General Description

The MAX4638/MAX4639 are single 8:1 and dual 4:1 CMOS analog multiplexers/demultiplexers (muxes/demuxes). Each mux operates from a single +1.8V to +5V supply or dual ±2.5V supplies. These devices feature 3.5Ω on-resistance (Ron) when powered with a single +5V supply and have -75dB off-isolation and -85dB crosstalk from the output to each off channel. The switching times are 18ns tON and 7ns tOFF. They feature a -3dB 85MHz bandwidth and a guaranteed 0.25nA leakage current at +25°C.

A +1.8V to +5.5V operating range makes the MAX4638/MAX4639 ideal for battery-powered, portable instruments. All channels guarantee break-before-make switching. These parts feature bidirectional operation and can handle Rail-to-Rail® analog signals. All control inputs are TTL/CMOS-logic compatible. Decoding is in standard BCD format, and an enable input is provided to simplify cascading of devices. These devices are available in small 16-pin thin QFN, TSSOP, and SO packages, as well as a 20-pin thin QFN package.

Features

♦ Guaranteed Ron
  3.5Ω (+5V or ±2.5V Supplies)
  6Ω (+3V Supply)
♦ Guaranteed 0.4Ω Ron Match Between Channels
♦ Guaranteed 1Ω Ron Flatness Over Signal Range
♦ Guaranteed Low Leakage Currents
  0.25nA at +25°C
♦ Switching Times: tON = 18ns, tOFF = 7ns
♦ +1.8V to +5.5V Single-Supply Operation
♦ ±2.5V Dual-Supply Operation
♦ Rail-to-Rail Signal Handling
♦ TTL/CMOS-Logic Compatible
♦ Crosstalk: -80dB (1MHz)
♦ Off-Isolation: -60dB (10MHz)

Applications

Automatic Test Equipment
Low-Voltage Data-Acquisition Systems
Audio and Video Signal Routing
Medical Equipment
Battery-Powered Equipment
Relay Replacement

Ordering Information

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Ordering Information continued at end of data sheet.

Pin Configurations/Functional Diagrams

Rail-to-Rail is a registered trademark of Nippon Motorola, Ltd.

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim’s website at www.maxim-ic.com.
# 3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

## ABSOLUTE MAXIMUM RATINGS
(Voltages Referenced to GND)
- $V_{+}$ to $V$ ................................................................................. $+6V$
- $V_{+}$, $A_{-}$, $EN$ ........................................................................ $-0.3V$ to $+6V$
- $V_{-}$ .......................................................................................... $+0.3V$ to $-6V$
- $NO_{-}$, $COM_{-}$ (Note 1) ................................... $-0.3V$ to $(V_{+} + 0.3V)$
- Continuous Current $A_{-}$, $EN$ ............................................. $±30mA$
- Continuous Current $NO_{-}$, $COM_{-}$ .................................. $±100mA$
- Peak Current ($NO_{-}$, $COM_{-}$) (pulsed at 1ms, 10% duty cycle) .................. $±200mA$

### Continuous Power Dissipation ($T_A = +70°C$)
- 16-Pin Thin QFN (derate $16.9mW/^°C$ above $+70°C$) .................. $1349mW$
- 16-Pin TSSOP (derate $8.7mW/^°C$ above $+70°C$) ............... $696mW$
- 20-Pin Thin QFN (derate $16.9mW/^°C$ above $+70°C$) ............... $1349mW$

### Operating Temperature Range
- MAX4638_E, E ................................................ $-40°$ to $+85°$
- Junction Temperature .......................................................... $+150°$
- Storage Temperature Range ........................................... $-65°$ to $+150°$
- Lead Temperature (soldering, 10s) ................................ $+300°$

### Note 1:
Signals on $COM_{-}$, $NO_{-}$ exceeding $V_{+}$ or $V_{-}$ are clamped by internal diodes. $A_{-}$ and $EN$ are clamped only to $V_{-}$ and can exceed $V_{+}$ up to their maximum ratings. Limit forward-diode current to maximum current rating.

