



## Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

### General Description

The MAX382/MAX384 are low-voltage, CMOS, 1-of-8 and dual 4-channel muxes with latchable digital inputs. They feature low-voltage operation from a +2.7V to +16.5V single supply and from  $\pm 3V$  to  $\pm 8V$  dual supplies. Pin compatible with the DG428/DG429, these muxes offer low on-resistance ( $100\Omega$  max) matched to within  $4\Omega$  max between channels. Additional features include off leakage less than 2.5nA at +85°C and guaranteed low charge injection (10pC max). ESD protection is greater than 2000V per Method 3015.7.

### Applications

Battery-Operated Systems  
Audio Signal Routing  
Low-Voltage Data-Acquisition Systems  
Sample-and-Hold Circuits  
Automatic Test Equipment

### Features

- ◆ Pin-Compatible with Industry-Standard DG428/DG429, DG528/DG529, MAX368/MAX369
- ◆ Single-Supply Operation (+2.7V to +16.5V)  
Bipolar Supply Operation ( $\pm 3V$  to  $\pm 8V$ )
- ◆ Low Power Consumption (<300 $\mu$ W)
- ◆ Low On-Resistance,  $100\Omega$  max
- ◆ Guaranteed On-Resistance Match Between Channels,  $4\Omega$  max
- ◆ Low Leakage, 2.5nA at +85°C
- ◆ TTL/CMOS-Logic Compatible

### Ordering Information

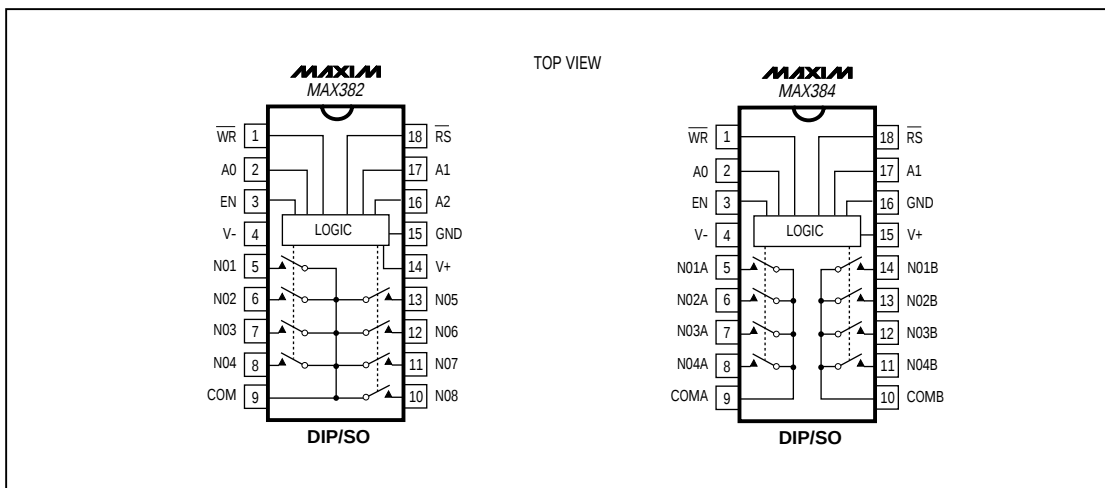
| PART      | TEMP. RANGE     | PIN-PACKAGE    |
|-----------|-----------------|----------------|
| MAX382CPN | 0°C to +70°C    | 18 Plastic DIP |
| MAX382CWN | 0°C to +70°C    | 18 Wide SO     |
| MAX382C/D | 0°C to +70°C    | Dice*          |
| MAX382EPN | -40°C to +85°C  | 18 Plastic DIP |
| MAX382EWN | -40°C to +85°C  | 18 Wide SO     |
| MAX382EJN | -40°C to +85°C  | 18 CERDIP**    |
| MAX382MJN | -55°C to +125°C | 18 CERDIP**    |

Ordering Information continued on last page.

\* Contact factory for dice specifications.

\*\* Contact factory for package availability.

### Pin Configurations



Maxim Integrated Products 1

Call toll free 1-800-998-8800 for free samples or literature.

MAX382/MAX384

# Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

## ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to GND

V+ .....-0.3V to +17V

V- .....+0.3V to -17V

V+ to V- .....-0.3V to +17V

Voltage into Any Terminal (Note 1).....(V- - 2V) to (V+ + 2V) or  
30mA (whichever occurs first)

Current into Any Terminal .....30mA

Peak Current, Any Terminal  
(pulsed at 1ms, 10% duty cycle max) .....100mA

Continuous Power Dissipation (T<sub>A</sub> = +70°C)

Plastic DIP (derate 11.11mW/°C above +70°C) .....889mW

Wide SO (derate 9.52mW/°C above +70°C) .....762mW

CERDIP (derate 10.53mW/°C above +70°C) .....842mW

Operating Temperature Ranges

MAX38\_C\_N .....0°C to +70°C

MAX38\_E\_N .....-40°C to +85°C

MAX38\_MJN .....-55°C to +125°C

Storage Temperature Range .....-65°C to +150°C

Lead Temperature (soldering, 10sec) .....+300°C

**Note 1:** Signals on any terminal exceeding V+ or V- are clamped by internal diodes. Limit forward current to maximum current ratings.

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—Dual Supplies

(V+ = +5V ±10%, V- = -5V ±10%, GND = 0V, V<sub>A\_H</sub> = V<sub>ENH</sub> = 2.4V, V<sub>A\_L</sub> = V<sub>ENL</sub> = 0.8V,  $\overline{WR}$  = 0V,  $\overline{RS}$  = 2.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

