



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

## 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 (R<sub>ON</sub>) when powered with a single +5V supply and have -75dB of off-isolation and -85dB crosstalk from the output to each off channel. The switching times are 18ns t<sub>ON</sub> and 7ns t<sub>OFF</sub>. 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 QFN, TSSOP and SOIC packages, as well as a 20-pin QFN package.

## Applications

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

## Features

- ◆ **Guaranteed R<sub>ON</sub>**  
3.5Ω (+5V or ±2.5V Supplies)  
6Ω (+3V Supply)
- ◆ **Guaranteed 0.4Ω R<sub>ON</sub> Match Between Channels**
- ◆ **Guaranteed 1Ω R<sub>ON</sub> Flatness Over Signal Range**
- ◆ **Guaranteed Low Leakage Currents**  
0.25nA at +25°C
- ◆ **Switching Times: t<sub>ON</sub> = 18ns, t<sub>OFF</sub> = 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)**

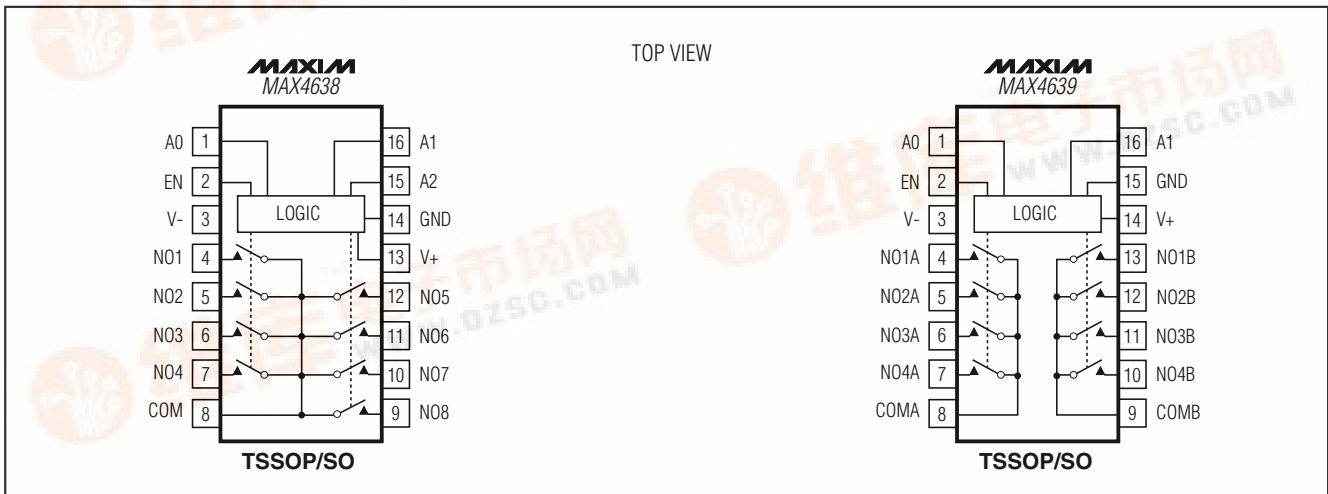
MAX4638/MAX4639

## Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX4638EGE	-40°C to +85°C	16 QFN (4 x 4)
MAX4638EUE	-40°C to +85°C	16 TSSOP
MAX4638ESE	-40°C to +85°C	16 SO
MAX4638EGP	-40°C to +85°C	20 QFN (4 x 4)

Ordering Information continued at end of data sheet.

## Pin Configurations/Functional Diagrams



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## 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_ (Note1)	-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<sub>A</sub> = +70°C)

16-Pin QFN (derate 18.5mW/°C above +70°C)	1481mW
16-Pin TSSOP (derate 5.7mW/°C above +70°C)	457mW
16-Pin SO (derate 8.70mW/°C above +70°C)	696mW
20-Pin QFN (derate 20mW/°C above +70°C)	1600mW
Operating Temperature Range	
MAX463_E_E	-40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C

**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 ±10%, V- = 0, V<sub>IH</sub> = +2.4V, V<sub>IL</sub> = +0.8V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP (Note 2)	MAX	UNITS
<b>ANALOG SWITCH</b>						
Analog Signal Range	V <sub>COM_</sub> , V <sub>NO_</sub>		0		V+	V
On-Resistance	R <sub>ON</sub>	V+ = +4.5V, I <sub>COM_</sub> = 10mA, V <sub>NO_</sub> = +3.5V		2.5	3.5	Ω
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			4.5	
On-Resistance Match Between Channels (Notes 3, 8)	ΔR <sub>ON</sub>	V+ = +4.5V, I <sub>COM_</sub> = 10mA, V <sub>NO_</sub> = +3.5V		0.1	0.4	Ω
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			0.5	
On-Resistance Flatness (Note 4)	R <sub>FLAT(ON)</sub>	V+ = +4.5V; I <sub>COM_</sub> = 10mA; V <sub>NO_</sub> = +1V, +2V, +3.5V		0.75	1	Ω
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			1.2	
NO_ Off-Leakage Current (Note 5)	I <sub>NO_(OFF)</sub>	V+ = +5.5V; V <sub>COM_</sub> = +1V, +4.5V; V <sub>NO_</sub> = +4.5V, +1V		-0.25	±0.01 0.25	nA
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		-0.35	0.35	
COM_ Off-Leakage Current (Note 5)	I <sub>COM_(OFF)</sub>	V+ = +5.5V; V <sub>COM_</sub> = +1V, +4.5V; V <sub>NO_</sub> = +4.5V, +1V		-0.25	±0.01 0.25	nA
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		-0.75	0.75	
COM_ On-Leakage Current (Note 5)	I <sub>COM_(ON)</sub>	V+ = +5.5V; V <sub>COM_</sub> = +1V, +4.5V; V <sub>NO_</sub> = +1V, +4.5V, or floating		-0.25	±0.01 0.25	nA
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		-0.75	0.75	
<b>DIGITAL I/O</b>						
Input Logic High	V <sub>IH</sub>		2.4			V
Input Logic Low	V <sub>IL</sub>				0.8	V
Input Leakage Current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>IN</sub> = 0 or V+	-0.1	0.005	0.1	μA
Digital Input Capacitance	C <sub>IN</sub>			2		pF
<b>DYNAMIC</b>						
Transition Time (Note 5)	t <sub>TRANS</sub>	R <sub>L</sub> = 100Ω, C <sub>L</sub> = 35pF, V <sub>NO1</sub> = +3V or 0, V <sub>NO8</sub> = 0 or +3V, Figure 2		14	18	ns
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			20	