### 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—+5V Single Supply
($V_{+}$ = $+5V \pm 10\%$, $V_{-}$ = 0, $V_{IH} = +2.4V$, $V_{IL} = +0.8V$, $T_A = T_{MIN}$ to $T_{MAX}$, unless otherwise noted. Typical values are at $T_A = +25°C$) (Note 9)

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<td>$T_A = +25°C$</td>
<td>0</td>
<td>$V_{+}$</td>
<td>$V$</td>
</tr>
<tr>
<td>On-Resistance</td>
<td>$R_{ON}$</td>
<td>$V_{+} = +4.5V$, $I_{COM_{-}} = 10mA$, $V_{NO_{-}} = +3.5V$</td>
<td>$T_A = T_{MIN}$ to $T_{MAX}$</td>
<td>2.5</td>
<td>3.5</td>
<td>$Ω$</td>
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<tr>
<td>On-Resistance Match Between Channels (Notes 3, 8)</td>
<td>$ΔR_{ON}$</td>
<td>$V_{+} = +4.5V$, $I_{COM_{-}} = 10mA$, $V_{NO_{-}} = +3.5V$</td>
<td>$T_A = T_{MIN}$ to $T_{MAX}$</td>
<td>0.1</td>
<td>0.4</td>
<td>$Ω$</td>
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<tr>
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<td>$R_{FLAT(ON)}$</td>
<td>$V_{+} = +4.5V$, $I_{COM_{-}} = 10mA$, $V_{NO_{-}} = +1V$, $+2V$, $+3.5V$</td>
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<td>0.75</td>
<td>1</td>
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<tr>
<td>NO$_{-}$ Off-Leakage Current (Note 5)</td>
<td>$I_{NO_{-(OFF)}}$</td>
<td>$V_{+} = +5.5V$, $V_{COM_{-}} = +1V$, $+4.5V$, $V_{NO_{-}} = +4.5V$, $+1V$</td>
<td>$T_A = T_{MIN}$ to $T_{MAX}$</td>
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<td>$±0.01$</td>
<td>$0.25$</td>
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<tr>
<td>COM$_{-}$ Off-Leakage Current (Note 5)</td>
<td>$I_{COM_{-(OFF)}}$</td>
<td>$V_{+} = +5.5V$, $V_{COM_{-}} = +1V$, $+4.5V$, $V_{NO_{-}} = +4.5V$, $+1V$</td>
<td>$T_A = T_{MIN}$ to $T_{MAX}$</td>
<td>$-0.25$</td>
<td>$±0.01$</td>
<td>$0.25$</td>
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<tr>
<td>COM$_{-}$ On-Leakage Current (Note 5)</td>
<td>$I_{COM_{-(ON)}}$</td>
<td>$V_{+} = +5.5V$, $V_{COM_{-}} = +1V$, $+4.5V$, $V_{NO_{-}} = +1V$, $+4.5V$, or floating</td>
<td>$T_A = T_{MIN}$ to $T_{MAX}$</td>
<td>$-0.75$</td>
<td>$±0.01$</td>
<td>$0.75$</td>
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<tr>
<td>DIGITAL I/O</td>
<td>$V_{IH}$</td>
<td></td>
<td></td>
<td>2.4</td>
<td></td>
<td>$V$</td>
</tr>
<tr>
<td>Input Logic Low</td>
<td>$V_{IL}$</td>
<td></td>
<td></td>
<td>0.8</td>
<td></td>
<td>$V$</td>
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<td>Input Leakage Current</td>
<td>$I_{IH}, I_{IL}$</td>
<td>$V_{IN_{-}} = 0$ or $V_{+}$</td>
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<td></td>
<td>2</td>
<td></td>
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<tr>
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<td>$R_L = 100Ω$, $C_L = 25pF$, $V_{NO1} = +3V$ or 0, $V_{NOE} = 0$ or $+3V$, $V_{A0}$</td>
<td>$T_A = +25°C$</td>
<td>14</td>
<td>18</td>
<td>$ns$</td>
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MAXIM
### ELECTRICAL CHARACTERISTICS—+5V Single Supply (continued)