| PARAMETER                                           | SYMBOL                             | CONDITIONS                                                                     |                                                          |                                                          | MIN  | TYP<br>(Note 2) | MAX | UNITS |    |
|-----------------------------------------------------|------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|------|-----------------|-----|-------|----|
| SWITCH                                              |                                    |                                                                                |                                                          |                                                          |      |                 |     |       |    |
| Analog Signal Range                                 | V <sub>COM</sub> , V <sub>NO</sub> | (Note 3)                                                                       |                                                          |                                                          | V-   |                 | V+  | V     |    |
| Channel On-Resistance                               | R <sub>ON</sub>                    | I <sub>NO</sub> = 1mA, V <sub>COM</sub> = ±3.5V                                | T <sub>A</sub> = +25°C                                   |                                                          | 60   |                 | 100 | Ω     |    |
|                                                     |                                    |                                                                                | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>    |                                                          | 125  |                 |     |       |    |
| On-Resistance Matching<br>Between Channels (Note 4) | ΔR <sub>ON</sub>                   | I <sub>NO</sub> = 1mA, V <sub>COM</sub> = ±3.5V,<br>V+ = 5V, V- = -5V          | T <sub>A</sub> = +25°C                                   |                                                          |      |                 | 4   | Ω     |    |
|                                                     |                                    |                                                                                | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>    |                                                          | 6    |                 |     |       |    |
| On-Resistance Flatness<br>(Note 5)                  | R <sub>FLAT(ON)</sub>              | I <sub>NO</sub> = 1mA, V <sub>COM</sub> = ±3V,<br>V+ = 5V, V- = -5V            | T <sub>A</sub> = +25°C                                   |                                                          |      |                 | 10  | Ω     |    |
|                                                     |                                    |                                                                                | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>    |                                                          | 13   |                 |     |       |    |
| NO-Off Leakage Current<br>(Note 6)                  | I <sub>NO(OFF)</sub>               | V <sub>NO</sub> = ±4.5V, V <sub>COM</sub> = ±4.5V,<br>V+ = 5.5V, V- = -5.5V    | T <sub>A</sub> = +25°C                                   |                                                          | -0.1 |                 | 0.1 | nA    |    |
|                                                     |                                    |                                                                                | T <sub>A</sub> = T <sub>MIN</sub><br>to T <sub>MAX</sub> | C, E                                                     | -1.0 | 1.0             |     |       |    |
|                                                     |                                    |                                                                                |                                                          | M                                                        | -10  | 10              |     |       |    |
| COM-Off Leakage Current<br>(Note 6)                 | I <sub>COM(OFF)</sub>              | V <sub>COM</sub> = ±4.5V,<br>V <sub>NO</sub> = ±4.5V,<br>V+ = 5.5V, V- = -5.5V | MAX382                                                   | T <sub>A</sub> = +25°C                                   |      | -0.2            |     | 0.2   | nA |
|                                                     |                                    |                                                                                |                                                          | T <sub>A</sub> = T <sub>MIN</sub><br>to T <sub>MAX</sub> | C, E | -2.5            | 2.5 |       |    |
|                                                     |                                    |                                                                                |                                                          |                                                          | M    | -20             | 20  |       |    |
|                                                     |                                    | V <sub>COM</sub> = ±4.5V,<br>V <sub>NO</sub> = ±4.5V,<br>V+ = 5.5V, V- = -5.5V | MAX384                                                   | T <sub>A</sub> = +25°C                                   |      | -0.1            |     | 0.1   |    |
|                                                     |                                    |                                                                                |                                                          | T <sub>A</sub> = T <sub>MIN</sub><br>to T <sub>MAX</sub> | C, E | -1.5            | 1.5 |       |    |
|                                                     |                                    |                                                                                |                                                          |                                                          | M    | -10             | 10  |       |    |
| COM-On Leakage Current<br>(Note 6)                  | I <sub>COM(ON)</sub>               | V <sub>COM</sub> = ±4.5V,<br>V <sub>NO</sub> = 4.5V,                           | MAX382                                                   | T <sub>A</sub> = +25°C                                   |      | -0.4            |     | 0.4   | nA |
|                                                     |                                    |                                                                                |                                                          | T <sub>A</sub> = T <sub>MIN</sub><br>to T <sub>MAX</sub> | C, E | -5              | 5   |       |    |
|                                                     |                                    |                                                                                |                                                          |                                                          | M    | -40             | 40  |       |    |
|                                                     |                                    | V <sub>COM</sub> = ±4.5V,<br>V <sub>NO</sub> = 4.5V,                           | MAX384                                                   | T <sub>A</sub> = +25°C                                   |      | -0.2            |     | 0.2   |    |
|                                                     |                                    |                                                                                |                                                          | T <sub>A</sub> = T <sub>MIN</sub><br>to T <sub>MAX</sub> | C, E | -2.5            | 2.5 |       |    |
|                                                     |                                    |                                                                                |                                                          |                                                          | M    | -20             | 20  |       |    |

# Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

MAX382/MAX384

## ELECTRICAL CHARACTERISTICS—Dual Supplies (continued)

(V+ = +5V ±10%, V- = -5V ±10%, GND = 0V, V<sub>A\_H</sub> = V<sub>ENH</sub> = 2.4V, V<sub>A\_L</sub> = V<sub>ENL</sub> = 0.8V,  $\overline{WR}$  = 0V,  $\overline{RS}$  = 2.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

| PARAMETER                                | SYMBOL                                       | CONDITIONS                                                                                                                | MIN      | TYP<br>(Note 2) | MAX | UNITS |
|------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------|-----------------|-----|-------|
| <b>DIGITAL LOGIC INPUT</b>               |                                              |                                                                                                                           |          |                 |     |       |
| Logic High Input Voltage                 | V <sub>A_H</sub> , V <sub>ENH</sub>          | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>                                                                     | 2.4      |                 |     | V     |
| Logic Low Input Voltage                  | V <sub>A_L</sub> , V <sub>ENL</sub>          | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>                                                                     |          |                 | 0.8 | V     |
| Input Current with Input Voltage High    | I <sub>A_H</sub> , I <sub>ENH</sub>          | V <sub>A_H</sub> = 2.4V, V <sub>A_L</sub> = 0.8V                                                                          | -0.1     |                 | 0.1 | μA    |
| Input Current with Input Voltage Low     | I <sub>A_L</sub> , I <sub>ENL</sub>          | V <sub>A_H</sub> = 2.4V, V <sub>A_L</sub> = 0.8V                                                                          | -0.1     |                 | 0.1 | μA    |
| <b>SUPPLY</b>                            |                                              |                                                                                                                           |          |                 |     |       |
| Power-Supply Range                       | V+, V-                                       |                                                                                                                           | ±2.4     |                 | ±8  | V     |
| Positive Supply Current                  | I+                                           | V <sub>EN</sub> = V <sub>A</sub> = 0V/V+, V+ = 5.5V, V- = -5.5V<br>T <sub>A</sub> = +25°C                                 | -1       |                 | 1   | μA    |
| Negative Supply Current                  | I-                                           | V <sub>EN</sub> = V <sub>A</sub> = 0V/V+, V+ = 5.5V, V- = -5.5V<br>T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>  | -1       |                 | 1   | μA    |
| AX, EN Data Hold Time                    | t <sub>H</sub>                               | Figure 5<br>T <sub>A</sub> = +25°C                                                                                        | 100      |                 |     | ns    |
| Reset Pulse Width                        | t <sub>RS</sub>                              | Figure 6, V+ = 5V<br>T <sub>A</sub> = +25°C                                                                               | 100      |                 |     | ns    |
| <b>DYNAMIC</b>                           |                                              |                                                                                                                           |          |                 |     |       |
| Transition Time                          | t <sub>TRANS</sub>                           | Figure 1<br>T <sub>A</sub> = +25°C                                                                                        | 100      | 275             |     | ns    |
| Break-Before-Make Interval               | t <sub>OPEN</sub>                            | Figure 2<br>T <sub>A</sub> = +25°C                                                                                        | 0        | 20              |     | ns    |
| Enable Turn-On Time                      | t <sub>ON(EN)</sub>                          | Figure 3<br>T <sub>A</sub> = +25°C<br>T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>                               | 100      | 150<br>250      |     | ns    |
| Enable Turn-Off Time                     | t <sub>OFF(EN)</sub>                         | Figure 3<br>T <sub>A</sub> = +25°C<br>T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>                               | 80       | 150<br>250      |     | ns    |
| Write Turn-On Time                       | t <sub>ON(<math>\overline{WR}</math>)</sub>  | Figure 4<br>T <sub>A</sub> = +25°C<br>T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>                               |          | 150<br>250      |     | ns    |
| Reset Turn-Off Time                      | t <sub>OFF(<math>\overline{RS}</math>)</sub> | Figure 6<br>T <sub>A</sub> = +25°C<br>T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>                               |          | 150<br>250      |     | ns    |
| Charge Injection (Note 3)                | V <sub>CTE</sub>                             | C <sub>L</sub> = 100pF, V <sub>NO</sub> = 0V<br>T <sub>A</sub> = +25°C                                                    | 2        | 5               |     | pC    |
| Off Isolation (Note 7)                   | V <sub>ISO</sub>                             | V <sub>EN</sub> = 0V, R <sub>L</sub> = 1kΩ, f = 100kHz<br>T <sub>A</sub> = +25°C                                          | -75      |                 |     | dB    |
| Crosstalk Between Channels               | V <sub>CT</sub>                              | V <sub>EN</sub> = 2.4V, f = 100kHz, V <sub>GEN</sub> = 1V <sub>p-p</sub> , R <sub>L</sub> = 1kΩ<br>T <sub>A</sub> = +25°C | -92      |                 |     | dB    |
| Logic Input Capacitance                  | C <sub>IN</sub>                              | f = 1MHz<br>T <sub>A</sub> = +25°C                                                                                        | 8        |                 |     | pF    |
| NO-Off Capacitance                       | C <sub>NO(OFF)</sub>                         | f = 1MHz, V <sub>EN</sub> = V <sub>COM</sub> = 0V<br>T <sub>A</sub> = +25°C                                               | 11       |                 |     | pF    |
| COM-Off Capacitance                      | C <sub>COM(OFF)</sub>                        | f = 1MHz, V <sub>EN</sub> = V <sub>COM</sub> = 0V<br>T <sub>A</sub> = +25°C                                               | 40<br>20 |                 |     | pF    |
| COM-On Capacitance                       | C <sub>COM(ON)</sub>                         | f = 1MHz, V <sub>EN</sub> = V <sub>COM</sub> = 0V<br>T <sub>A</sub> = +25°C                                               | 54<br>34 |                 |     | pF    |
| <b>MINIMUM INPUT TIMING REQUIREMENTS</b> |                                              |                                                                                                                           |          |                 |     |       |
| Write Pulse Width                        | t <sub>W</sub>                               | Figure 5<br>T <sub>A</sub> = +25°C                                                                                        | 100      |                 |     | ns    |
| AX, EN Data Setup Time                   | t <sub>S</sub>                               | Figure 5<br>T <sub>A</sub> = +25°C                                                                                        | 100      |                 |     | ns    |

## Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

### ELECTRICAL CHARACTERISTICS—Single +5V Supply

(V+ = +5V ±10%, V- = 0V, GND = 0V, V<sub>A\_H</sub> = V<sub>ENH</sub> = 2.4V, V<sub>A\_L</sub> = V<sub>ENL</sub> = 0.8V,  $\overline{WR}$  = 0V,  $\overline{RS}$  = 2.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

| PARAMETER                                             | SYMBOL                             | CONDITIONS                                                        |                                                       |                                                       | MIN  | TYP<br>(Note 2) | MAX  | UNITS |
|-------------------------------------------------------|------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|------|-----------------|------|-------|
| AX, EN Data Hold Time                                 | t <sub>H</sub>                     | Figure 5                                                          | T <sub>A</sub> = +25°C                                |                                                       | 100  |                 |      | ns    |
| Reset Pulse Width                                     | t <sub>RS</sub>                    | Figure 6, V+ = 5V                                                 | T <sub>A</sub> = +25°C                                |                                                       | 100  |                 |      | ns    |
| SWITCH                                                |                                    |                                                                   |                                                       |                                                       |      |                 |      |       |
| Analog Signal Range                                   | V <sub>COM</sub> , V <sub>NO</sub> | (Note 3)                                                          |                                                       |                                                       | V-   |                 | V+   | V     |
| On-Resistance                                         | R <sub>ON</sub>                    | I <sub>NO</sub> = 1mA, V <sub>COM</sub> = 3.5V, V+ = 4.5V         | T <sub>A</sub> = +25°C                                |                                                       | 150  |                 | 225  | Ω     |
|                                                       |                                    |                                                                   | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                                       |      |                 | 280  |       |
| On-Resistance Matching Between Channels (Note 4)      | ΔR <sub>ON</sub>                   | I <sub>NO</sub> = 1mA, V <sub>COM</sub> = 3.5V, V+ = 4.5V         | T <sub>A</sub> = +25°C                                |                                                       |      |                 | 10   | Ω     |
|                                                       |                                    |                                                                   | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                                       |      |                 | 12   |       |
| On-Resistance Flatness                                | R <sub>FLAT</sub>                  | I <sub>NO</sub> = 1mA; V <sub>COM</sub> = 3V, 2V, 1V; V+ = 5V     | T <sub>A</sub> = +25°C                                |                                                       |      |                 | 10   | Ω     |
|                                                       |                                    |                                                                   | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                                       |      |                 | 15   |       |
| NO-Off Leakage Current (Note 8)                       | I <sub>NO(OFF)</sub>               | V <sub>NO</sub> = 4.5V, V <sub>COM</sub> = 0V, V+ = 5.5V          | T <sub>A</sub> = +25°C                                |                                                       | -0.1 |                 | 0.1  | nA    |
|                                                       |                                    |                                                                   | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                                       | C, E | -1.0            | 1.0  |       |
|                                                       |                                    |                                                                   |                                                       |                                                       | M    | -10             | 10   |       |
| COM-Off Leakage Current (Note 8)                      | I <sub>COM(OFF)</sub>              | V <sub>COM</sub> = 4.5V, V <sub>NO</sub> = 0V, V+ = 5.5V          | MAX382                                                | T <sub>A</sub> = +25°C                                |      | -0.2            | 0.2  | nA    |
|                                                       |                                    |                                                                   |                                                       | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |      | C, E            | -2.5 |       |
|                                                       |                                    |                                                                   |                                                       | M                                                     | -20  | 20              |      |       |
|                                                       |                                    | V <sub>COM</sub> = 4.5V, V <sub>NO</sub> = 0V, V+ = 5.5V          | MAX384                                                | T <sub>A</sub> = +25°C                                |      | -0.2            | 0.2  |       |
| T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                    |                                                                   |                                                       | C, E                                                  | -1.5 | 1.5             |      |       |
|                                                       |                                    |                                                                   |                                                       | M                                                     | -10  | 10              |      |       |
| COM-On Leakage Current (Note 8)                       | I <sub>COM(ON)</sub>               | V <sub>COM</sub> = 4.5V, V <sub>NO</sub> = 4.5V, V+ = 5.5V        | MAX382                                                | T <sub>A</sub> = +25°C                                |      | -0.4            | 0.4  | nA    |
|                                                       |                                    |                                                                   |                                                       | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |      | C, E            | -5   |       |
|                                                       |                                    |                                                                   |                                                       |                                                       | M    | -40             | 40   |       |
|                                                       |                                    |                                                                   | MAX384                                                | T <sub>A</sub> = +25°C                                |      | -0.2            | 0.2  |       |
| T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                    | C, E                                                              |                                                       | -2.5                                                  | 2.5  |                 |      |       |
|                                                       |                                    |                                                                   |                                                       | M                                                     | -20  | 20              |      |       |
| DIGITAL LOGIC INPUT                                   |                                    |                                                                   |                                                       |                                                       |      |                 |      |       |
| Logic High Input Voltage                              | V <sub>H</sub> , V <sub>ENH</sub>  |                                                                   | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                                       | 2.4  |                 |      | V     |
| Logic Low Input Voltage                               | V <sub>L</sub> , V <sub>ENL</sub>  |                                                                   | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                                       |      |                 | 0.8  | V     |
| Input Current with Input Voltage High                 | I <sub>H</sub> , I <sub>ENH</sub>  | V <sub>H</sub> = 2.4V, V <sub>L</sub> = 0.8V                      |                                                       |                                                       | -0.1 |                 | 0.1  | μA    |
| Input Current with Input Voltage Low                  | I <sub>L</sub> , I <sub>ENL</sub>  | V <sub>H</sub> = 2.4V, V <sub>L</sub> = 0.8V                      |                                                       |                                                       | -0.1 |                 | 0.1  | μA    |
| SUPPLY                                                |                                    |                                                                   |                                                       |                                                       |      |                 |      |       |
| Power-Supply Range                                    |                                    |                                                                   |                                                       |                                                       | 2.4  |                 | 15   | V     |
| Positive Supply Current                               | I+                                 | V <sub>EN</sub> = V <sub>A</sub> = 0V, V+; V+ = 5.5V; V- = 0V     |                                                       |                                                       | -1.0 |                 | 1.0  | μA    |
| Negative Supply Current                               | I-                                 | V <sub>EN</sub> = V <sub>A</sub> = 0V, V+; V+ = 5.5V; V- = 0V     |                                                       |                                                       | -1.0 |                 | 1.0  | μA    |
| I <sub>GND</sub> Supply Current                       | I <sub>GND</sub>                   | V <sub>EN</sub> = V+, 0V; V <sub>A</sub> = 0V; V+ = 5.5V; V- = 0V | T <sub>A</sub> = +25°C                                |                                                       | -1.0 |                 | 1.0  | μA    |
|                                                       |                                    |                                                                   | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |                                                       | -1.0 |                 | 1.0  |       |

# Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

MAX382/MAX384

## ELECTRICAL CHARACTERISTICS—Single +5V Supply (continued)

(V<sub>+</sub> = +5V ±10%, V<sub>-</sub> = 0V, GND = 0V, V<sub>A\_H</sub> = V<sub>ENH</sub> = 2.4V, V<sub>A\_L</sub> = V<sub>ENL</sub> = 0.8V,  $\overline{WR}$  = 0V,  $\overline{RS}$  = 2.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

| PARAMETER                        | SYMBOL               | CONDITIONS                                                |                                                       | MIN | TYP<br>(Note 2) | MAX | UNITS |
|----------------------------------|----------------------|-----------------------------------------------------------|-------------------------------------------------------|-----|-----------------|-----|-------|
| DYNAMIC                          |                      |                                                           |                                                       |     |                 |     |       |
| Transition Time                  | t <sub>TRANS</sub>   | Figure 1, V <sub>NO</sub> = 3V                            |                                                       | 90  | 280             |     | ns    |
| Break-Before-Make Interval       | t <sub>OPEN</sub>    | Figure 2 (Note 3)                                         | T <sub>A</sub> = +25°C                                | 5   | 40              |     | ns    |
| Enable Turn-On Time<br>(Note 3)  | t <sub>ON(EN)</sub>  | Figure 3                                                  | T <sub>A</sub> = +25°C                                | 130 | 200             |     | ns    |
|                                  |                      |                                                           | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |     | 275             |     |       |
| Enable Turn-Off Time<br>(Note 3) | t <sub>OFF(EN)</sub> | Figure 3                                                  | T <sub>A</sub> = +25°C                                | 80  | 200             |     | ns    |
|                                  |                      |                                                           | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |     | 275             |     |       |
| Write Turn-On Time<br>(Note 3)   | t <sub>ON(WR)</sub>  | Figure 4                                                  | T <sub>A</sub> = +25°C                                |     | 200             |     | ns    |
|                                  |                      |                                                           | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |     | 275             |     |       |
| Reset Turn-Off Time<br>(Note 3)  | t <sub>OFF(RS)</sub> | Figure 4                                                  | T <sub>A</sub> = +25°C                                |     | 200             |     | ns    |
|                                  |                      |                                                           | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |     | 275             |     |       |
| Charge Injection (Note 3)        | V <sub>CTE</sub>     | Figure 7, C <sub>L</sub> = 100pF,<br>V <sub>NO</sub> = 0V | T <sub>A</sub> = +25°C                                | 1.5 | 5               |     | pC    |

## ELECTRICAL CHARACTERISTICS—Single +3V Supply

(V<sub>+</sub> = +3V ±10%, V<sub>-</sub> = 0V, GND = 0V, V<sub>A\_H</sub> = V<sub>ENH</sub> = 2.4V, V<sub>A\_L</sub> = V<sub>ENL</sub> = 0.8V,  $\overline{WR}$  = 0V,  $\overline{RS}$  = 2.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

| PARAMETER                        | SYMBOL               | CONDITIONS                                                                           |                                                       | MIN | TYP<br>(Note 2) | MAX | UNITS |
|----------------------------------|----------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------|-----|-----------------|-----|-------|
| SWITCH                           |                      |                                                                                      |                                                       |     |                 |     |       |
| Analog Signal Range              | V <sub>ANALOG</sub>  | (Note 3)                                                                             |                                                       | V-  |                 | V+  | V     |
| On-Resistance                    | R <sub>ON</sub>      | I <sub>NO</sub> = 1mA, V <sub>COM</sub> = 1.5V,<br>V+ = 3V                           | T <sub>A</sub> = +25°C                                |     | 230             | 375 | Ω     |
|                                  |                      |                                                                                      | T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub> |     |                 | 425 |       |
| DYNAMIC                          |                      |                                                                                      |                                                       |     |                 |     |       |
| Transition Time (Note 3)         | t <sub>TRANS</sub>   | Figure 1, V <sub>IN</sub> = 2.4V,<br>V <sub>N01</sub> = 1.5V, V <sub>N08</sub> = 0V  | T <sub>A</sub> = +25°C                                |     | 230             | 575 | ns    |
| Enable Turn-On Time<br>(Note 3)  | t <sub>ON(EN)</sub>  | Figure 3, V <sub>INH</sub> = 2.4V,<br>V <sub>INL</sub> = 0V, V <sub>N01</sub> = 1.5V | T <sub>A</sub> = +25°C                                |     | 200             | 500 | ns    |
| Enable Turn-Off Time<br>(Note 3) | t <sub>OFF(EN)</sub> | Figure 3, V <sub>INH</sub> = 2.4V,<br>V <sub>INL</sub> = 0V, V <sub>N01</sub> = 1.5V | T <sub>A</sub> = +25°C                                |     | 75              | 400 | ns    |
| Write Turn-On Time (Note 3)      | t <sub>ON(WR)</sub>  | Figure 4                                                                             | T <sub>A</sub> = +25°C                                |     | 200             | 500 | ns    |
| Reset Turn-Off Time (Note 3)     | t <sub>OFF(RS)</sub> | Figure 4                                                                             | T <sub>A</sub> = +25°C                                |     | 75              | 400 | ns    |
| Charge Injection<br>(Note 3)     | V <sub>CTE</sub>     | Figure 7, C <sub>L</sub> = 100pF,<br>V <sub>NO</sub> = 0V                            | T <sub>A</sub> = +25°C                                |     | 1               | 5   | pC    |