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

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

(V<sub>+</sub> = +5V ±10%, V<sub>-</sub> = 0, V<sub>IH</sub> = +2.4V, V<sub>IL</sub> = +0.8V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
Break-Before-Make (Note 5)	t <sub>BBM</sub>	R <sub>L</sub> = 100Ω, C <sub>L</sub> = 35pF, V <sub>NO-</sub> = +3V, Figure 3	T <sub>A</sub> = +25°C	8		ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	1			
Enable Turn-On Time (Note 5)	t <sub>ON(EN)</sub>	R <sub>L</sub> = 100Ω, C <sub>L</sub> = 35pF, V <sub>NO1</sub> = +3V, V <sub>NO2</sub> to V <sub>NO8</sub> = 0, Figure 4	T <sub>A</sub> = +25°C	14	18	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	20			
Enable Turn-Off Time (Note 5)	t <sub>OFF(EN)</sub>	R <sub>L</sub> = 100Ω, C <sub>L</sub> = 35pF, V <sub>NO1</sub> = +3V, V <sub>NO2</sub> to V <sub>NO8</sub> = 0, Figure 4	T <sub>A</sub> = +25°C	5	7	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	8			
On-Channel -3dB Bandwidth	BW	Signal = 0dBm, C <sub>L</sub> = 5pF, 50Ω in and out, Figure 6	MAX4638 T <sub>A</sub> = +25°C	50		MHz	
			MAX4639 T <sub>A</sub> = +25°C	85			
Charge Injection	Q	V <sub>GEN</sub> = +2.5V, R <sub>GEN</sub> = 0, C <sub>L</sub> = 1.0nF, Figure 5	T <sub>A</sub> = +25°C	13		pC	
NO <sub>-</sub> Off-Capacitance	C <sub>NO(OFF)</sub>	V <sub>NO-</sub> = 0V, f = 1MHz, Figure 8	T <sub>A</sub> = +25°C	9		pF	
COM <sub>-</sub> Off-Capacitance	C <sub>COM(OFF)</sub>	V <sub>COM-</sub> = 0V, f = 1MHz, Figure 8	MAX4638 T <sub>A</sub> = +25°C	40		pF	
			MAX4639 T <sub>A</sub> = +25°C	20			
Switch On-Capacitance	C <sub>(ON)</sub>	V <sub>COM-</sub> = V <sub>NO-</sub> = 0V, f = 1MHz, Figure 8	MAX4638 T <sub>A</sub> = +25°C	54		pF	
			MAX4639 T <sub>A</sub> = +25°C	34			
Off-Isolation (Note 6)	V <sub>ISO</sub>	C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 1MHz, V <sub>NO-</sub> = 1V <sub>RMS</sub> , Figure 6	T <sub>A</sub> = +25°C	-55		dB	
		C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 10MHz, V <sub>NO-</sub> = 1V <sub>RMS</sub> , Figure 6	T <sub>A</sub> = +25°C	-75			
Crosstalk (Note 7)	V <sub>CT</sub>	C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 10MHz, V <sub>NO-</sub> = 1V <sub>RMS</sub> , Figure 7	T <sub>A</sub> = +25°C	-65		dB	
		C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 1MHz, V <sub>NO-</sub> = 1V <sub>RMS</sub> , Figure 7	T <sub>A</sub> = +25°C	-85			
Total Harmonic Distortion	THD	R <sub>L</sub> = 600Ω, R <sub>FLAT(ON)/R<sub>L</sub></sub>	T <sub>A</sub> = +25°C	0.5		%	
<b>SUPPLY</b>							
Positive Supply Current	I <sub>+</sub>	V <sub>+</sub> = +5.5V, V <sub>IN</sub> = 0 or V <sub>+</sub>		0.001	1.0	μA	

**MAX4638/MAX4639**

## 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, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at V+ = +3V and T<sub>A</sub> = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP (Note 2)	MAX	UNITS	
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>COM_</sub> , V <sub>NO_</sub>		0		V+	V	
On-Resistance	R <sub>ON</sub>	I <sub>COM_</sub> = 10mA, V <sub>NO_</sub> = +1.7V	T <sub>A</sub> = +25°C	4.5	6	Ω	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		8		
On-Resistance Match Between Channels (Notes 3, 8)	ΔR <sub>ON</sub>	I <sub>COM_</sub> = 10mA, V <sub>NO_</sub> = +1.7V	T <sub>A</sub> = +25°C	0.25	0.6	Ω	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		0.8		
On-Resistance Flatness (Note 4)	R <sub>FLAT(ON)</sub>	I <sub>COM_</sub> = 10mA; V <sub>NO_</sub> = +1.5V, +1.7V, +1.9V	T <sub>A</sub> = +25°C	1	2	Ω	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		2.5		
NO_ Off-Leakage Current (Note 5)	I <sub>NO_(OFF)</sub>	V+ = +3.3V; V <sub>COM_</sub> = +1V, +3V; V <sub>NO_</sub> = +3V, +1V	T <sub>A</sub> = +25°C	-0.25	±0.01	0.25	nA
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-0.35		0.35	
COM_ Off-Leakage Current (Note 5)	I <sub>COM_(OFF)</sub>	V+ = +3.3V; V <sub>COM_</sub> = +1V, +3V; V <sub>NO_</sub> = +3V, +1V	T <sub>A</sub> = +25°C	-0.25	±0.01	0.25	nA
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-0.35		0.35	
COM_ On-Leakage Current (Note 5)	I <sub>COM_(ON)</sub>	V+ = +3.3V; V <sub>COM_</sub> = +1V, +3V; V <sub>NO_</sub> = +1V, +3V, or floating	T <sub>A</sub> = +25°C	-0.25	±0.01	0.25	nA
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-0.35		0.35	
<b>DIGITAL I/O</b>							
Input Logic High	V <sub>IH</sub>		2.0			V	
Input Logic Low	V <sub>IL</sub>				0.4	V	
Input Leakage Current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>IN_</sub> = 0 or V+	-0.1	0.005	0.1	μA	
Digital Input Capacitance	C <sub>IN</sub>			2		pF	
<b>DYNAMIC</b>							
Transition Time (Note 5)	t <sub>TRANS</sub>	V <sub>NO_</sub> = +2V, C <sub>L</sub> = 35pF, R <sub>L</sub> = 100Ω, Figure 2	T <sub>A</sub> = +25°C	16	20	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		24		
Break-Before-Make (Note 5)	t <sub>BBM</sub>	V <sub>NO_</sub> = +2V, C <sub>L</sub> = 35pF, R <sub>L</sub> = 100Ω, Figure 3	T <sub>A</sub> = +25°C	8		ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	1			
Enable Turn-On Time (Note 5)	t <sub>ON(EN)</sub>	V <sub>NO_</sub> = +2V, C <sub>L</sub> = 35pF, R <sub>L</sub> = 100Ω, Figure 4	T <sub>A</sub> = +25°C	15	20	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		24		
Enable Turn-Off Time (Note 5)	t <sub>OFF(EN)</sub>	V <sub>NO_</sub> = +2V, C <sub>L</sub> = 35pF, R <sub>L</sub> = 100Ω, Figure 4	T <sub>A</sub> = +25°C	5	9	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		10		