(V+ = +5V ±10%, V− = 0, VIL = +0.8V, VIL = +2.4V, T A = TMIN to TMAX, unless otherwise noted. Typical values are at T A = +25°C.) (Note 9)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
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<td></td>
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<tr>
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<td>RL = 100kΩ, CL = 35pF, VNO1 = +3V, VNO2 to VNO8 = 0, Figure 4</td>
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<td>14 18 ns</td>
<td></td>
</tr>
<tr>
<td>Enable Turn-Off Time (Note 5)</td>
<td>tOFF(EN)</td>
<td>RL = 100kΩ, CL = 35pF, VNO1 = +3V, VNO2 to VNO8 = 0, Figure 4</td>
<td>MAX4639 T A = +25°C</td>
<td>5  7 ns</td>
<td></td>
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<td>Signal = 0dBm, CL = 5pF, 50Ω in and out, Figure 6</td>
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<td>MAX4639 T A = +25°C</td>
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<td></td>
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<td>RL = 600Ω, RFLAT(ON)/RL</td>
<td>MAX4639 T A = +25°C</td>
<td>0.5 %</td>
<td></td>
</tr>
</tbody>
</table>

#### SUPPLY

| Positive Supply Current | I+ | V+ = +5.5V, VIN = 0 or V+ | 0.001 | 1.0 | μA |
# 3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

## ELECTRICAL CHARACTERISTICS—+3.0V Single Supply

(V+ = +2.7V to +3.3V, V- = 0, VIH = +2.0V, VIL = +0.4V, TA = TMIN to TMAX, unless otherwise noted. Typical values are at V+ = +3V and TA = +25°C.) (Note 9)

<table>
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<tr>
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<td></td>
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<td>RON</td>
<td>ICOM_ = 10mA, VNO_ = +1.7V</td>
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<td>6</td>
<td></td>
<td>Ω</td>
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<tr>
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<td>ICOM_ = 10mA, VNO_ = +1.7V</td>
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<td>0.6</td>
<td>0.8</td>
<td>Ω</td>
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<tr>
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<td>RFLAT(ON)</td>
<td>ICOM_ = 10mA, VNO_ = +1.7V, 1.9V</td>
<td>1</td>
<td>2</td>
<td></td>
<td>Ω</td>
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<tr>
<td>NO_ Off-Leakage Current (Note 5)</td>
<td>INO_(OFF)</td>
<td>V+ = +3.3V, VCOM_ = +1V, +3V; VNO_ = +3V, +1V</td>
<td>-0.25</td>
<td>±0.01</td>
<td>0.25</td>
<td>nA</td>
</tr>
<tr>
<td>COM_ Off-Leakage Current (Note 5)</td>
<td>ICOM_(OFF)</td>
<td>V+ = +3.3V, VCOM_ = +1V, +3V; VNO_ = +3V, +1V</td>
<td>-0.35</td>
<td>0.35</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>COM_ On-Leakage Current (Note 5)</td>
<td>ICOM_(ON)</td>
<td>V+ = +3.3V, VCOM_ = +1V, +3V; VNO_ = +1V, +3V, or floating</td>
<td>-0.35</td>
<td>0.35</td>
<td></td>
<td>nA</td>
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<td><strong>DIGITAL I/O</strong></td>
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<td>0.1</td>
<td>µA</td>
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<td>2</td>
<td></td>
<td></td>
<td>pF</td>
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<tr>
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<td></td>
<td>ns</td>
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<tr>
<td>Break-Before-Make (Note 5)</td>
<td>tBBM</td>
<td>VNNO_ = +2V, CL = 35pF, RL = 100Ω, Figure 3</td>
<td>8</td>
<td></td>
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<td>ns</td>
</tr>
<tr>
<td>Enable Turn-On Time (Note 5)</td>
<td>tON(EN)</td>
<td>VNNO_ = +2V, CL = 35pF, RL = 100Ω, Figure 4</td>
<td>15</td>
<td>20</td>
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<td>ns</td>
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<tr>
<td>Enable Turn-Off Time (Note 5)</td>
<td>tOFF(EN)</td>
<td>VNNO_ = +2V, CL = 35pF, RL = 100Ω, Figure 4</td>
<td>5</td>
<td>9</td>
<td></td>
<td>ns</td>
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</table>
### 3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

**ELECTRICAL CHARACTERISTICS—+3.0V Single Supply (continued)**

(V+ = +2.7V to +3.3V, V- = 0, VIH = +2.0V, VIL = +0.4V, TA = TMIN to TMAX, unless otherwise noted. Typical values are at V+ = +3V and TA = +25°C.) (Note 9)

