



# 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 (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.

## Applications

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

## 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)**

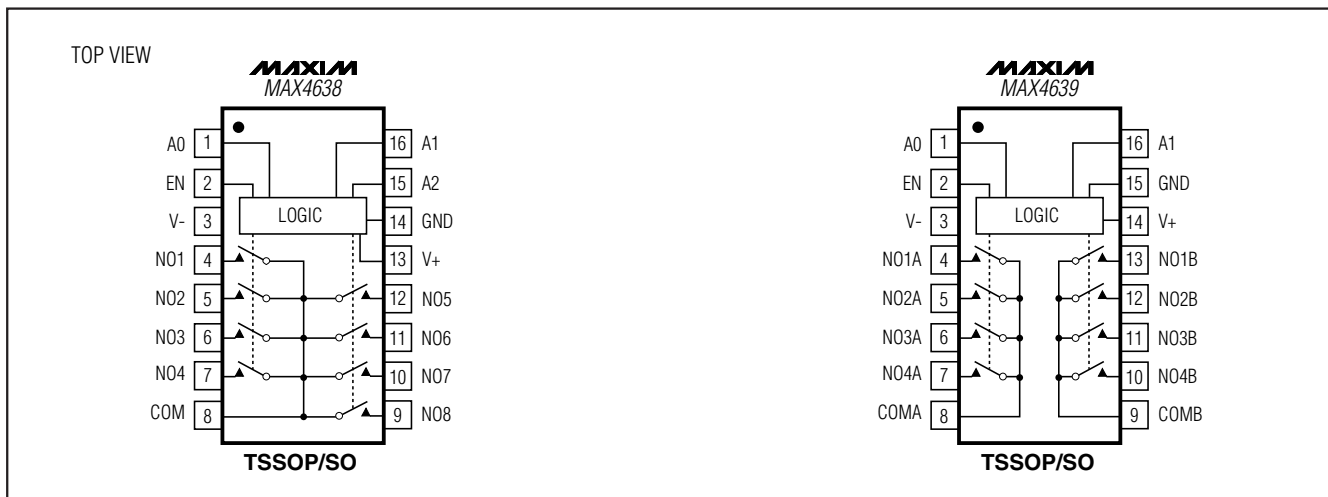
MAX4638/MAX4639

## Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX4638ETE	-40°C to +85°C	16 Thin QFN (4 x 4)
MAX4638EUE	-40°C to +85°C	16 TSSOP
MAX4638ESE	-40°C to +85°C	16 SO
MAX4638ETP	-40°C to +85°C	20 Thin QFN (4 x 4)

Ordering Information continued at end of data sheet.

## Pin Configurations/Functional Diagrams



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



Maxim Integrated Products 1

**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](http://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 <sub>-</sub> , EN	.....-0.3V to +6V
V-	.....+0.3V to -6V
NO <sub>-</sub> , COM <sub>-</sub> (Note 1)	.....-0.3V to (V+ + 0.3V)
Continuous Current A <sub>-</sub> , EN	.....±30mA
Continuous Current NO <sub>-</sub> , COM <sub>-</sub>	.....±100mA
Peak Current (NO <sub>-</sub> , COM <sub>-</sub> ) (pulsed at 1ms, 10% duty cycle)	.....±200mA

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

16-Pin Thin QFN (derate 16.9mW/°C above +70°C)	.....1349mW
16-Pin TSSOP (derate 5.7mW/°C above +70°C)	.....457mW
16-Pin SO (derate 8.70mW/°C above +70°C)	.....696mW
20-Pin Thin QFN (derate 16.9mW/°C above +70°C)	.....1349mW
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<sub>-</sub>, NO<sub>-</sub> exceeding V+ or V- are clamped by internal diodes. A<sub>-</sub> 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.) (Note 9)

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 <sub>-</sub> 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		±0.01	0.25	nA
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-0.25		0.35	
COM <sub>-</sub> 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		±0.01	0.25	nA
		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-0.25		0.75	
COM <sub>-</sub> 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		±0.01	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

**MAX4638/MAX4639**

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

(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.) (Note 9)

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_ 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_ 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+	V+ = +5.5V, V <sub>IN</sub> = 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, 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.) (Note 9)

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		
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		
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		
<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