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**MAX4638/MAX4639**

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

(V+ = +2.7V to +3.3V, V- = 0, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at V+ = +3V and T<sub>A</sub> = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
Off-Isolation (Note 6)	V <sub>ISO</sub>	C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 10MHz, V <sub>NO-</sub> = +1V <sub>RMS</sub> , Figure 6	T <sub>A</sub> = +25°C		55		dB
		C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 1MHz, V <sub>NO-</sub> = 1V <sub>RMS</sub> , Figure 6	T <sub>A</sub> = +25°C		-75		
Crosstalk (Note 7)	V <sub>CT</sub>	C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 10MHz, V <sub>NO-</sub> = 1V <sub>RMS</sub> , Figure 7	T <sub>A</sub> = +25°C		-65		dB
		C <sub>L</sub> = 5pF, R <sub>L</sub> = 50Ω, f = 1MHz, V <sub>NO-</sub> = 1V <sub>RMS</sub> , Figure 7	T <sub>A</sub> = +25°C		-85		
On-Channel -3dB Bandwidth	BW	Signal = 0dBm, 50Ω in and out, Figure 6	MAX4638	T <sub>A</sub> = +25°C		50	MHz
			MAX4639	T <sub>A</sub> = +25°C		85	
NO <sub>-</sub> Off-Capacitance	C <sub>NO-(OFF)</sub>	V <sub>NO-</sub> = 0V, f = 1MHz, Figure 8	T <sub>A</sub> = +25°C		9		pF
COM <sub>-</sub> Off-Capacitance	C <sub>COM-(OFF)</sub>	V <sub>COM-</sub> = 0V, f = 1MHz, Figure 8	MAX4638	T <sub>A</sub> = +25°C		40	pF
			MAX4639	T <sub>A</sub> = +25°C		20	
Switch On-Capacitance	C <sub>(ON)</sub>	V <sub>COM-</sub> = V <sub>NO-</sub> = 0V, f = 1MHz, Figure 8	MAX4638	T <sub>A</sub> = +25°C		54	pF
			MAX4639	T <sub>A</sub> = +25°C		34	
<b>SUPPLY</b>							
Positive Supply Current	I+	V+ = +3.3V, V <sub>IN-</sub> = 0 or V+			0.001	1	μA

### ELECTRICAL CHARACTERISTICS—±2.5V Dual Supplies

(V+ = +2.5 ±10%, V- = -2.5V ±10%, V<sub>IH</sub> = +2.0V, V<sub>IL</sub> = +0.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at V± = ±2.5V and T<sub>A</sub> = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>COM-</sub> , V <sub>NO-</sub>			V-		V+	V
On-Resistance	R <sub>ON</sub>	I <sub>COM-</sub> = 10mA, V <sub>NO-</sub> = ±1.5V, V+ = +2.25V, V- = -2.25V	T <sub>A</sub> = +25°C		2.5	3.5	Ω
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			4.5	
On-Resistance Match Between Channels (Notes 3, 8)	ΔR <sub>ON</sub>	I <sub>COM-</sub> = 10mA, V <sub>NO-</sub> = ±1.5V, V+ = +2.25V, V- = -2.25V	T <sub>A</sub> = +25°C		0.2	0.4	Ω
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			0.5	

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

(V+ = +2.5 ±10%, V- = -2.5V ±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.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP (Note 2)	MAX	UNITS	
On-Resistance Flatness (Note 4)	R <sub>FLAT(ON)</sub>	I <sub>COM</sub> = 10mA; V <sub>NO</sub> = ±1.5V, 0; V+ = +2.25V; V- = -2.25V	TA = +25°C	0.75	1	Ω	
			TA = TMIN to TMAX		1.2		
NO <sub>-</sub> Off-Leakage Current (Note 5)	I <sub>NO</sub> (OFF)	V+ = +2.75V; V- = -2.75V; V <sub>COM</sub> = +1V, +2.5V; V <sub>NO</sub> = +2.5V, +1V	TA = +25°C	-0.25	±0.01	0.25	nA
			TA = TMIN to TMAX	-0.35		0.35	
COM <sub>-</sub> Off-Leakage Current (Note 5)	I <sub>COM</sub> (OFF)	V+ = +2.75V; V- = -2.75V; V <sub>COM</sub> = +1V, +2.5V; V <sub>NO</sub> = +2.5V, +1V	TA = +25°C	-0.25	±0.01	0.25	nA
			TA = TMIN to TMAX	-0.35		0.35	
COM <sub>-</sub> On-Leakage Current (Note 5)	I <sub>COM</sub> (ON)	V+ = +2.5V; V- = -2.5V; V <sub>COM</sub> = +1V, +2.5V; V <sub>NO</sub> = +1V, +2.5V, or floating	TA = +25°C	-0.25	±0.01	0.25	nA
			TA = TMIN to TMAX	-0.35		0.35	
<b>DIGITAL I/O</b>							
Input Logic High	VIH		2.0			V	
Input Logic Low	VIL				0.4	V	
Input Leakage Current	I <sub>IH</sub> , I <sub>IL</sub>	V <sub>IN</sub> = 0 or V+	-0.1	0.005	0.1	μA	
Digital Input Capacitance	C <sub>IN</sub>			2		pF	
<b>DYNAMIC</b>							
Transition Time (Note 5)	t <sub>TRANS</sub>	V <sub>NO</sub> = +1.2V, C <sub>L</sub> = 35pF, R <sub>L</sub> = 100Ω, Figure 2	TA = +25°C	16	20	ns	
			TA = TMIN to TMAX		24		
Enable Turn-On Time (Note 5)	t <sub>ON(EN)</sub>	V <sub>NO</sub> = +1.2V, C <sub>L</sub> = 35pF, R <sub>L</sub> = 100Ω, Figure 4	TA = +25°C	14	18	ns	
			TA = TMIN to TMAX		20		
Enable Turn-Off Time (Note 5)	t <sub>OFF(EN)</sub>	V <sub>NO</sub> = +1.2V, C <sub>L</sub> = 35pF, R <sub>L</sub> = 100Ω, Figure 4	TA = +25°C	5	7	ns	
			TA = TMIN to TMAX		8		
Break-Before-Make (Note 5)	t <sub>BBM</sub>	V <sub>NO</sub> = +1.2V, C <sub>L</sub> = 35pF, R <sub>L</sub> = 100Ω, Figure 3	TA = +25°C	8		ns	
			TA = TMIN to TMAX	1			

**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:**  $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ .

**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 =  $20 \log_{10} (V_{COM} / V_{NO})$ , V<sub>COM</sub> = output, V<sub>NO</sub> = input to off switch.