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<td>dB</td>
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<td></td>
<td></td>
<td>CL = 5pF, RL = 50Ω, f = 1MHz, VNO = ±1Vrms, Figure 6</td>
<td>TA = +25°C</td>
<td>-75</td>
<td>dB</td>
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<tr>
<td>Crosstalk (Note 7)</td>
<td>VCT</td>
<td>CL = 5pF, RL = 50Ω, f = 1MHz, VNO = ±1Vrms, Figure 6</td>
<td>TA = +25°C</td>
<td>-65</td>
<td>dB</td>
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<tr>
<td></td>
<td></td>
<td>CL = 5pF, RL = 50Ω, f = 1MHz, VNO = ±1Vrms, Figure 7</td>
<td>TA = +25°C</td>
<td>-85</td>
<td>dB</td>
<td></td>
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<td>On-Channel -3dB Bandwidth</td>
<td>BW</td>
<td>Signal = 0dBm, 50Ω in and out, Figure 6</td>
<td>MAX4638</td>
<td>TA = +25°C</td>
<td>50</td>
<td>MHz</td>
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<td>MAX4639</td>
<td>TA = +25°C</td>
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<td>MHz</td>
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<tr>
<td>NO_ Off-Capacitance</td>
<td>CNO_(OFF)</td>
<td>VNO_ = 0V, f = 1MHz, Figure 8</td>
<td>TA = +25°C</td>
<td>9</td>
<td>pF</td>
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<tr>
<td>COM_ Off-Capacitance</td>
<td>CCOM_(OFF)</td>
<td>VCOM_ = 0V, f = 1MHz, Figure 8</td>
<td>MAX4638</td>
<td>TA = +25°C</td>
<td>40</td>
<td>pF</td>
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<td>MAX4639</td>
<td>TA = +25°C</td>
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<td>pF</td>
<td></td>
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<tr>
<td>Switch On-Capacitance</td>
<td>C_(ON)</td>
<td>VCOM = VNO_ = 0V, f = 1MHz, Figure 8</td>
<td>MAX4638</td>
<td>TA = +25°C</td>
<td>54</td>
<td>pF</td>
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<tr>
<td></td>
<td></td>
<td>MAX4639</td>
<td>TA = +25°C</td>
<td>34</td>
<td>pF</td>
<td></td>
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</tbody>
</table>

**SUPPLY**

| Positive Supply Current | I+ | V+ = +3.3V, VIN_ = 0 or V+ | 0.001 | 1 | μA |

**ELECTRICAL CHARACTERISTICS—±2.5V Dual Supplies**

(V+ = ±2.5 ±10%, V- = -2.5 ±10%, VIH = +2.0V, VIL = +0.4V, TA = TMIN to TMAX, unless otherwise noted. Typical values are at V± = ±2.5V and TA = +25°C.)

<table>
<thead>
<tr>
<th>PARAMETER</th>
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<th>UNITS</th>
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<td>VCOM_, VNO_</td>
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<td>V</td>
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</tr>
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<td>On-Resistance</td>
<td>RON</td>
<td>ICOM_ = 10mA, VNO_ = ±1.5V, V+ = +2.25V, V- = -2.25V</td>
<td>TA = +25°C</td>
<td>2.5</td>
<td>3.5</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-Resistance Match Between Channels (Notes 3, 8)</td>
<td>ΔRON</td>
<td>ICOM_ = 10mA, VNO_ = ±1.5V, V+ = +2.25V, V- = -2.25V</td>
<td>TA = +25°C</td>
<td>0.2</td>
<td>0.4</td>
<td>Ω</td>
</tr>
<tr>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
### MAX4638/MAX4639

