

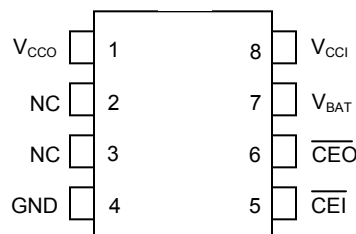


## DS1218 Nonvolatile Controller

### FEATURES

- Converts CMOS RAM into nonvolatile memories
- Unconditionally write protects when  $V_{CC}$  is out of tolerance
- Automatically switches to battery when power fail occurs
- Space saving 8-pin PDIP or 8-pin 150 mil SO Packages
- Consumes less than 100nA of battery current

### PIN ASSIGNMENT



### PIN DESCRIPTION

|                  |                                 |
|------------------|---------------------------------|
| $V_{CCI}$        | - Input +5 Volt Supply          |
| $V_{CCO}$        | - RAM Power ( $V_{CC}$ ) Supply |
| $\overline{CEI}$ | - Chip Enable Input             |
| NC               | - No Connection                 |
| $\overline{CEO}$ | - Chip Enable Output            |
| $V_{BAT}$        | - + Battery                     |
| GND              | - Ground                        |

### DESCRIPTION

The DS1218 is a CMOS circuit which solves the application problems of converting CMOS RAM into nonvolatile memory. Incoming power is monitored for an out-of-tolerance condition. When such a condition is detected, the chip enable output is inhibited to accomplish write protection and the battery is switched on to supply RAM with uninterrupted power. Special circuitry uses a low-leakage CMOS process which affords precise voltage detection at extremely low battery consumption. The 8-pin package keeps PC board real estate requirements to a minimum. By combining the DS1218 nonvolatile controller chip with a full CMOS memory and lithium batteries, 10 years of nonvolatile RAM operation can be achieved.

### OPERATION

The DS1218 Nonvolatile Controller performs the circuit functions required to battery back-up a RAM. First, a switch is provided to direct power from the battery or  $V_{CCI}$  supply, depending on which is greater. This switch has a voltage drop of less than 0.2V. The second function which the nonvolatile controller provides is power-fail detection. The DS1218 constantly monitors the  $V_{CC}$  supply. When  $V_{CCI}$  falls to 1.26 times the battery voltage, a precision comparator outputs a power-fail detect signal to the chip enable logic. The third function of write protection is accomplished by holding the chip enable output signal to within 0.2V of the  $V_{CCI}$  or battery supply, when a power-fail condition is detected.

During nominal supply conditions, the chip enable output will follow chip enable input with a maximum propagation delay of 10 ns.

**ABSOLUTE MAXIMUM RATINGS**

|                                             |                 |
|---------------------------------------------|-----------------|
| Voltage Range on Any Pin Relative to Ground | -0.5V to +7.0V  |
| Operating Temperature Range                 | 0°C to +70°C    |
| Storage Temperature Range                   | -55°C to +125°C |
| Soldering Temperature (reflow, SO)          | +260°C          |
| Lead Temperature (soldering, 10s)           | +300°C          |

*This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.*

**PACKAGE THERMAL CHARACTERISTICS (Note 1)****PDIP**

|                                                          |         |
|----------------------------------------------------------|---------|
| Junction-to-Ambient Thermal Resistance ( $\theta_{JA}$ ) | 110°C/W |
| Junction-to-Case Thermal Resistance ( $\theta_{JC}$ )    | 40°C/W  |

**SO**

|                                                          |         |
|----------------------------------------------------------|---------|
| Junction-to-Ambient Thermal Resistance ( $\theta_{JA}$ ) | 136°C/W |
| Junction-to-Case Thermal Resistance ( $\theta_{JC}$ )    | 38°C/W  |

**Note 1:** Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board for the SO. For detailed information on package thermal considerations, refer to [www.maxim-ic.com/thermal-tutorial](http://www.maxim-ic.com/thermal-tutorial).