**Note 7:** Between any two switches.

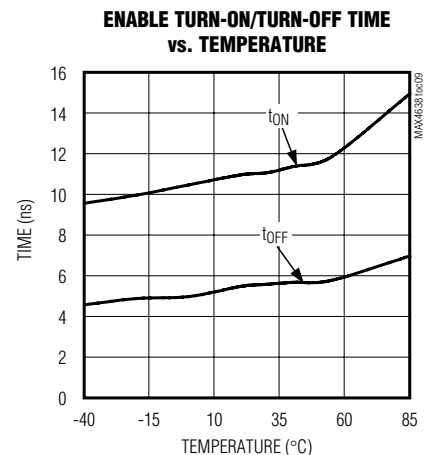
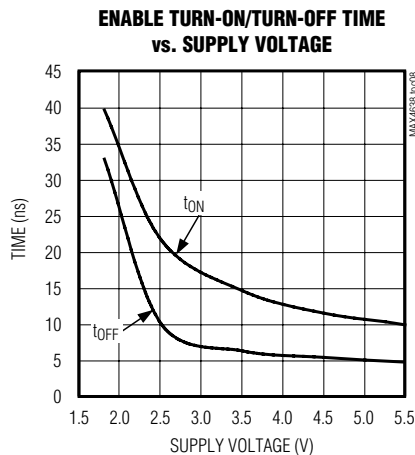
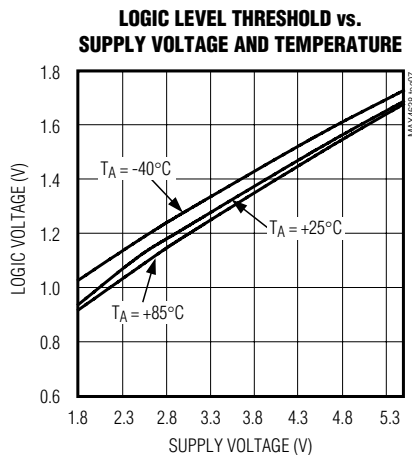
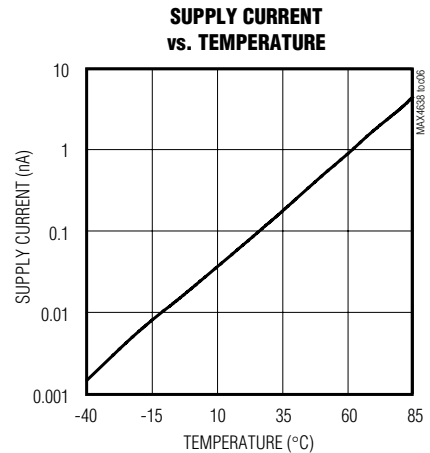
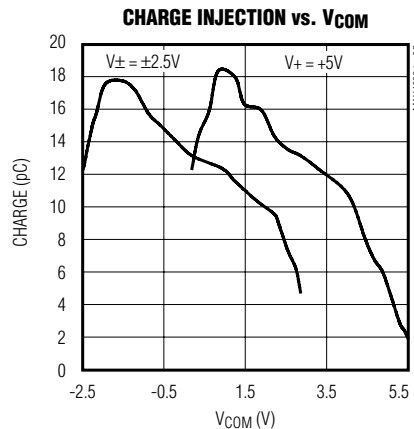
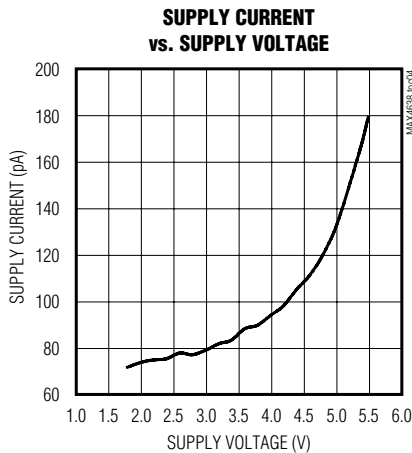
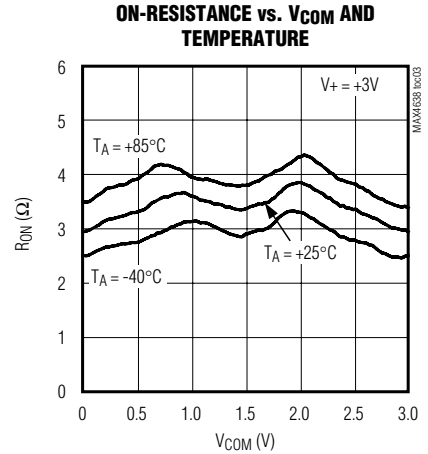
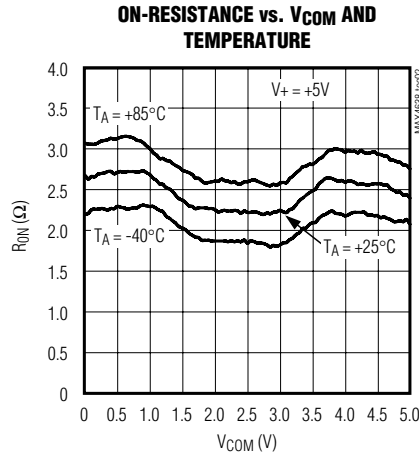
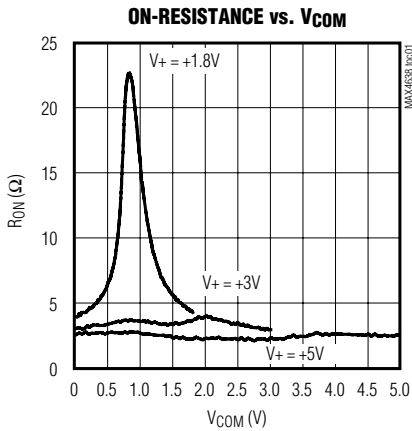
**Note 8:**  $\Delta R_{ON}$  matching specifications for QFN packaged parts are guaranteed by design.

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

## Typical Operating Characteristics

(V+ = +5V, V- = 0, T<sub>A</sub> = +25°C, unless otherwise noted.)