#### 3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

**ELECTRICAL CHARACTERISTICS—±2.5V Dual Supplies (continued)**

(V+ = +2.5 ±10%, V- = -2.5V ±10%, VIH = +2.0V, VIL = +0.4V, TA = T_MIN to T_MAX, unless otherwise noted. Typical values are at V± = ±2.5V and TA = +25°C.)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP (Note 2)</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Resistance Flatness (Note 4)</td>
<td>RFLAT(ON)</td>
<td>ICOM_, = 10mA; VNO_, = ±1.5V; V = +2.25V; V_- = -2.25V</td>
<td></td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TA = +25°C; TA = T_MIN to T_MAX</td>
<td></td>
<td>0.75</td>
<td>1</td>
<td></td>
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<tr>
<td>NO_ Off-Leakage Current (Note 5)</td>
<td>INO_(OFF)</td>
<td>V+ = +2.75V; V_- = -2.75V; VCOM_, = +1V, +2.5V; VNO_, = +2.5V, +1V</td>
<td></td>
<td></td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TA = +25°C; TA = T_MIN to T_MAX</td>
<td></td>
<td>-0.25</td>
<td>±0.01</td>
<td>0.25</td>
</tr>
<tr>
<td>COM_, Off-Leakage Current (Note 5)</td>
<td>ICOM_(OFF)</td>
<td>V+ = +2.75V; V_- = -2.75V; VCOM_, = +1V, +2.5V; VNO_, = +2.5V, +1V</td>
<td></td>
<td></td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TA = +25°C; TA = T_MIN to T_MAX</td>
<td></td>
<td>-0.25</td>
<td>±0.01</td>
<td>0.25</td>
</tr>
<tr>
<td>COM_, On-Leakage Current (Note 5)</td>
<td>ICOM_(ON)</td>
<td>V+ = +2.5V; V_- = -2.5V, +2V, +2.5V; VCOM_, = +1V, +2.5V; VNO_, = +1V, +2.5V or floating</td>
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<td></td>
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<td>nA</td>
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<tr>
<td></td>
<td></td>
<td>TA = +25°C; TA = T_MIN to T_MAX</td>
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<td>-0.25</td>
<td>±0.01</td>
<td>0.25</td>
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**DIGITAL I/O**

<table>
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<tr>
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<th>MAX</th>
<th>UNITS</th>
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</thead>
<tbody>
<tr>
<td>Input Logic High</td>
<td>VIH</td>
<td>V= 0 or V+</td>
<td>2.0</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Input Logic Low</td>
<td>VIL</td>
<td>V= +0.4V or +2.5V</td>
<td>0.4</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Input Leakage Current</td>
<td>IIH, IIL</td>
<td>V= 0 or V+</td>
<td>0.1</td>
<td>0.005</td>
<td>0.1</td>
<td>μA</td>
</tr>
<tr>
<td>Digital Input Capacitance</td>
<td>CIN</td>
<td>V= 0 or V+</td>
<td>2</td>
<td></td>
<td></td>
<td>pF</td>
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</table>

**DYNAMIC**

<table>
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<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>MIN</th>
<th>TYP (Note 2)</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition Time (Note 5)</td>
<td>tTRANS</td>
<td>VNO_, = +1.2V, CL = 35pF, RL = 100Ω, Figure 2</td>
<td></td>
<td>16</td>
<td>20</td>
<td>ns</td>
</tr>
<tr>
<td>Enable Turn-On Time (Note 5)</td>
<td>tON(EN)</td>
<td>VNO_, = +1.2V, CL = 35pF, RL = 100Ω, Figure 4</td>
<td></td>
<td>14</td>
<td>18</td>
<td>ns</td>
</tr>
<tr>
<td>Enable Turn-Off Time (Note 5)</td>
<td>tOFF(EN)</td>
<td>VNO_, = +1.2V, CL = 35pF, RL = 100Ω, Figure 4</td>
<td></td>
<td>5</td>
<td>7</td>
<td>ns</td>
</tr>
<tr>
<td>Break-Before-Make (Note 5)</td>
<td>tBBM</td>
<td>VNO_, = +1.2V, CL = 35pF, RL = 100Ω, Figure 3</td>
<td></td>
<td>8</td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

**Notes:**

- **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:** ∆RON = RON(MAX) - RON(MIN).
- **Note 4:** Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.
- **Note 5:** Guaranteed by design.
- **Note 6:** Off-Isolation = 20log10 (VCOM_/ VNO_), VCOM_ = output; VNO_ = input to off switch.
- **Note 7:** Between any two switches.
- **Note 8:** ∆RON matching specifications for thin QFN packaged parts are guaranteed by design.
- **Note 9:** Parts are tested at +85°C and guaranteed by design over the entire temperature range.
3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

Typical Operating Characteristics

(V+ = +5V, V− = 0, TA = +25°C, unless otherwise noted.)
3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

Typical Operating Characteristics (continued)

(V+ = +5V, V- = 0, TA = +25°C, unless otherwise noted.)