**RECOMMENDED OPERATING CONDITIONS**

(0°C to +70°C)

| PARAMETER      | SYMBOL    | MIN  | TYP | MAX | UNITS | NOTES |
|----------------|-----------|------|-----|-----|-------|-------|
| Supply         | $V_{CCI}$ | 4.5  | 5.0 | 5.5 | V     | 2     |
| Logic 1        | $V_{IH}$  | 2.0  |     | 5.5 | V     | 2     |
| Logic 0        | $V_{IL}$  | -0.3 |     | 0.8 | V     | 2     |
| Battery Supply | $V_{BAT}$ | 2.5  | 3.0 | 3.5 | V     | 2     |

**DC ELECTRICAL CHARACTERISTICS**(0°C to +70°C;  $V_{CCI} = 5V \pm 10\%$ )

| PARAMETER                                         | SYMBOL     | MIN  | TYP                   | MAX  | UNITS   | NOTES |
|---------------------------------------------------|------------|------|-----------------------|------|---------|-------|
| Active Current                                    | $I_{CCI}$  |      | 2                     | 5    | mA      | 4     |
| Battery Current                                   | $I_{BAT}$  |      |                       | 100  | nA      | 4, 5  |
| RAM Current<br>( $V_{CCOI} \geq V_{CCI} - 0.3V$ ) | $I_{CCO}$  |      |                       | 80   | mA      | 6     |
| RAM Current<br>( $V_{CCO} \geq V_{CCI} - 0.2V$ )  | $I_{CCO}$  |      | 70                    |      | mA      |       |
| Input Leakage                                     | $I_{IL}$   | -1.0 |                       | +1.0 | $\mu A$ |       |
| $\overline{CEO}$ Output @ 2.4V                    | $I_{OH}$   | -1.0 |                       |      | mA      |       |
| $\overline{CEO}$ Output @ 0.4V                    | $I_{OL}$   |      |                       | 4.0  | mA      |       |
| $V_{CC}$ Trip Point                               | $V_{CCTP}$ |      | $1.26 \times V_{BAT}$ |      |         |       |

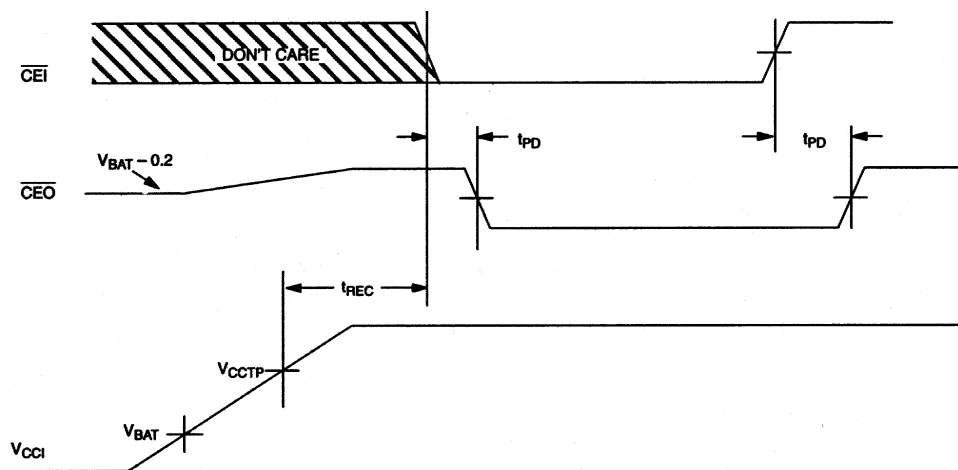
**CAPACITANCE**(T<sub>A</sub> = +25°C)

| PARAMETER          | SYMBOL    | MIN | TYP | MAX | UNITS | NOTES |
|--------------------|-----------|-----|-----|-----|-------|-------|
| Input Capacitance  | $C_{IN}$  |     |     | 5   | pF    |       |
| Output Capacitance | $C_{OUT}$ |     |     | 7   | pF    |       |

