

# MAXIM

## $\mu$ P Power-Supply Monitor with Reset

MAX7705

### General Description

In applications with microprocessors ( $\mu$ Ps) that have a **RESET** input, the MAX7705 is functionally and socket compatible with the TL7705, but requires **no external components**. It provides power-supply glitch immunity and a guaranteed power-up reset delay, while typically consuming 1/27<sup>th</sup> the power from a +5V supply.

The MAX7705 monitors the power supply in  $\mu$ P and digital systems. The **RESET** output is valid for  $V_{CC}$  down to 1V. The device offers excellent circuit reliability and low cost by eliminating external components and adjustments.

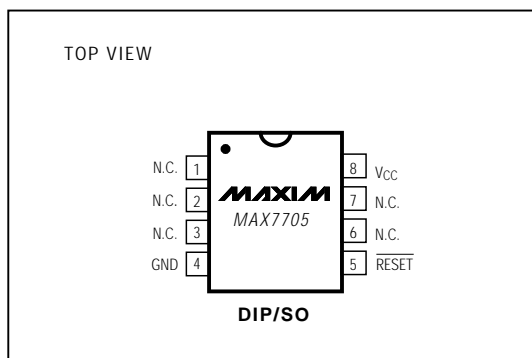
A system reset is provided during power-up, power-down, and brownout conditions. When  $V_{CC}$  is below the reset threshold, **RESET** is low and holds the  $\mu$ P in reset. **RESET** will go high 280ms after  $V_{CC}$  rises above the reset threshold. The MAX7705 is available in 8-pin DIP and SO packages.

| FEATURE                             | MAX7705                        | TL7705 |
|-------------------------------------|--------------------------------|--------|
| No. of External Components Required | 0                              | 3      |
| Operating Supply Current            | +5V <b>65<math>\mu</math>A</b> | 1.8mA  |
|                                     | +3V <b>35<math>\mu</math>A</b> | 1.8mA  |
| Power-Supply Glitch Immunity        | <b>Yes</b>                     | No     |
| Guaranteed Minimum Reset Delay      | <b>Yes</b>                     | No     |

### Applications

Minimum Component Count, Low-Cost  
Processor Systems

### Pin Configuration



### Features

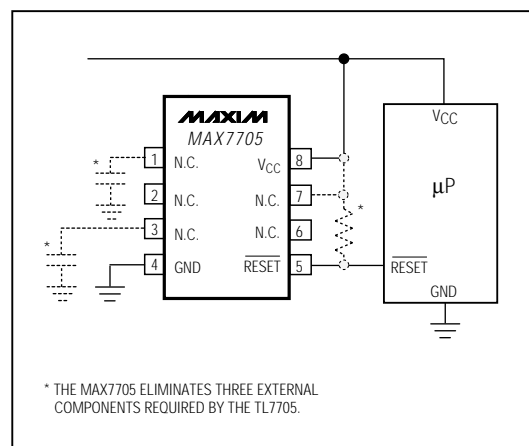
- ◆ No External Components
- ◆ Low Cost
- ◆ Precise Reset Threshold
- ◆ 280ms Power-On Reset Delay
- ◆ 8-Pin DIP and SO Packages

### Ordering Information

| PART       | TEMP. RANGE    | PIN-PACKAGE   |
|------------|----------------|---------------|
| MAX7705CPA | 0°C to +70°C   | 8 Plastic DIP |
| MAX7705CSA | 0°C to +70°C   | 8 SO          |
| MAX7705C/D | 0°C to +70°C   | Dice*         |
| MAX7705EPA | -40°C to +85°C | 8 Plastic DIP |
| MAX7705ESA | -40°C to +85°C | 8 SO          |

\* Contact factory for dice specifications.