**Note 2:** The algebraic convention, where the most negative value is a minimum and the most positive value a maximum, is used in this data sheet.

**Note 3:** Guaranteed by design.

**Note 4:**  $\Delta R_{ON} = R_{ON(max)} - R_{ON(min)}$ .

**Note 5:** Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges, i.e., V<sub>NO</sub> = 3V to 0V and 0V to -3V.

**Note 6:** Leakage parameters are 100% tested at maximum rated hot operating temperature, and guaranteed by correlation at +25°C.

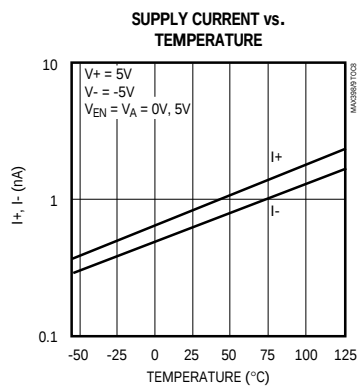
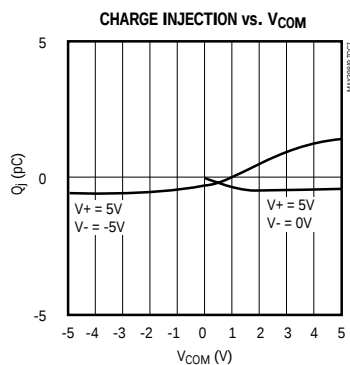
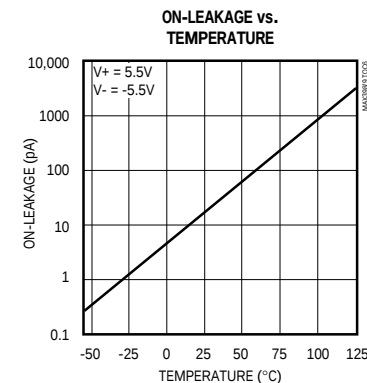
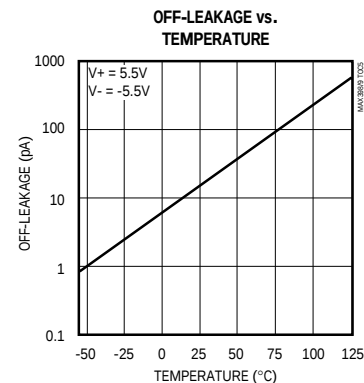
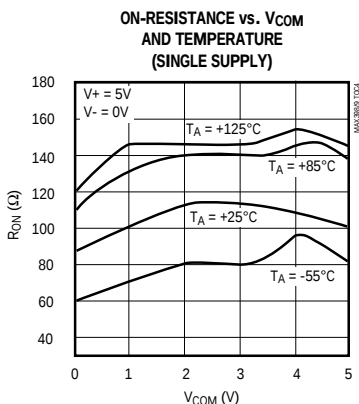
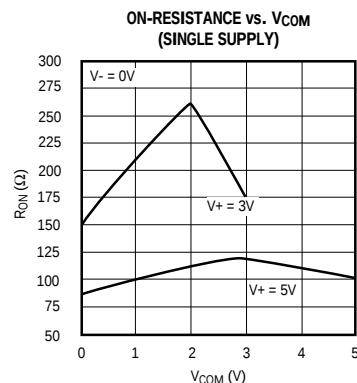
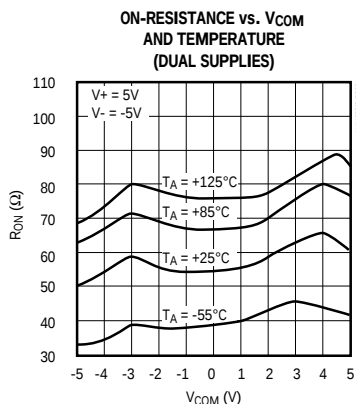
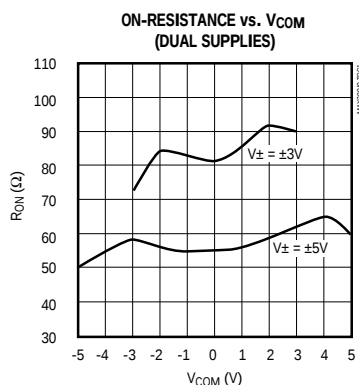
**Note 7:** Worst-case isolation is on channel 4 because of its proximity to the COM pin. Off isolation = 20log V<sub>COM</sub>/V<sub>NO</sub>, V<sub>COM</sub> = output, V<sub>NO</sub> = input to off switch.

**Note 8:** Leakage testing at single supply is guaranteed by correlation testing with dual supplies.

# Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

## Typical Operating Characteristics

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)



# Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

## Pin Description

MAX382/MAX384

| PIN       |        | NAME*           | FUNCTION                                                                   |
|-----------|--------|-----------------|----------------------------------------------------------------------------|
| MAX382    | MAX384 |                 |                                                                            |
| 1         | 1      | $\overline{WR}$ | WRITE Logic Input                                                          |
| 2, 16, 17 | —      | A0, A2, A1      | Address Logic Inputs (see <i>Truth Tables</i> at end of data sheet)        |
| —         | 2, 17  | A0, A1          | Address Logic Inputs (see <i>Truth Tables</i> at end of data sheet)        |
| 3         | 3      | EN              | Enable Logic Input (see <i>Truth Tables</i> at end of data sheet)          |
| 4         | 4      | V-              | Negative Supply Voltage Input. Connect to GND for single-supply operation. |
| 5–8       | —      | NO1–NO4         | Analog Signal Inputs—bidirectional                                         |
| —         | 5–8    | NO1A–NO4A       | Analog Signal Inputs—bidirectional                                         |
| 9         | —      | COM             | Analog Signal Output—bidirectional                                         |
| —         | 9, 10  | COMA, COMB      | Analog Signal Outputs—bidirectional                                        |
| 10–13     | —      | NO8–NO5         | Analog Signal Inputs—bidirectional                                         |
| —         | 11–14  | NO4B–NO1B       | Analog Signal Inputs—bidirectional                                         |
| 14        | 15     | V+              | Positive Supply Voltage Input                                              |
| 15        | 16     | GND             | Ground                                                                     |
| 18        | 18     | $\overline{RS}$ | RESET Logic Input                                                          |

\*Analog inputs and outputs are names of convenience only. Inputs and outputs are identical and interchangeable.