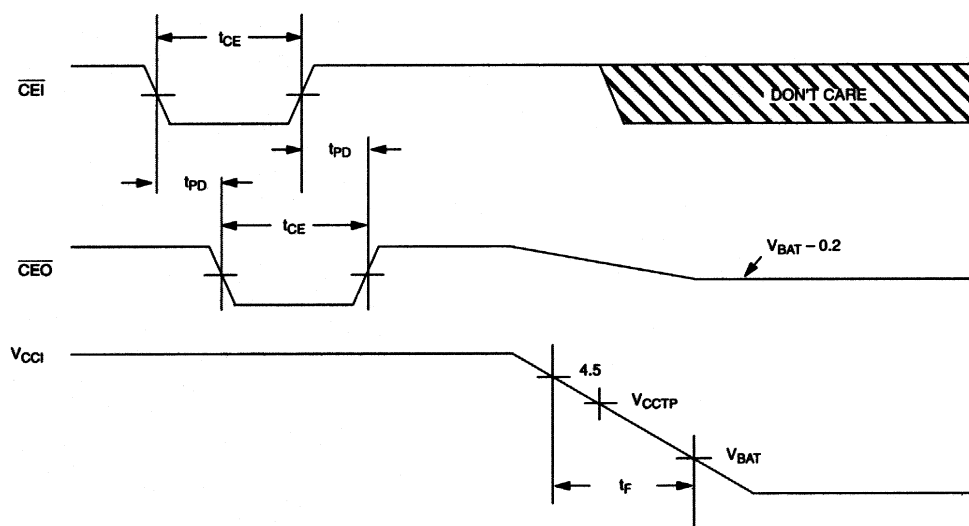
**AC ELECTRICAL CHARACTERISTICS** (0°C to +70°C;  $V_{CC} = 5.0V \pm 10\%$ )

| PARAMETER                         | SYMBOL    | MIN | TYP | MAX | UNITS   | NOTES |
|-----------------------------------|-----------|-----|-----|-----|---------|-------|
| $\overline{CE}$ Propagation Delay | $t_{PD}$  |     | 4   | 10  | ns      | 3     |
| Recovery at Power-up              | $t_{REC}$ | 0.2 |     | 2   | ms      |       |
| $V_{CC}$ Slew Rate                | $t_F$     | 500 |     |     | $\mu s$ |       |
| $\overline{CE}$ Pulse Width       | $t_{CE}$  |     |     | 1.5 | $\mu s$ | 7, 8  |

## TIMING DIAGRAM: POWER-UP

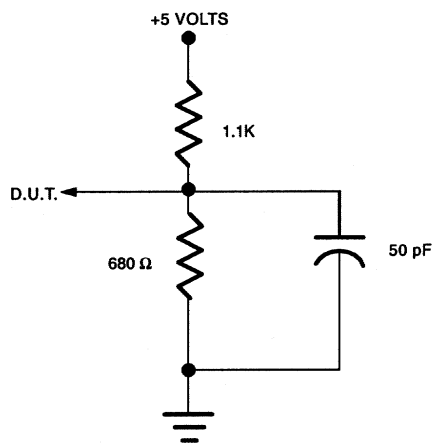


## TIMING DIAGRAM: POWER-DOWN



**NOTES:**

2. All voltages referenced to ground.
3. Measured with a load as shown in Figure 1.
4. Outputs open.
5. Drain from battery when  $V_{CC} < V_{BAT}$ .
6. Maximum amount of current which can be drawn through pin 1 of the controller.
7.  $t_{CE}$  max must be met to ensure data integrity on power loss.
8.  $\overline{CEO}$  can only sustain leakage current in the battery backup mode.

**OUTPUT LOAD Figure 1**

## ORDERING INFORMATION

| PART     | TEMP RANGE   | PIN-PACKAGE |
|----------|--------------|-------------|
| DS1218+  | 0°C to +70°C | 8 PDIP      |
| DS1218S+ | 0°C to +70°C | 8 SO        |

+Denotes a lead(Pb)-free/RoHS-compliant package.

## PACKAGE INFORMATION

For the latest package outline information and land patterns (footprints), go to [www.maxim-ic.com/packages](http://www.maxim-ic.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+1         | <a href="#">21-0043</a> | —                       |
| 8 SO         | S8+2         | <a href="#">21-0041</a> | <a href="#">90-0096</a> |

**REVISION HISTORY**

| <b>REVISION<br/>DATE</b> | <b>DESCRIPTION</b>                                                                                                                                                                                                                                   | <b>PAGES<br/>CHANGED</b> |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 6/12                     | Added lead temperature and soldering temperature information to the <i>Absolute Maximum Ratings</i> section; added the <i>Package Thermal Characteristics</i> section; added the <i>Ordering Information</i> and <i>Package Information</i> sections | 2, 6                     |

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