### Typical Operating Circuit



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# $\mu$ P Power-Supply Monitor with Reset

## ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (with respect to GND)

$V_{CC}$  .....-0.3V to 6.0V

**RESET** .....-0.3V to ( $V_{CC} + 0.3$ V)

Input Current,  $V_{CC}$  .....20mA

Output Current, **RESET** .....20mA

Rate-of-Rise,  $V_{CC}$  .....100V/ $\mu$ s

Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )

Plastic DIP (derate 9.09mW/ $^\circ\text{C}$  above  $+70^\circ\text{C}$ ) .....727mW

SO (derate 5.88mW/ $^\circ\text{C}$  above  $+70^\circ\text{C}$ ) .....471mW

Operating Temperature Ranges:

MAX7705C\_ \_ ..... $0^\circ\text{C}$  to  $+70^\circ\text{C}$

MAX7705E\_ \_ ..... $-40^\circ\text{C}$  to  $+85^\circ\text{C}$

Storage Temperature Range ..... $-65^\circ\text{C}$  to  $+160^\circ\text{C}$

Lead Temperature (soldering, 10sec) ..... $+300^\circ\text{C}$

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

( $V_{CC}$  = full range,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted.)

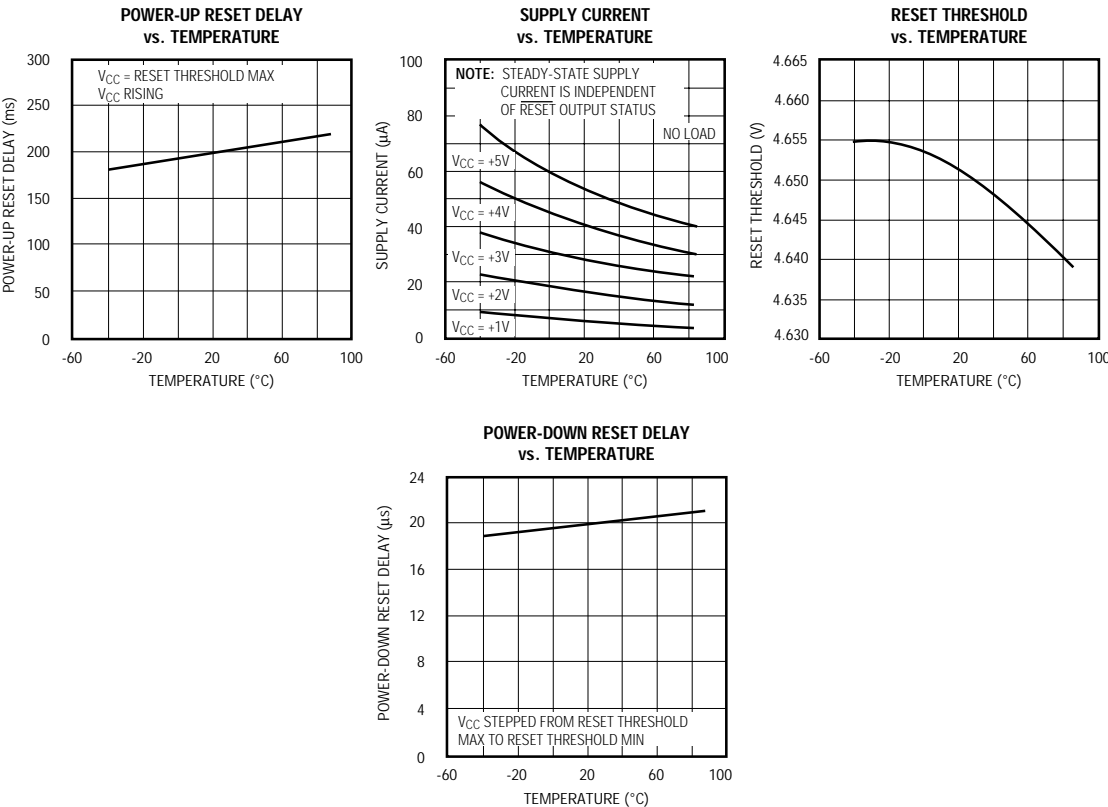
| PARAMETER                      | CONDITIONS                                                    | MIN            | TYP  | MAX  | UNITS   |
|--------------------------------|---------------------------------------------------------------|----------------|------|------|---------|
| $V_{CC}$ Range                 | MAX7705C                                                      | 1.0            |      | 5.5  | V       |
|                                | MAX7705E                                                      | 1.2            |      | 5.5  |         |
| Supply Current                 | MAX7705C, $V_{CC} < 5.5$ V                                    |                | 65   | 150  | $\mu$ A |
|                                | MAX7705E, $V_{CC} < 5.5$ V                                    |                | 65   | 200  |         |
| <b>RESET</b> Threshold         |                                                               | 4.50           | 4.65 | 4.75 | V       |
| $V_{CC}$ to <b>RESET</b> Delay | $V_{CC}$ = reset threshold max to reset threshold min         |                | 20   |      | $\mu$ s |
| Reset Active Timeout Period    | $V_{CC}$ = reset threshold max, $V_{CC}$ rising               | 140            | 280  | 560  | ms      |
| <b>RESET</b> Output Voltage    | $I_{SINK} = 3.2$ mA, $V_{CC}$ = reset threshold min           |                |      | 0.4  | V       |
|                                | $I_{SINK} = 50$ $\mu$ A, $V_{CC} \geq 1.0$ V, MAX7705C        |                |      | 0.3  |         |
|                                | $I_{SINK} = 100$ $\mu$ A, $V_{CC} \geq 1.2$ V, MAX7705E       |                |      | 0.4  |         |
|                                | $I_{SOURCE} = 800$ $\mu$ A, $V_{CC} \geq$ reset threshold max | $V_{CC} - 1.5$ |      |      |         |