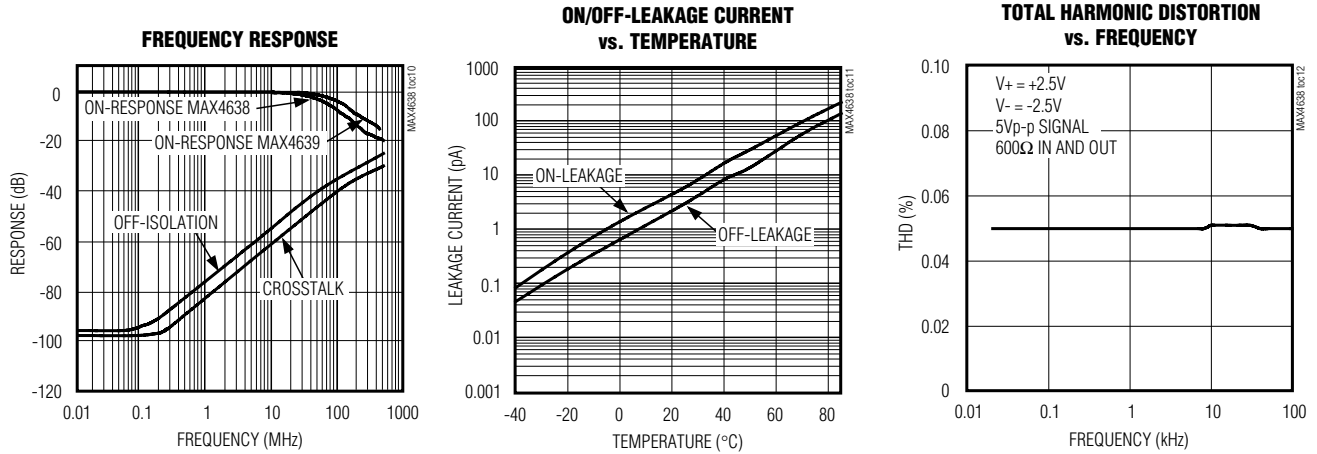
MAX4638/MAX4639



# 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.)



## Pin Description

PIN						NAME	FUNCTION
MAX4638			MAX4639				
DIP/SO	QFN		DIP/SO	QFN			
	16-PIN	20-PIN		16-PIN	20-PIN		
1, 15, 16	15, 14, 13	19, 18, 17	—	—	—	A0, A2, A1	Address Inputs
—	—	—	1, 16	15, 14	19, 17	A0, A1	Address Inputs
2	16	1	2	16	1	EN	Enable
3	1	2	3	1	2	V-	Negative-Supply Voltage Input
4-7	2-5	3-6	—	—	—	NO1-N04	Bidirectional Analog Inputs
—	—	—	4-7	2-5	3-6	NO1A-N04A	Bidirectional Analog Inputs
8	6	7	—	—	—	COM	Bidirectional Analog outputs
—	—	—	8, 9	6, 7	7, 9	COMA, COMB	Bidirectional Analog outputs
9-12	7-10	10-13	—	—	—	NO8-NO5	Bidirectional Analog Inputs
—	—	—	10-13	8-11	10-13	NO4B-NO1B	Bidirectional Analog Inputs
13	11	14	14	12	14	V+	Positive-Supply Voltage Input
14	12	15	15	13	15	GND	Ground
—	—	8, 9, 16, 20	—	—	8, 16, 18, 20	N.C.	No Connection



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

## 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.

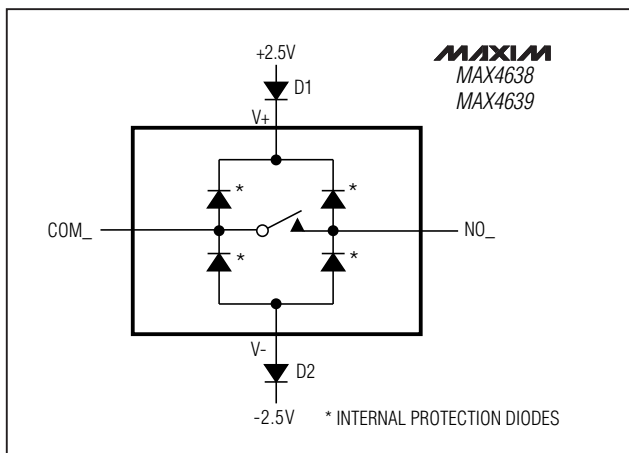


Figure 1. Overvoltage Protection Using External Blocking Diodes

## Ordering Information (continued)

PART	TEMP RANGE	PIN-PACKAGE
MAX4639EGE	-40°C to +85°C	16 QFN (4 x 4)
MAX4639EUE	-40°C to +85°C	16 TSSOP
MAX4639ESE	-40°C to +85°C	16 SO
MAX4639EGP	-40°C to +85°C	20 QFN (4 x 4)

## Truth Tables

### MAX4638 (Single 8-to-1 Mux)

A2	A1	A0	EN	ON SWITCH
X	X	X	0	None
0	0	0	1	NO1
0	0	1	1	NO2
0	1	0	1	NO3
0	1	1	1	NO4
1	0	0	1	NO5
1	0	1	1	NO6
1	1	0	1	NO7
1	1	1	1	NO8