FREQUENCY RESPONSE

ON/OFF-LEAKAGE CURRENT vs. TEMPERATURE

TOTAL HARMONIC DISTORTION vs. FREQUENCY

Pin Description

<table>
<thead>
<tr>
<th>PIN</th>
<th>MAX4638 THIN QFN</th>
<th>MAX4639 THIN QFN</th>
<th>NAME</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIP/SO</td>
<td>16-PIN</td>
<td>20-PIN</td>
<td>DIP/SO</td>
<td>16-PIN</td>
</tr>
<tr>
<td>1, 15, 16</td>
<td>15, 14, 13</td>
<td>19, 18, 17</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1, 16</td>
<td>15, 14</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>1</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4–7</td>
<td>2–5</td>
<td>3–6</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>—</td>
<td>4–7</td>
<td>2–5</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>7</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>—</td>
<td>8, 9</td>
<td>6, 7</td>
</tr>
<tr>
<td>9–12</td>
<td>7–10</td>
<td>10–13</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>—</td>
<td>10–13</td>
<td>8–11</td>
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<td>15</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>—</td>
<td>8, 9, 16, 20</td>
<td>—</td>
</tr>
</tbody>
</table>
Detailed Description

The MAX4638/MAX4639 are low-voltage, CMOS analog muxes. The MAX4638 is an 8:1 mux that switches one of eight inputs (NO1–NO8) to a common output (COM) as determined by the 3-bit binary inputs A0, A1, and A2. The MAX4639 is a 4:1 dual mux that switches one of four differential inputs to a common differential output as determined by the 2-bit binary inputs A0 and A1. Both the MAX4638/MAX4639 have an EN input that can be used to enable or disable the device. When disabled, all channels are switched off. See Truth Tables.

Applications Information

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. If power-supply sequencing is not possible, add two small-signal diodes (D1, D2) in series with the supply pins for overvoltage protection (Figure 1). 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. Device operation is unchanged, and the difference between V+ and V- should not exceed 6V. These protection diodes are not recommended when using a single supply. For single-supply operation, V- should be connected to GND as close to the device as possible.

Ordering Information (continued)

<table>
<thead>
<tr>
<th>PART</th>
<th>TEMP RANGE</th>
<th>PIN-PACKAGE</th>
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</thead>
<tbody>
<tr>
<td>MAX4639ETE</td>
<td>-40°C to +85°C</td>
<td>16 Thin QFN (4 x 4)</td>
</tr>
<tr>
<td>MAX4639EUE</td>
<td>-40°C to +85°C</td>
<td>16 TSSOP</td>
</tr>
<tr>
<td>MAX4639ESE</td>
<td>-40°C to +85°C</td>
<td>16 SO</td>
</tr>
<tr>
<td>MAX4639ETP</td>
<td>-40°C to +85°C</td>
<td>20 Thin QFN (4 x 4)</td>
</tr>
</tbody>
</table>

Truth Tables

MAX4638 (Single 8-to-1 Mux)

<table>
<thead>
<tr>
<th>A2</th>
<th>A1</th>
<th>A0</th>
<th>EN</th>
<th>ON SWITCH</th>
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<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
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<td>1</td>
<td>NO1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>NO2</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>NO3</td>
</tr>
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<td>1</td>
<td>NO4</td>
</tr>
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<td>NO5</td>
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<td>1</td>
<td>NO6</td>
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<td>1</td>
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<td>0</td>
<td>1</td>
<td>NO7</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>NO8</td>
</tr>
</tbody>
</table>

MAX4639 (Dual 4-to-1 Mux)

<table>
<thead>
<tr>
<th>A1</th>
<th>A0</th>
<th>EN</th>
<th>COMA</th>
<th>COMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>0</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>NO1A</td>
<td>NO1B</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>NO2A</td>
<td>NO2B</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>NO3A</td>
<td>NO3B</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>NO4A</td>
<td>NO4B</td>
</tr>
</tbody>
</table>
3.5\(\Omega\), Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

Test Circuits/Timing Diagrams

Figure 2. Transition Time

Figure 3. MAX4638 Break-Before-Make Interval
3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

Test Circuits/Timing Diagrams (continued)

Figure 4. Enable Switching Time

Figure 5. Charge Injection

$\Delta V_{OUT}$ is the measured voltage due to charge transfer error $Q$ when the channel turns off.