# $\mu$ P Power-Supply Monitor with Reset

## Typical Operating Characteristics

(T<sub>A</sub> = +25°C, unless otherwise noted.)

MAX7705



## Pin Description

| PIN       | NAME            | FUNCTION                                                                                                                                          |
|-----------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1,2,3,6,7 | N.C.            | No Connection. There is no internal connection to these pins.                                                                                     |
| 4         | GND             | Ground                                                                                                                                            |
| 5         | RESET           | Reset Output remains low while V <sub>CC</sub> is below the reset threshold, and for 280ms after V <sub>CC</sub> rises above the reset threshold. |
| 8         | V <sub>CC</sub> | +5V Supply Voltage                                                                                                                                |

## $\mu$ P Power-Supply Monitor with Reset

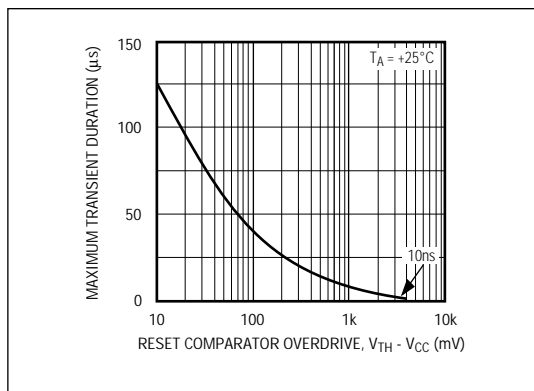


Figure 1. Maximum Transient Duration without Causing a Reset Pulse vs. Reset Comparator Overdrive

### Applications Information

#### Replacing the TL7705 with a MAX7705 in an Existing Design

The MAX7705 has only three active pins:  $V_{CC}$ , GND, and **RESET**. When using a TL7705 with a  $\mu$ P that has a **RESET** input, simply plug the MAX7705 into the same socket and omit the **RESET** pull-up resistor, reset timing capacitor, and reference bypass capacitor (see the *Typical Operating Circuit*).

The MAX7705 monitors the  $V_{CC}$  voltage and asserts reset whenever  $V_{CC}$  falls below the reset threshold. The reset power-up delay is created by an internal fixed oscillator. This delay is 100% tested and guaranteed over the full temperature range. The **RESET** output both sources and sinks current (see **RESET** Output Voltage in the *Electrical Characteristics*).

#### Negative-Going $V_{CC}$ Transients

The MAX7705 asserts **RESET** during power-up, power-down, and brownout conditions. However, it is relatively immune to short-duration negative-going  $V_{CC}$  transients (glitches).

Figure 1 shows typical transient duration vs. reset comparator overdrive for which the MAX7705 does **not** generate a reset pulse. The graph was generated using a fast-edge, negative-going pulse applied to  $V_{CC}$ , starting 1.5V above the actual reset threshold and ending below the reset threshold by the magnitude indicated (reset comparator overdrive). It indicates the typical maxi-

mum pulse width a negative-going  $V_{CC}$  transient may have without causing a reset pulse to be issued. As the magnitude of the transient increases (goes farther below the reset threshold), the maximum allowable pulse width decreases. Typically, a  $V_{CC}$  transient that goes 100mV below the reset threshold and lasts 40 $\mu$ s or less will not cause a reset pulse to be issued.

