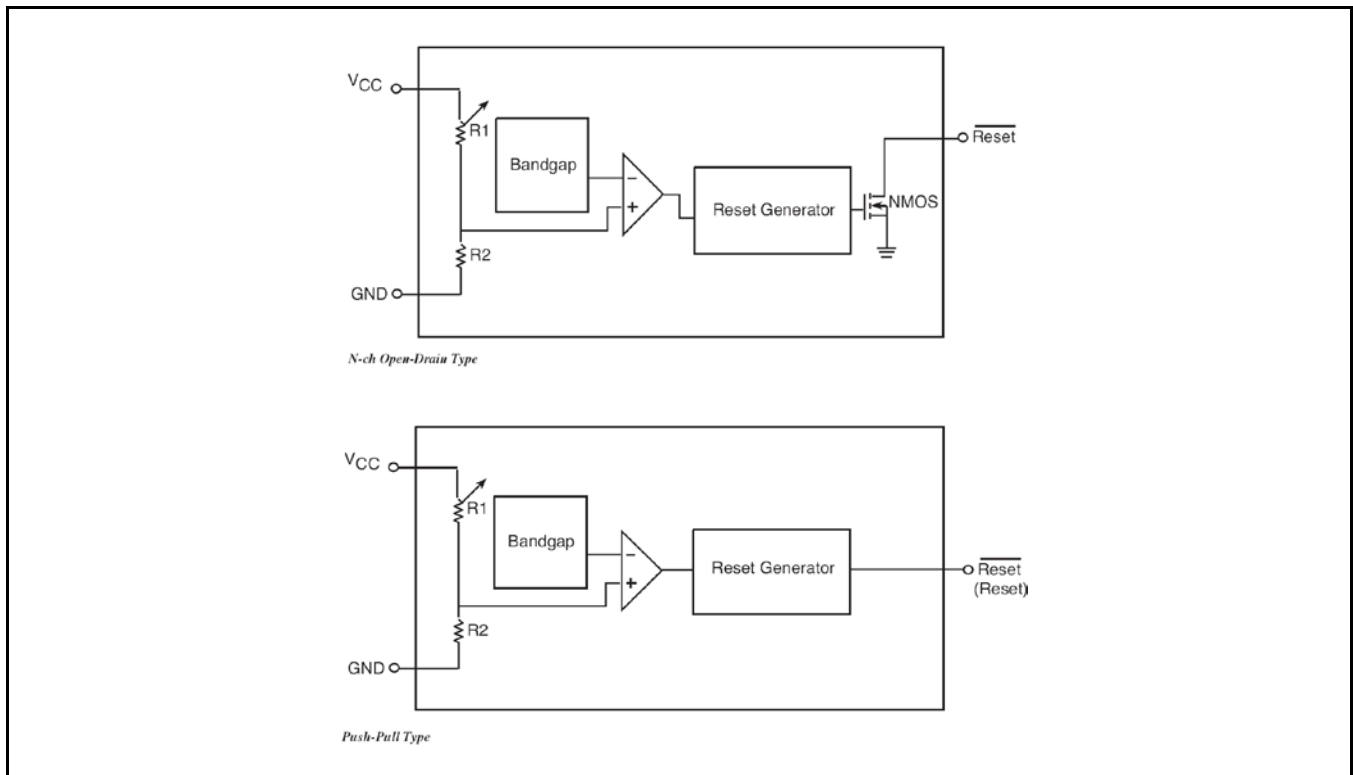


Fig. 2: SP809 / SP810 Block Diagram

PIN ASSIGNMENT

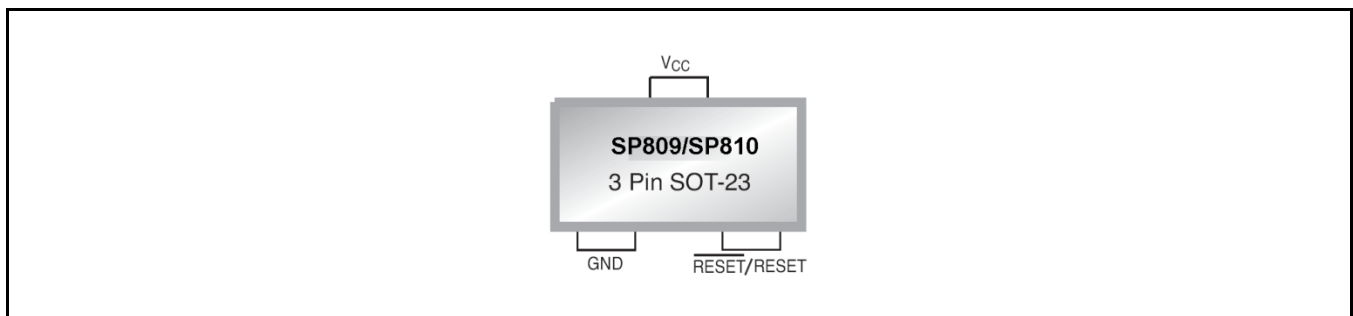


Fig. 3: SP809 / SP810 Pin Assignment

PIN DESCRIPTION

| Name | Pin Number | Description |
|---------------------------|------------|---|
| GND | 1 | Ground Signal |
| $\overline{\text{RESET}}$ | 2 | Active Low Output Pin. RESET Output remains high while VCC is below the reset threshold |
| RESET | | Active High Output Pin. RESET Output remains high while VCC is below the reset threshold |
| V _{CC} | 3 | Supply Voltage |

ORDERING INFORMATION⁽¹⁾

| Part Number | Operating Temperature Range | Lead-Free | Package | Packing Method |
|----------------------------------|--------------------------------|--------------------|---------|----------------|
| SP809EK-L-2-3/TR | -40°C ≤ T _A ≤ +85°C | Yes ⁽²⁾ | SOT23-3 | Tape & Reel |
| SP809EK-L-2-6/TR | | | | |
| SP809EK-L-2-9/TR | | | | |
| SP809EK-L-3-1/TR ⁽³⁾ | | | | |
| SP809EK-L-4-6/TR ⁽³⁾ | | | | |
| SP809NEK-L-2-3/TR ⁽³⁾ | | | | |
| SP809NEK-L-2-9/TR ⁽³⁾ | | | | |
| SP809NEK-L-3-1/TR | | | | |
| SP809NEK-L-4-6/TR ⁽³⁾ | | | | |
| SP810EK-L-4-4/TR ⁽³⁾ | | | | |

NOTES:

1. Refer to www.exar.com/SP809 and www.exar.com/SP810 for most up-to-date Ordering Information.
2. Visit www.exar.com for additional information on Environmental Rating.
3. NRND – Not Recommended for New Designs.

TYPICAL PERFORMANCE CHARACTERISTICS

All data taken at $T_A = 25^\circ\text{C}$, unless otherwise specified - Schematic and BOM from Application Information section of this datasheet.