## Applications Information

The internal structures of the MAX382/MAX384 include translators for the A2/A1/EN/ $\overline{WR}$ / $\overline{RS}$  digital inputs, latches, and a decode section for channel selection (see *Truth Tables*). The analog-signal switches consist of parallel combinations of N and P MOSFETs.

WRITE ( $\overline{WR}$ ) and RESET ( $\overline{RS}$ ) strobes are provided for interfacing with  $\mu$ P-bus lines, alleviating the need for the  $\mu$ P to provide constant address inputs to the mux to hold a particular channel (Figures 2–7).

When the  $\overline{WR}$  strobe is in the low state (less than 0.8V) and the  $\overline{RS}$  strobe is in the high state (greater than 2.4V), the muxes are in the transparent mode—they act similar to nonlatching devices, such as the MAX398/MAX399.

When the  $\overline{WR}$  goes high, the previous BCD address input is latched and held in that state indefinitely.

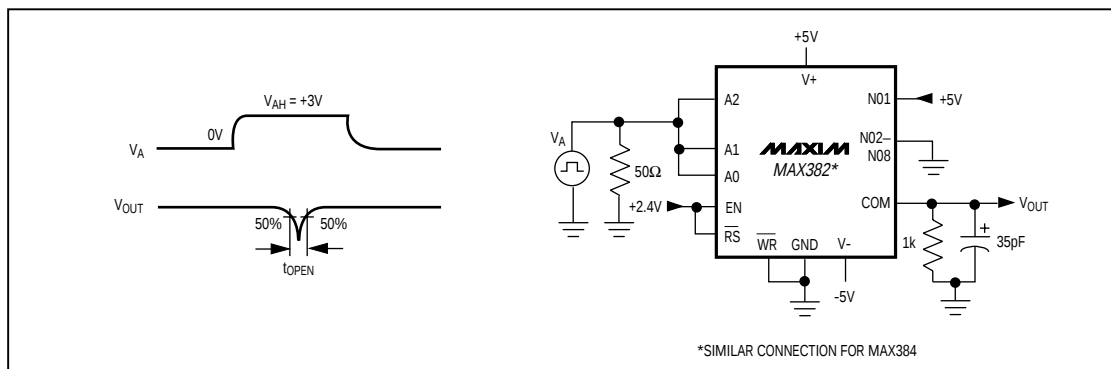
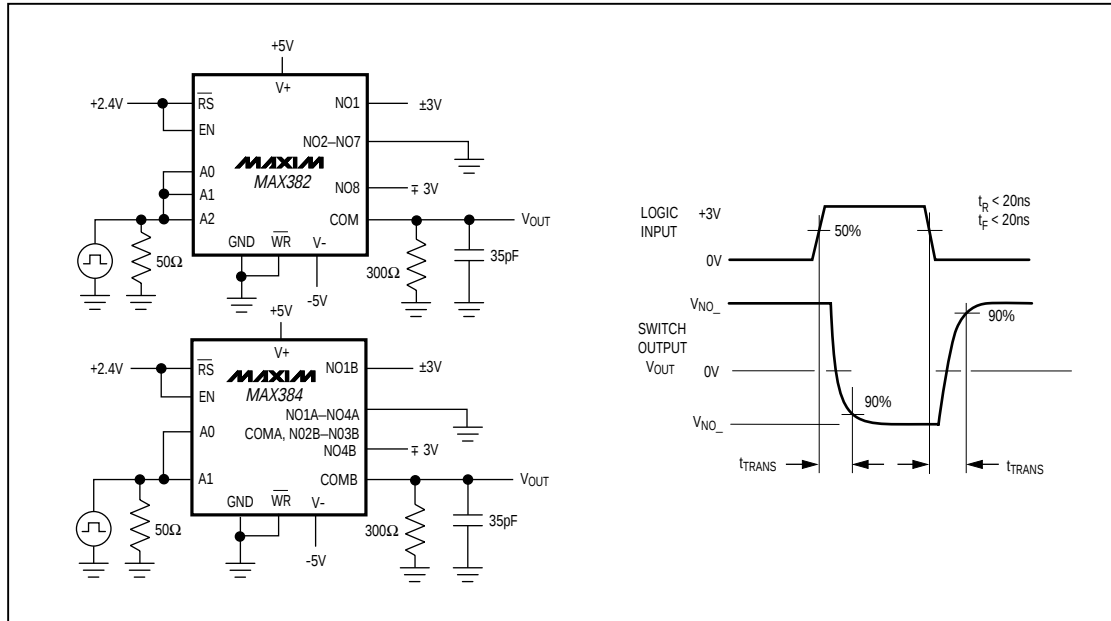
$\overline{RS}$  turns off all channels when it is low. All switches stay off until  $\overline{RS}$  and EN are high and  $\overline{WR}$  is low.

The MAX382/MAX384 work with both single and dual supplies and function over the +2.4V to +16V single-supply range. For example, with a single +5V power supply, analog signals in the 0V to +5V range can be switched normally. If negative signals around 0V are expected, a negative supply is needed.

The EN latch allows all switches to be turned off under program control. This is useful when two or more are cascaded to build 16-line and larger analog-signal multiplexers.

# Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

## Test Circuits/Timing Diagrams



## Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

MAX382/MAX384

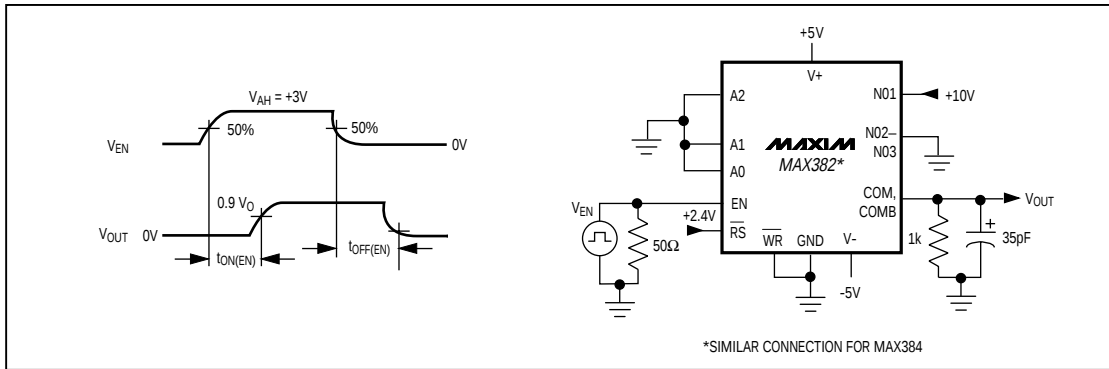


Figure 3. Enable Delay ( $t_{ON}(EN)$ ,  $t_{OFF}(EN)$ )