A 0.1 $\mu$ F bypass capacitor mounted as close as possible to pin 2 ( $V_{CC}$ ) provides additional transient immunity.

#### Ensuring a Valid **RESET** Output Down to $V_{CC} = 0V$

When  $V_{CC}$  falls below 1V, the MAX7705 **RESET** output no longer sinks current; it becomes high impedance. Therefore, high-impedance CMOS logic inputs connected to the **RESET** output can drift to indeterminate voltages. In most applications this presents no problem, as  $\mu$ P and other circuitry is generally inoperative with  $V_{CC}$  below 1V. In applications where the **RESET** output must be valid down to 0V, adding a pull-down resistor to the **RESET** pin (as shown in Figure 2) will cause any stray leakage currents to flow to ground, holding **RESET** low. The resistance value of R1 is not critical. It should be about 100k $\Omega$ , which is large enough not to load **RESET** and small enough to pull **RESET** to ground.

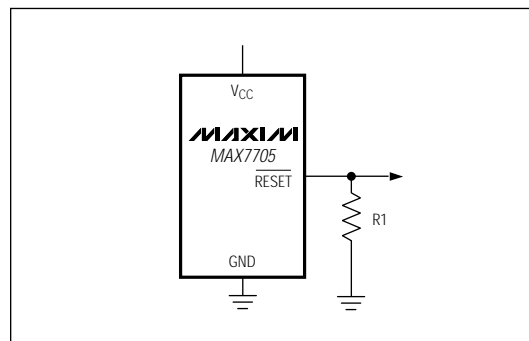


Figure 2. **RESET** Valid to  $V_{CC} = \text{Ground}$  Circuit

## *$\mu$ P Power-Supply Monitor with Reset*

### *Interfacing to $\mu$ Ps with Bidirectional Reset Inputs*

$\mu$ Ps with bidirectional reset pins, such as Motorola's 68HC11 series, can contend with the MAX7705 reset output. If, for example, the MAX7705 **RESET** output is asserted high and the  $\mu$ P wants to pull it low, an indeterminate logic level may result. To correct this, connect a  $4.7k\Omega$  resistor between the MAX7705 **RESET** output and the  $\mu$ P reset I/O, as in Figure 3. Buffer the **RESET** signal to other system components.

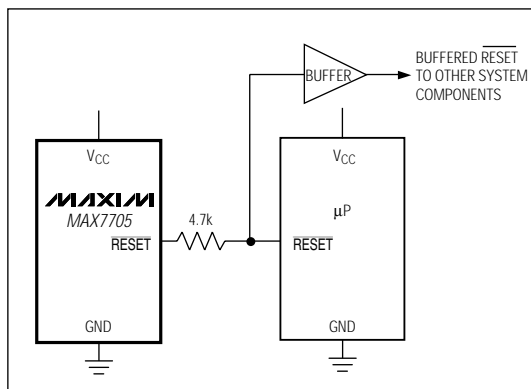
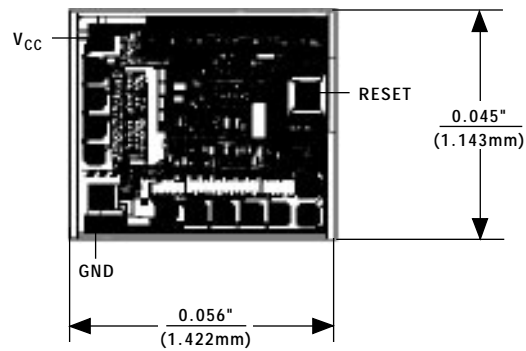