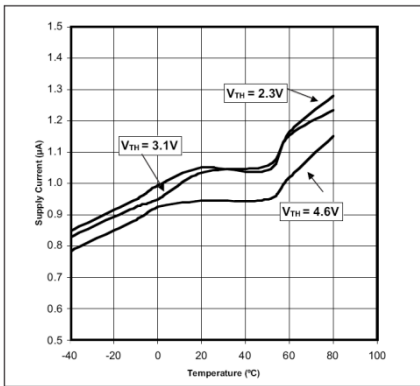


Fig. 4: Supply Current versus Temperature

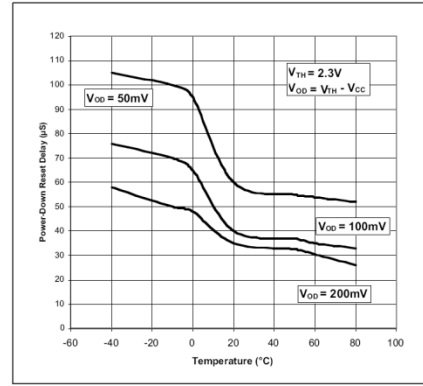


Fig. 5: Power-Down Reset Delay versus Temperature

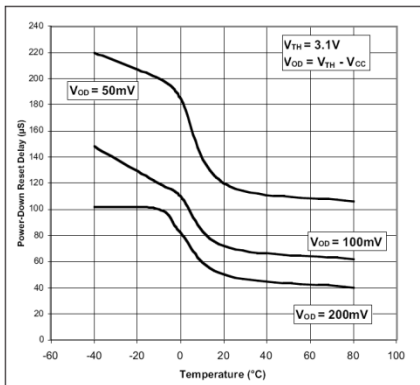


Fig. 6: Power-Down Reset Delay versus Temperature

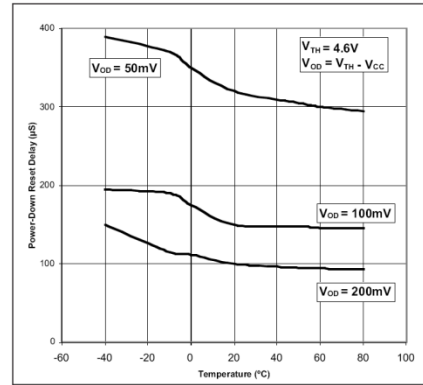


Fig. 7: Power-Down Reset Delay versus Temperature

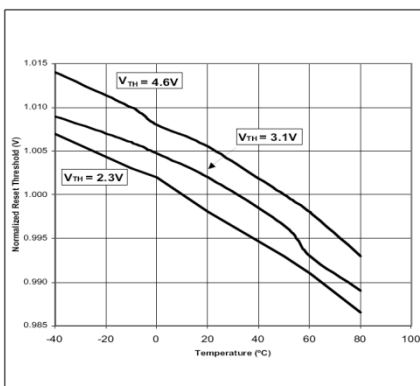


Fig. 8: Normalized Reset Threshold versus Temperature

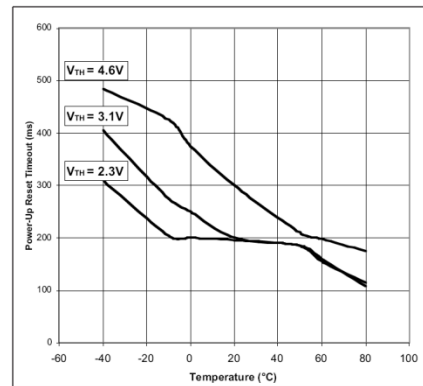


Fig. 9: Power-Up Reset Time-out versus Temperature

THEORY OF OPERATION

μ P will be activated at a valid reset state. These μ P supervisory circuits assert reset to prevent code execution errors during power-up, power-down, or brownout conditions.

Reset is guaranteed to be a logic low for $V_{TH} > V_{CC} > 0.9V$. Once V_{CC} exceeded the reset threshold, an internal timer keeps \overline{RESET} low for the reset timeout period; after this interval, \overline{RESET} goes high.

If a brownout condition occurs (V_{CC} drops below the reset threshold), \overline{RESET} goes low. Any time V_{CC} goes below the reset threshold, the internal timer resets to zero, and \overline{RESET} goes low. The internal timer is activated after V_{CC} returns above the reset threshold, and \overline{RESET} remains low for the reset timeout period.

BENEFIT OF HIGHLY ACCURATE RESET THRESHOLD

SP809/810 with specified voltage as $5V \pm 10\%$ or $3V \pm 10\%$ are ideal for systems using a

APPLICATION INFORMATION

NEGATIVE GOING V_{CC} TRANSIENTS

In addition to issuing a reset to the μ P during power-up, power-down, and brownout conditions, SP809 series are relatively resistant to short-duration negative-going V_{CC} transient.

ENSURING A VALID RESET OUTPUT DOWN TO $V_{CC}=0$

When V_{CC} falls below 0.9V, SP809 \overline{RESET} output no longer sinks current; it becomes an open circuit. In this case, high-impedance CMOS logic inputs connecting to \overline{RESET} can drift to undetermined voltages. Therefore, SP809/810 with CMOS is perfect for most applications of V_{CC} down to 0.9V.

However in applications where \overline{RESET} must be valid down to 0V, adding a pull-down resistor to \overline{RESET} causes any leakage currents to flow to ground, holding \overline{RESET} low.

$5V \pm 5\%$ or $3V \pm 5\%$ power supply. The reset is guaranteed to assert after the power supply falls below the minimum specified operating voltage range of the system ICs. The pre-trimmed thresholds are reducing the range over which an undesirable reset may occur.