### MAX4639 (Dual 4-to-1 Mux)

A1	A0	EN	COMA	COMB
X	X	0	None	None
0	0	1	NO1A	NO1B
0	1	1	NO2A	NO2B
1	0	1	NO3A	NO3B
1	1	1	NO4A	NO4B

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

## Test Circuits/Timing Diagrams

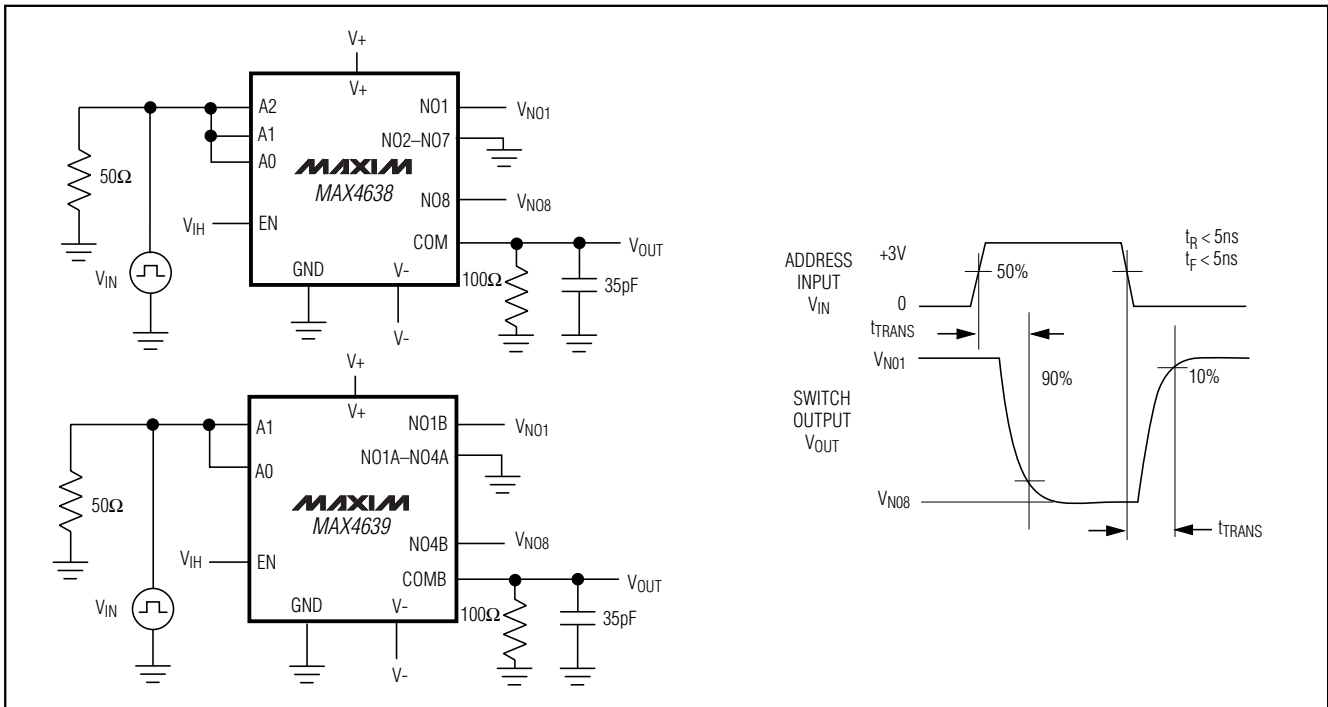


Figure 2. Transition Time

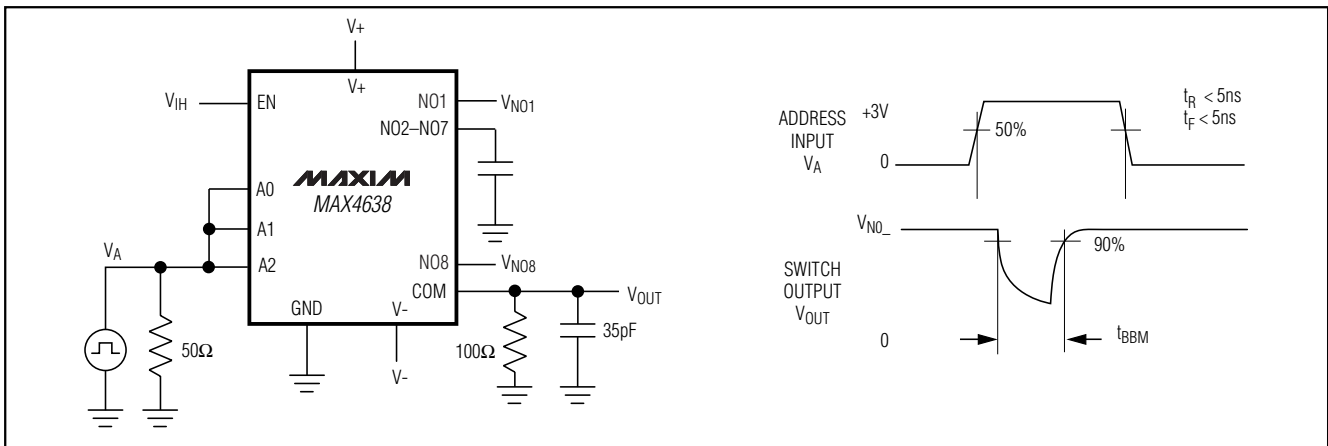


Figure 3. MAX4638 Break-Before-Make Interval

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

## Test Circuits/Timing Diagrams (continued)

MAX4638/MAX4639

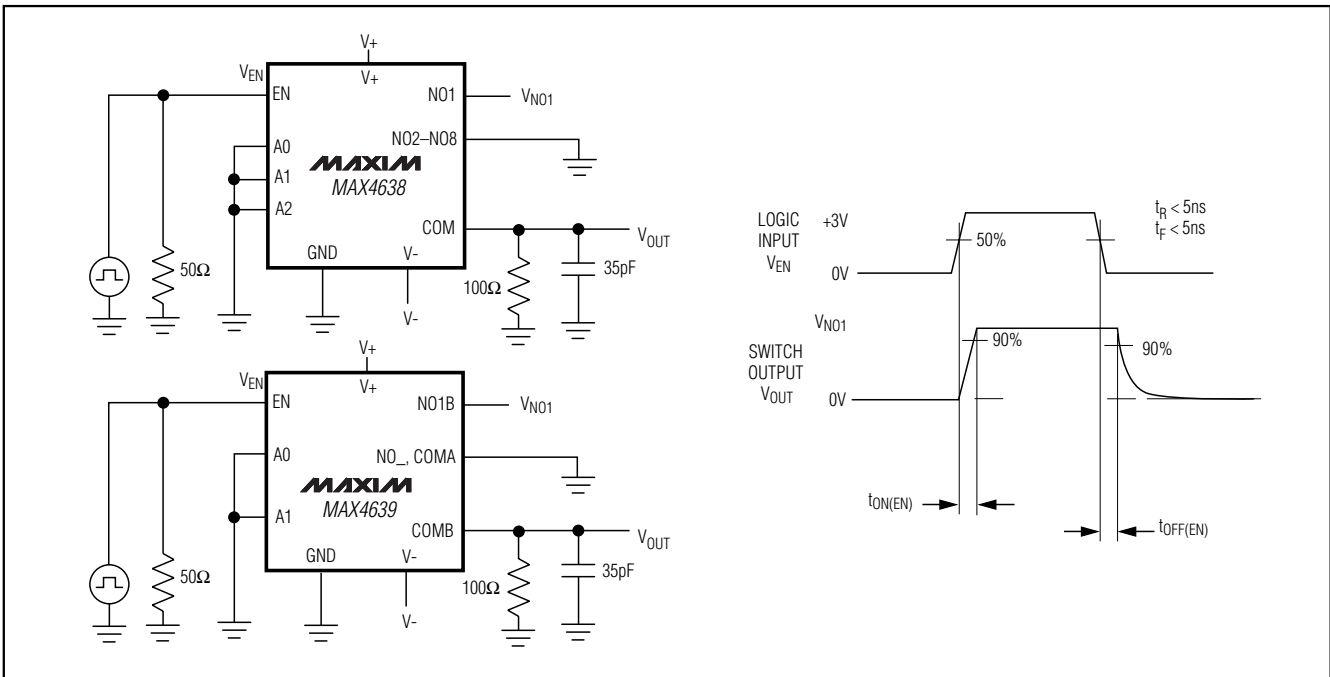


Figure 4. Enable Switching Time