Figure 3. Interfacing to  $\mu$ Ps with Bidirectional Reset I/O

### *Chip Topography*

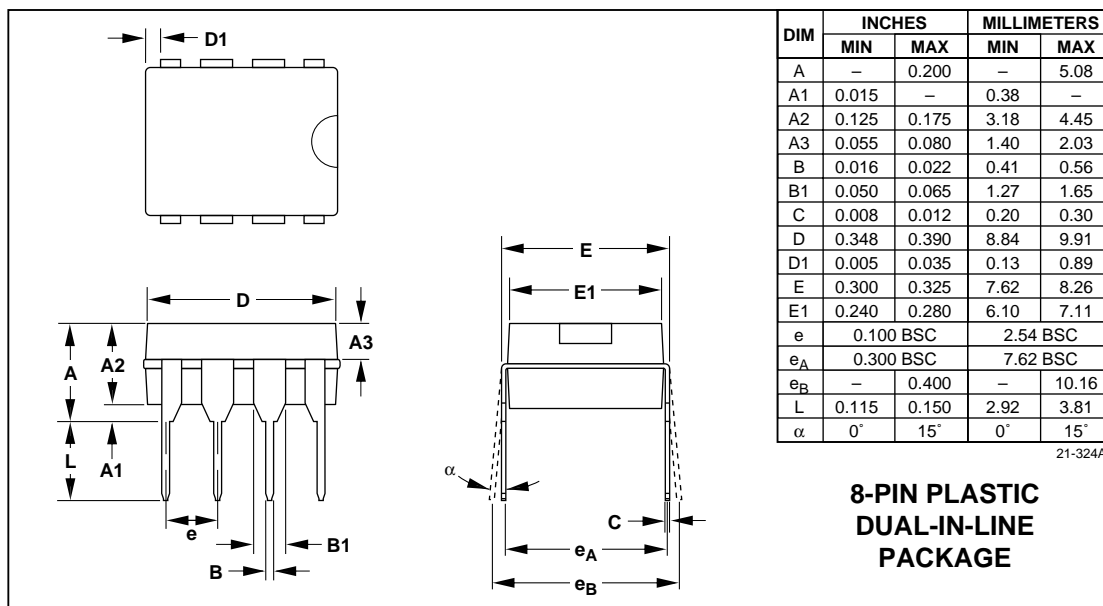


TRANSISTOR COUNT = 380;  
SUBSTRATE CONNECTED TO  $V_{CC}$ .