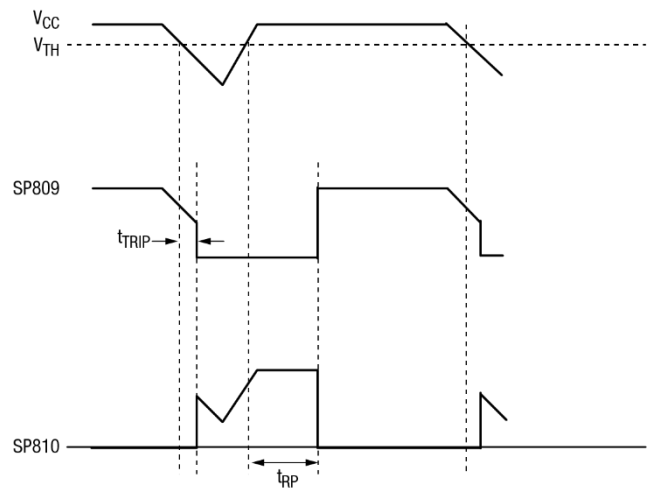


Fig. 10: Timing Waveforms

INTERFACING TO μ P WITH BIDIRECTIONAL RESET PINS

The \overline{RESET} output on the SP809N is open drain, this device interfaces easily with μ Ps that have bidirectional reset pins. Connecting the μ P supervisor's \overline{RESET} output directly to the microcontroller's \overline{RESET} pin with a single pull-up resistor allows either device to assert reset.

TEST CIRCUIT

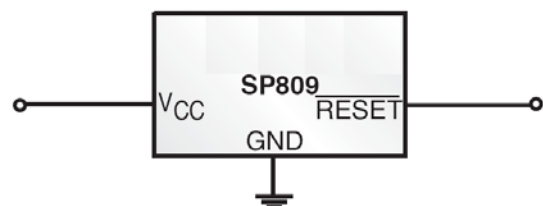
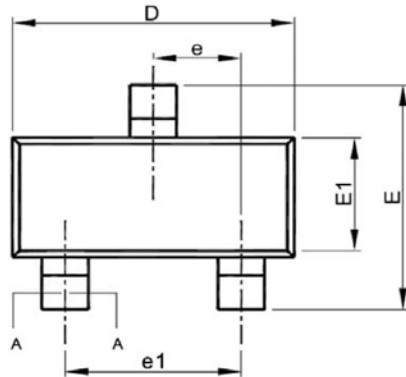


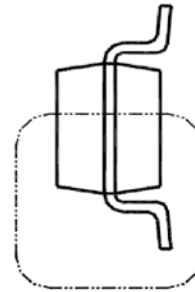
Fig. 11: Test Circuit

PACKAGE SPECIFICATION

3-PIN SOT23

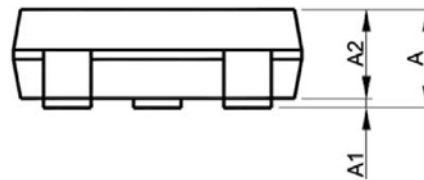


TOP VIEW



SEE VIEW B

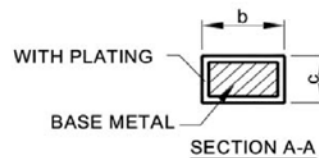
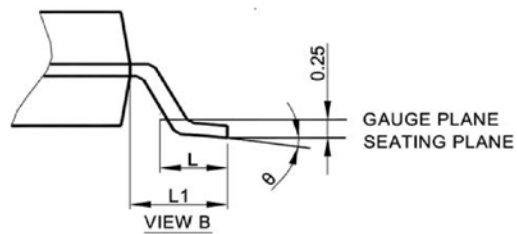
BOTTOM VIEW



SIDE VIEW

| SYMBOL | SOT-23 | |
|--------|-------------|------|
| | MILLIMETERS | |
| | MIN. | MAX. |
| A | 0.95 | 1.45 |
| A1 | 0.00 | 0.15 |
| A2 | 0.90 | 1.30 |
| b | 0.30 | 0.50 |
| c | 0.08 | 0.22 |
| D | 2.80 | 3.00 |
| E | 2.60 | 3.00 |
| E1 | 1.50 | 1.70 |
| e | 0.95 BSC | |
| e1 | 1.90 BSC | |
| L | 0.30 | 0.60 |
| L1 | 0.60 REF | |
| θ | 0° | 8° |

TERMINAL DETAILS



1. Refer to Jeduc MO-178
2. Dimension "D" does not include mold flash, protrusions or gate burrs.
Mold flash, protrusion or gate burrs shall not exceed 10mils per side.
3. Dimension "E1" does not include inter-lead flash or protrusions.
4. All dimensions are millimeters.

REVISION HISTORY

| Revision | Date | Description |
|----------|---------------|---|
| 2.0.0 | 2011 | Reformat of Datasheet Correction of package drawing |
| 2.0.1 | August 2017 | Correct Reset Delay conditions. Updated to MaxLinear logo. Updated format and ordering information table. |
| 2.0.2 | November 2017 | Corrected typo from rev 2.0.1, added 2 missing overlines to RESET in Electrical Specifications. |

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