$Q = \Delta V_{OUT} \times C_L$
3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

Test Circuits/Timing Diagrams (continued)

Figure 6. Off-Isolation/On-Channel Bandwidth

Figure 7. Crosstalk

Chip Information

TRANSISTOR COUNT: 632

Note: Exposed pad on thin QFN packages is connected to V-.
**MAX4638/MAX4639**

3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

**Pin Configurations (continued)**
3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

**Package Information**

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to www.maxim-ic.com/packages.)
3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to www.maxim-ic.com/packages.)

<table>
<thead>
<tr>
<th>COMMON DIMENSIONS</th>
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<tr>
<td><strong>PHC</strong></td>
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<tr>
<td>A</td>
</tr>
<tr>
<td>A1</td>
</tr>
<tr>
<td>AE</td>
</tr>
<tr>
<td>A2</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C1</td>
</tr>
<tr>
<td>C2</td>
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<tr>
<td>H</td>
</tr>
<tr>
<td>HD</td>
</tr>
<tr>
<td>HE</td>
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<table>
<thead>
<tr>
<th>EXPOSED PAD VARIATIONS</th>
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</tr>
<tr>
<td>1044-5</td>
</tr>
<tr>
<td>1044-6</td>
</tr>
</tbody>
</table>

NOTES:
1. DIMENSIONS & TOLERANCES CONFORM TO ASME B4.4.1M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. A IS THE TOTAL NUMBER OF TERMINALS.
4. THE TERMINAL 1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO IEC 607-0-1. TERMINAL 1 IDENTIFIER IS OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL 1 IDENTIFIER MAY BE EITHER A WINE OR IMPRESSED FEATURE.
5. DIMENSION A APPLIES TO TELLS DRIVER AND IS MEASURED BETWEEN 0.25 mm AND 0.5 mm FROM TERMINAL 3.
6. HD AND HE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. CONVEXITY IS POSSIBLE IN A SYMMETRIAL FASHION.
8. CONVEXITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINAL.
9. DRAWING CONFORMS TO JEDC MO22, EXCEPT FOR 1044-1, 1044-3 AND 1044-4.
3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

Package Information (continued)
(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to www.maxim-ic.com/packages.)

### Package Outline, .150" SOIC

![Package Outline Diagram]

#### DIMENSIONS

<table>
<thead>
<tr>
<th>INCHES</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIM MIN MAX</td>
<td>MIN MAX</td>
</tr>
<tr>
<td>A</td>
<td>0.053 0.069</td>
</tr>
<tr>
<td>A1</td>
<td>0.004 0.010</td>
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<tr>
<td>B</td>
<td>0.014 0.019</td>
</tr>
<tr>
<td>C</td>
<td>0.007 0.010</td>
</tr>
<tr>
<td>e</td>
<td>0.050 BSC</td>
</tr>
<tr>
<td>E</td>
<td>0.150 0.157</td>
</tr>
<tr>
<td>H</td>
<td>0.228 0.244</td>
</tr>
<tr>
<td>L</td>
<td>0.016 0.050</td>
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#### VARIATIONS:

<table>
<thead>
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<th>INCHES</th>
<th>MILLIMETERS</th>
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</thead>
<tbody>
<tr>
<td>DIM MIN MAX</td>
<td>MIN MAX N</td>
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<tr>
<td>D</td>
<td>0.189 0.197</td>
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<tr>
<td>D</td>
<td>0.337 0.344</td>
</tr>
<tr>
<td>D</td>
<td>0.386 0.394</td>
</tr>
</tbody>
</table>

#### NOTES:

1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. LEADS TO BE COPLANAR WITHIN 0.10mm (.004").
4. CONTROLLING DIMENSION: MILLIMETERS.
5. MEETS JEDEC MS012.
6. N = NUMBER OF PINS.

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