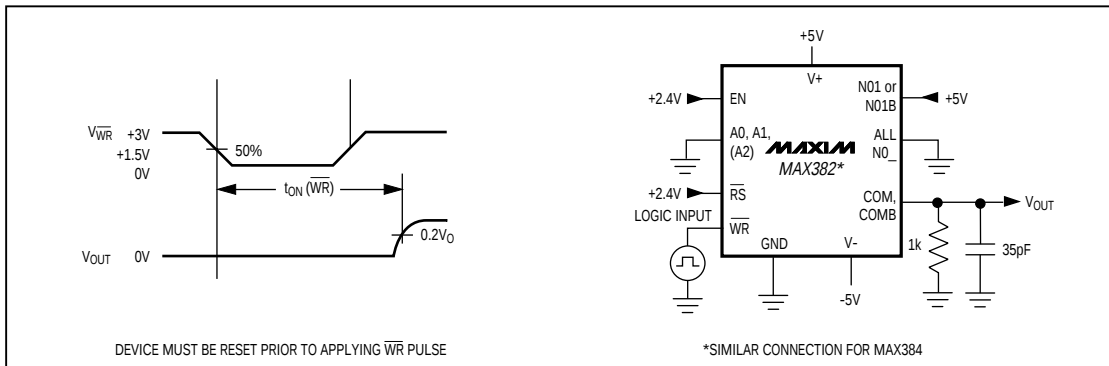


Figure 4. Write Turn-On Time ( $t_{ON}(WR)$ )

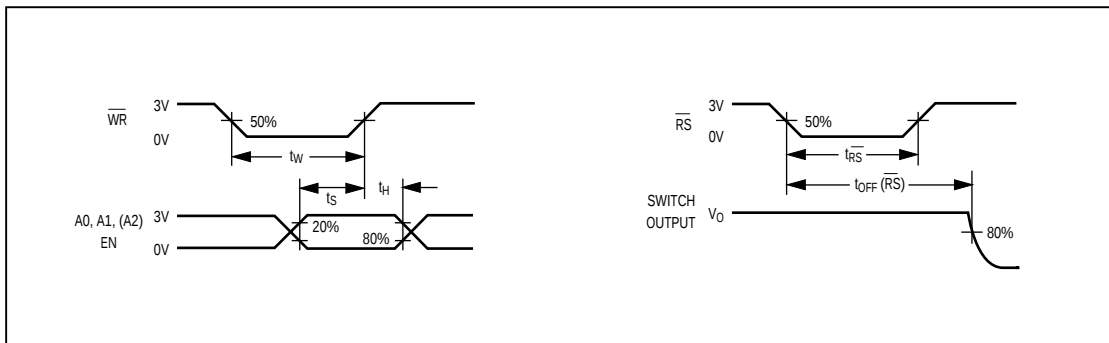


Figure 5. Write, Setup, and Hold Timing ( $t_w$ ,  $t_s$ ,  $t_h$ )

## Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

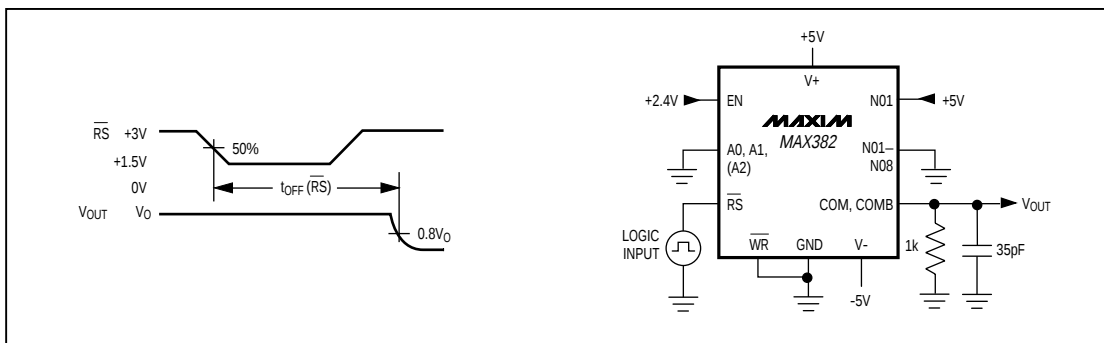


Figure 6. Reset Turn-Off Time ( $t_{OFF(RS)}$ )

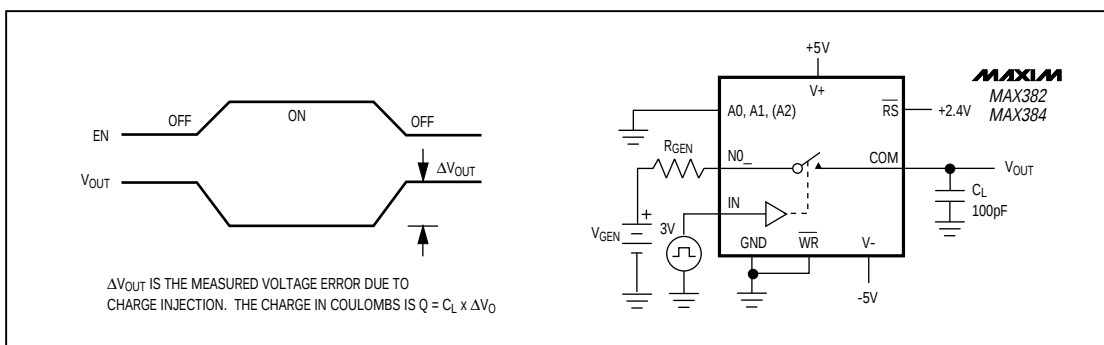


Figure 7. Charge Injection ( $V_{CTE}$ )

### Operation with Supply Voltages Other than ±5V

Using supply voltages less than ±5V reduces the analog signal range. The MAX382/MAX384 muxes operate with ±3V to ±8V bipolar supplies or with a +2.7V to +16.5V single supply. Connect V- to GND when operating with a single supply. Both devices can also operate with unbalanced supplies, such as +10V and -5V. The *Typical Operating Characteristics* graphs show typical on-resistance with ±3V, ±5V, +3V and +5V supplies. (Switching times increase by a factor of two or more for operation at +5V or below.)

### Overvoltage Protection

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings can cause permanent damage to the devices. Always sequence V+ on first, then V-, followed by the logic inputs, NO, or COM. If power-supply sequencing is not possible, add two small signal diodes (D1, D2) in series with supply pins for overvoltage protection (Figure 8). Adding diodes reduces the analog signal range to one diode drop below V+ and one diode drop above V-, but does not affect the devices' low switch resistance and low leakage characteristics. Device operation is unchanged, and the difference between V+ and V- should not exceed 17V. These protection diodes are not recommended when using a single supply.

Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

MAX382/MAX384

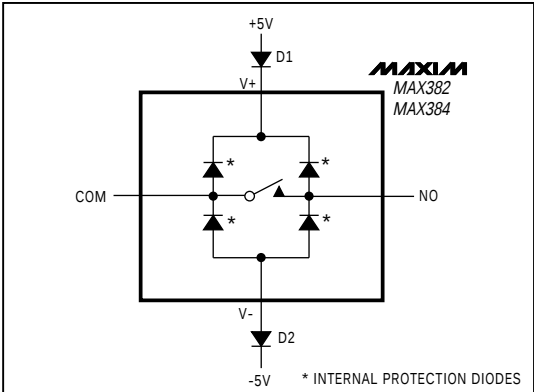
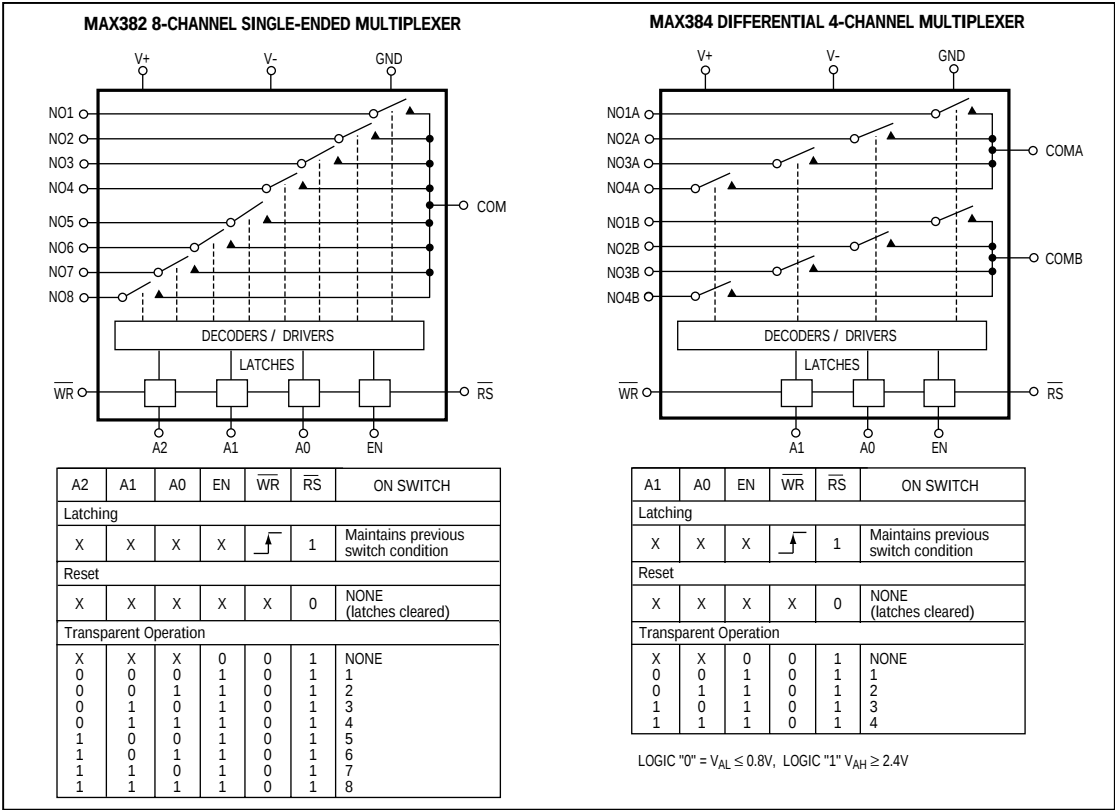


Figure 8. Overvoltage Protection Using External Blocking Diodes

Functional Diagrams/Truth Tables



# Low-Voltage, 8-Channel/Dual 4-Channel Multiplexers with Latchable Inputs

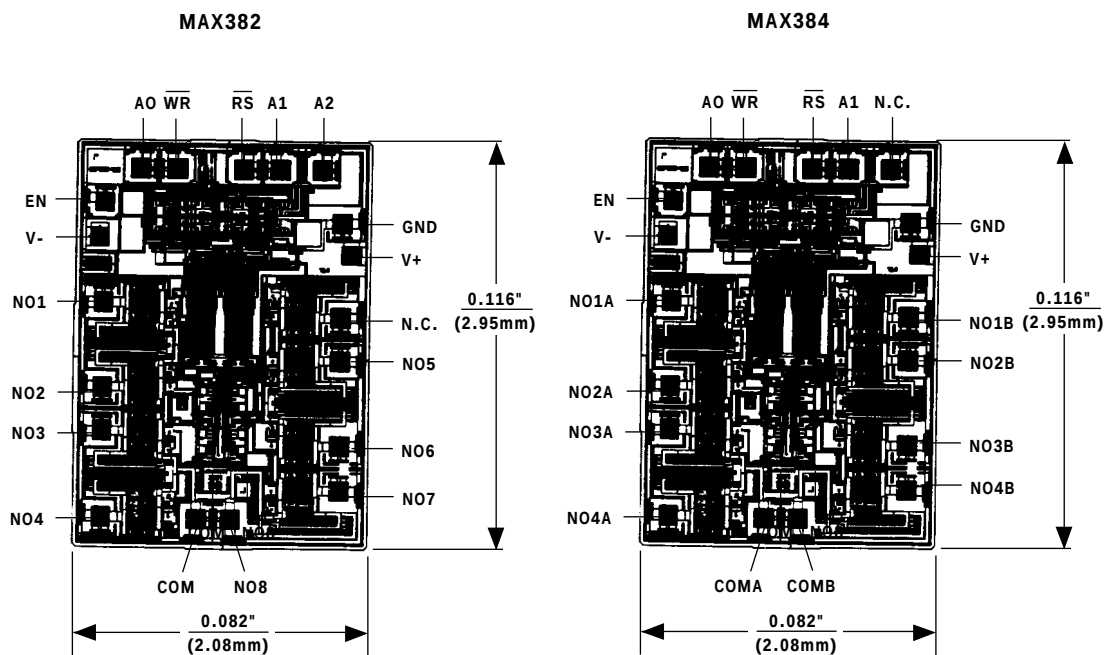
## \_Ordering Information (continued)

| PART      | TEMP. RANGE     | PIN-PACKAGE    |
|-----------|-----------------|----------------|
| MAX384CPN | 0°C to +70°C    | 18 Plastic DIP |
| MAX384CWN | 0°C to +70°C    | 18 Wide SO     |
| MAX384C/D | 0°C to +70°C    | Dice*          |
| MAX384EPN | -40°C to +85°C  | 18 Plastic DIP |
| MAX384EWN | -40°C to +85°C  | 18 Wide SO     |
| MAX384EJN | -40°C to +85°C  | 18 CERDIP**    |
| MAX384MJN | -55°C to +125°C | 18 CERDIP**    |

\* Contact factory for dice specifications.

\*\* Contact factory for package availability.

## Chip Topographies



TRANSISTOR COUNT: 165  
SUBSTRATE CONNECTED TO V+

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

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