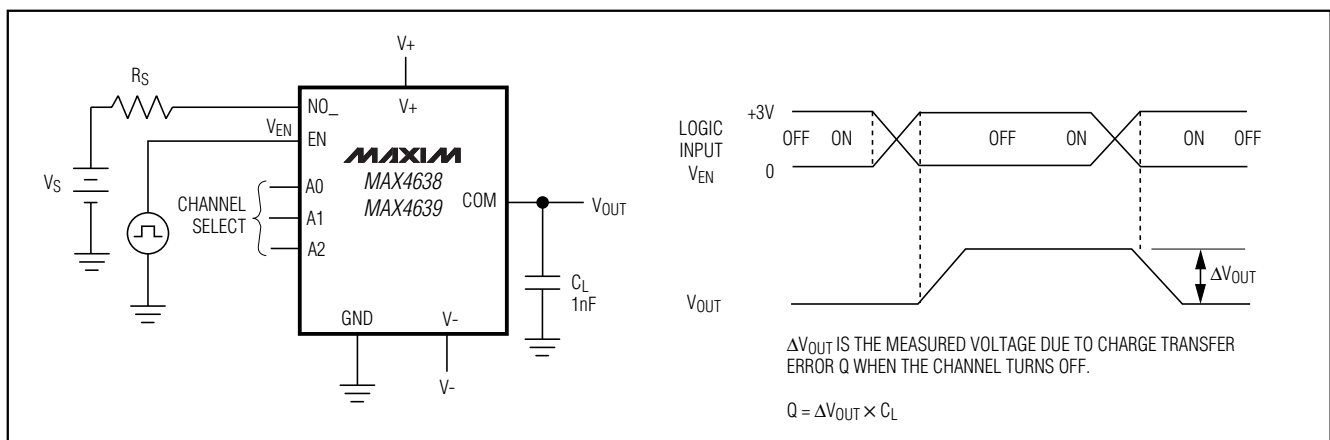


Figure 5. Charge Injection

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

## Test Circuits/Timing Diagrams (continued)

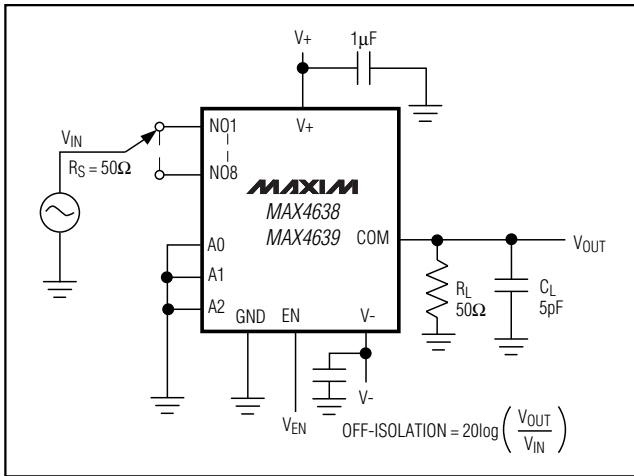


Figure 6. Off-Isolation/On-Channel Bandwidth

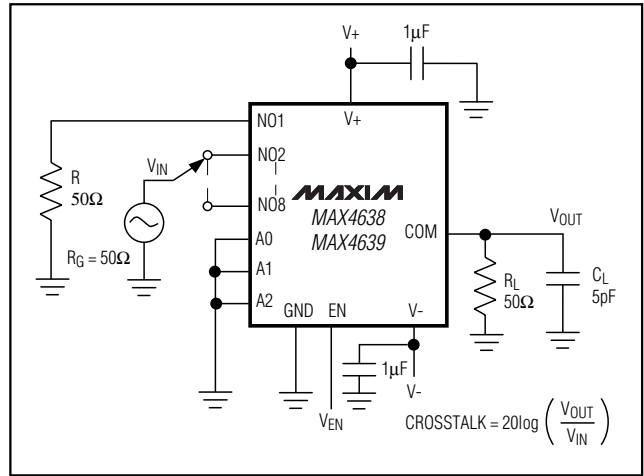


Figure 7. Crosstalk

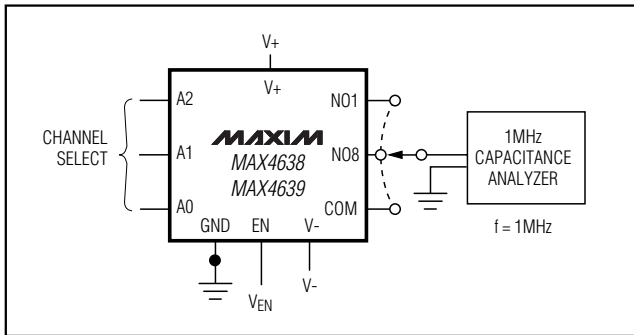


Figure 8. Channel OFF/ON Capacitance

## Chip Information

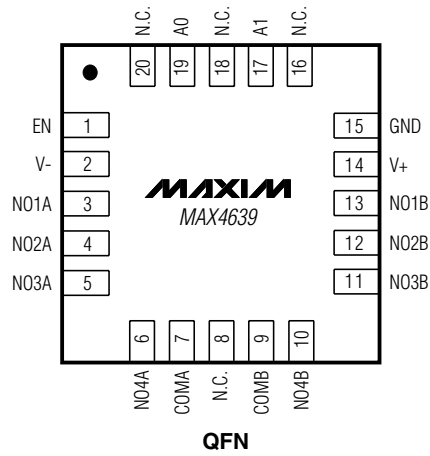
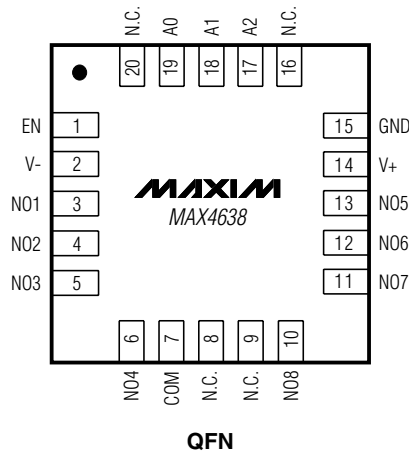
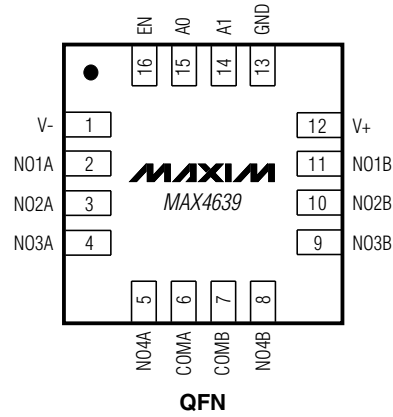
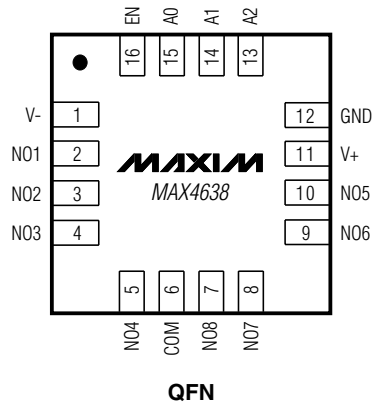
TRANSISTOR COUNT: 632