MAX7705

# $\mu$ P Power-Supply Monitor with Reset

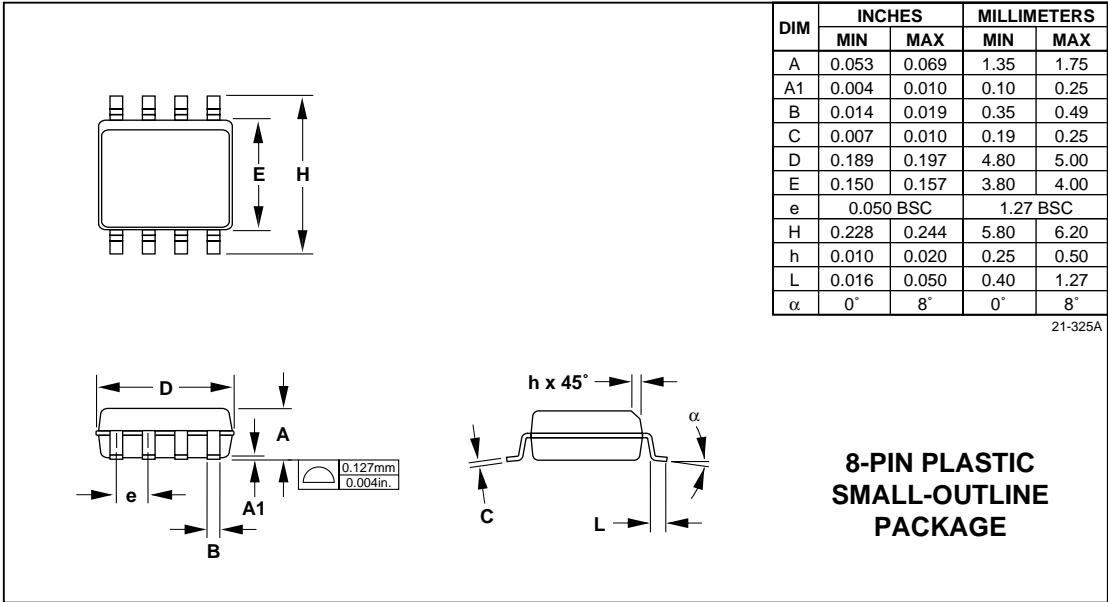
## Package Information



*μP Power-Supply Monitor  
with Reset*

*Package Information (continued)*

MAX7705



# $\mu$ P Power-Supply Monitor with Reset

## $\mu$ P Supervisory Circuits

| Part Number     | Nominal Reset Threshold (V) | Minimum Reset Pulse Width (ms) | Nominal Watchdog Timeout Period (sec) | Backup-Battery Switch | $\overline{CE}$ - Write Protect | Power-Fail Comparator | Manual-Reset Input | Watch-dog Output | Low-Line Output | Active-High Reset | Battery-On Output |
|-----------------|-----------------------------|--------------------------------|---------------------------------------|-----------------------|---------------------------------|-----------------------|--------------------|------------------|-----------------|-------------------|-------------------|
| MAX690A/692A    | 4.65/4.40                   | 140                            | 1.6                                   | ✓                     |                                 | ✓                     |                    |                  |                 |                   |                   |
| MAX691A/693A    | 4.65/4.40                   | 140/adj.                       | 1.6/adj.                              | ✓                     | ✓/10ns                          | ✓                     |                    | ✓                | ✓               | ✓                 | ✓                 |
| MAX696          | Adj.                        | 35/adj.                        | 1.6/adj.                              | ✓                     |                                 | ✓                     |                    | ✓                | ✓               | ✓                 | ✓                 |
| MAX697          | Adj.                        | 35/adj.                        | 1.6/adj.                              |                       | ✓                               | ✓                     |                    | ✓                | ✓               | ✓                 |                   |
| MAX700          | 4.65/adj.                   | 200                            | -                                     |                       |                                 |                       | ✓                  |                  |                 | ✓                 |                   |
| MAX703/704      | 4.65/4.40                   | 140                            | -                                     | ✓                     |                                 | ✓                     | ✓                  |                  |                 |                   |                   |
| MAX705/706      | 4.65/4.40                   | 140                            | 1.6                                   |                       |                                 | ✓                     | ✓                  | ✓                |                 |                   |                   |
| MAX706P         | 2.63                        | 140                            | 1.6                                   |                       |                                 | ✓                     | ✓                  | ✓                |                 | ✓                 |                   |
| MAX706R/S/T     | 2.63/2.93/3.08              | 140                            | 1.6                                   |                       |                                 | ✓                     | ✓                  | ✓                |                 |                   |                   |
| MAX707/708      | 4.65/4.40                   | 140                            | -                                     |                       |                                 | ✓                     | ✓                  |                  |                 | ✓                 |                   |
| MAX708R/S/T     | 2.63/2.93/3.08              | 140                            | -                                     |                       |                                 | ✓                     | ✓                  |                  |                 | ✓                 |                   |
| MAX709L/M/R/S/T | 4.65/4.40/2.63/2.93/3.08    | 140                            | -                                     |                       |                                 |                       |                    |                  |                 |                   |                   |
| MAX791          | 4.65                        | 140                            | 1                                     | ✓                     | ✓/10ns                          | ✓                     | ✓                  | ✓                | ✓               | ✓                 | ✓                 |
| MAX792L/M/R/S/T | 4.65/4.40/2.63/2.93/3.08    | 140                            | 1                                     |                       | ✓/10ns                          | ✓                     | ✓                  | ✓                | ✓               | ✓                 |                   |
| MAX800L/M       | 4.60/4.40                   | 140                            | 1.6/adj.                              | ✓                     | ✓/10ns                          | ✓/±2%                 |                    | ✓                | ✓               | ✓                 | ✓                 |
| MAX802L/M       | 4.60/4.40                   | 140                            | 1.6                                   | ✓                     |                                 | ✓/±2%                 |                    |                  |                 |                   |                   |
| MAX805L         | 4.65                        | 140                            | 1.6                                   | ✓                     |                                 | ✓                     |                    |                  |                 | ✓                 |                   |
| MAX813L         | 4.65                        | 140                            | 1.6                                   |                       |                                 | ✓                     | ✓                  | ✓                |                 | ✓                 |                   |
| MAX820L/M/R/S/T | 4.65/4.40/2.63/2.93/3.08    | 140                            | 1                                     |                       | ✓/10ns                          | ✓/±2%                 | ✓                  | ✓                | ✓               | ✓                 |                   |
| MAX1232         | 4.37/4.62                   | 250                            | 0.15/0.60/1.2                         |                       |                                 |                       | ✓                  |                  |                 |                   |                   |
| MAX1259         | -                           | -                              | -                                     | ✓                     |                                 | ✓                     |                    |                  |                 |                   |                   |

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