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

## Pin Configurations (continued)

**MAX4638/MAX4639**

TOP VIEW



# 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](http://www.maxim-ic.com/packages).)

**TOP VIEW**

**BOTTOM VIEW**

**SIDE VIEW**

**END VIEW**

**LEAD TIP DETAIL**

COMMON DIMENSIONS					
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	0.05	0.15	.002	.006	
A <sub>1</sub>	0.85	0.95	.033	.037	
b	0.19	0.30	.007	.012	
b <sub>1</sub>	0.19	0.25	.007	.010	
c	0.090	0.20	.0035	.008	
c <sub>1</sub>	0.090	0.135	.0035	.0053	
D	SEE VARIATIONS		SEE VARIATIONS		
E	4.30	4.50	.169	.177	
e	0.65 BSC		.026 BSC		
H	6.25	6.50	.246	.256	
L	0.50	0.70	.020	.028	
N	SEE VARIATIONS		SEE VARIATIONS		
Y	2.85	3.15	.112	.124	
α	0°	8°	0°	8°	

JEDEC		VARIATIONS				
MO-153	N	MILLIMETERS		INCHES		
		MIN.	MAX.	MIN.	MAX.	
AB	14	D	4.90	5.10	.193	.201
AC	16	D	4.90	5.10	.193	.201
AC-EP	16	D	4.90	5.10	.193	.201
		X	2.85	3.15	.112	.124
AD	20	D	6.40	6.60	.252	.260
AD-EP	20	D	6.40	6.60	.252	.260
		X	4.00	4.34	.157	.171
AE	24	D	7.70	7.90	.303	.311
AF	28	D	9.60	9.80	.378	.386
AF-EP		D	9.60	9.80	.378	.386
		X	5.35	5.65	.211	.222

**NOTES:**

- DIMENSIONS D AND E DO NOT INCLUDE FLASH.
- MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15 mm PER SIDE.
- CONTROLLING DIMENSION: MILLIMETER.
- MEETS JEDEC OUTLINE MO-153 VARIATIONS AB, AC, AD, AE, AF.
- DIMENSIONS X AND Y APPLY TO EXPOSED PAD (EP) VERSIONS ONLY.
- EXPOSED PAD FLUSH WITH BOTTOM OF PACKAGE WITHIN .002".

**MAXIM**

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, TSSOP, 4.40mm BODY, 0.65mm PITCH

APPROVAL	DOCUMENT CONTROL NO.	REV	1/1
	21-0066	C	

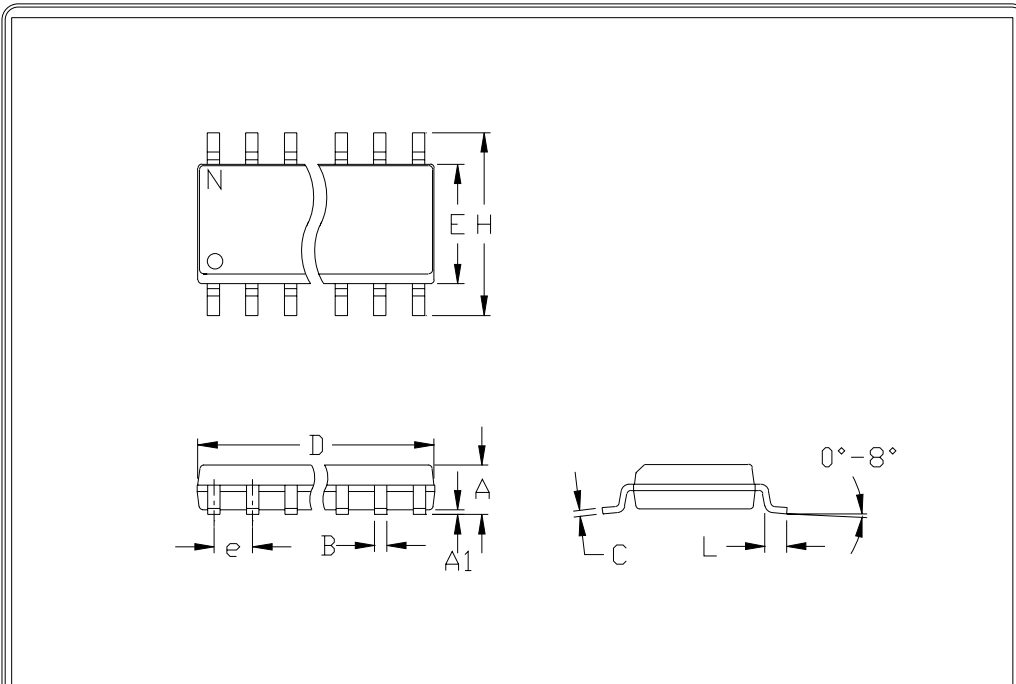
TSSOP-EP

# 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](http://www.maxim-ic.com/packages).)

**MAX4638/MAX4639**



	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
e	0.050		1.27	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
h	0.010	0.020	0.25	0.50
L	0.016	0.050	0.40	1.27

	INCHES		MILLIMETERS		N	MS012
	MIN	MAX	MIN	MAX		
D	0.189	0.197	4.80	5.00	8	A
D	0.337	0.344	8.55	8.75	14	B
D	0.386	0.394	9.80	10.00	16	C

**NOTES:**

1. D&E DO NOT INCLUDE MOLD FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")
3. LEADS TO BE COPLANAR WITHIN .102mm (.004")
4. CONTROLLING DIMENSION: MILLIMETER
5. MEETS JEDEC MS012-XX AS SHOWN IN ABOVE TABLE
6. N = NUMBER OF PINS



PACKAGE FAMILY OUTLINE: SOIC .150"

1/1

21-0041 A  
DOCUMENT CONTROL NUMBER REV

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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