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

**MAX4638/MAX4639**

## 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)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
Off-Isolation (Note 6)	VISO	CL = 5pF, RL = 50Ω, f = 10MHz, VNO_ = +1VRMS, Figure 6	TA = +25°C		55		dB
		CL = 5pF, RL = 50Ω, f = 1MHz, VNO_ = 1VRMS, Figure 6	TA = +25°C		-75		
Crosstalk (Note 7)	VCT	CL = 5pF, RL = 50Ω, f = 10MHz, VNO_ = 1VRMS, Figure 7	TA = +25°C		-65		dB
		CL = 5pF, RL = 50Ω, f = 1MHz, VNO_ = 1VRMS, Figure 7	TA = +25°C		-85		
On-Channel -3dB Bandwidth	BW	Signal = 0dBm, 50Ω in and out, Figure 6	MAX4638	TA = +25°C		50	MHz
			MAX4639	TA = +25°C		85	
NO_ Off-Capacitance	CNO_(OFF)	VNO_ = 0V, f = 1MHz, Figure 8	TA = +25°C		9		pF
COM_ Off-Capacitance	CCOM_(OFF)	VCOM_ = 0V, f = 1MHz, Figure 8	MAX4638	TA = +25°C		40	pF
			MAX4639	TA = +25°C		20	
Switch On-Capacitance	C(ON)	VCOM = VNO_ = 0V, f = 1MHz, Figure 8	MAX4638	TA = +25°C		54	pF
			MAX4639	TA = +25°C		34	
<b>SUPPLY</b>							
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- = -2.5V ±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
<b>ANALOG SWITCH</b>							
Analog Signal Range	VCOM_, VNO_			V-		V+	V
On-Resistance	RON	ICOM_ = 10mA, VNO_ = ±1.5V, V+ = +2.25V, V- = -2.25V	TA = +25°C		2.5	3.5	Ω
			TA = TMIN to TMAX			4.5	
On-Resistance Match Between Channels (Notes 3, 8)	ΔRON	ICOM_ = 10mA, VNO_ = ±1.5V, V+ = +2.25V, V- = -2.25V	TA = +25°C		0.2	0.4	Ω
			TA = TMIN to TMAX			0.5	

## 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 = 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)	RFLAT(ON)	ICOM_ = 10mA; VNO_ = ±1.5V, 0; V+ = +2.25V; V- = -2.25V	TA = +25°C	0.75	1	Ω	
			TA = TMIN to TMAX				1.2
NO_ Off-Leakage Current (Note 5)	INO_ (OFF)	V+ = +2.75V; V- = -2.75V; VCOM_ = +1V, +2.5V; VNO_ = +2.5V, +1V	TA = +25°C	-0.25	±0.01	0.25	nA
			TA = TMIN to TMAX	-0.35		0.35	
COM_ Off-Leakage Current (Note 5)	ICOM_ (OFF)	V+ = +2.75V; V- = -2.75V; VCOM_ = +1V, +2.5V; VNO_ = +2.5V, +1V	TA = +25°C	-0.25	±0.01	0.25	nA
			TA = TMIN to TMAX	-0.35		0.35	
COM_ On-Leakage Current (Note 5)	ICOM_ (ON)	V+ = +2.5V; V- = -2.5V; VCOM_ = +1V, +2.5V; VNO_ = +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>	VIN_ = 0 or V+	-0.1	0.005	0.1	μA	
Digital Input Capacitance	CIN			2		pF	
<b>DYNAMIC</b>							
Transition Time (Note 5)	tTRANS	VNO_ = +1.2V, CL = 35pF, RL = 100Ω, Figure 2	TA = +25°C	16	20	ns	
			TA = TMIN to TMAX				24
Enable Turn-On Time (Note 5)	tON(EN)	VNO_ = +1.2V, CL = 35pF, RL = 100Ω, Figure 4	TA = +25°C	14	18	ns	
			TA = TMIN to TMAX				20
Enable Turn-Off Time (Note 5)	tOFF(EN)	VNO_ = +1.2V, CL = 35pF, RL = 100Ω, Figure 4	TA = +25°C	5	7	ns	
			TA = TMIN to TMAX				8
Break-Before-Make (Note 5)	tBBM	VNO_ = +1.2V, CL = 35pF, RL = 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 =  $20 \log_{10} (V_{COM\_} / V_{NO\_})$ . VCOM\_ = output, VNO\_ = input to off switch.

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

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

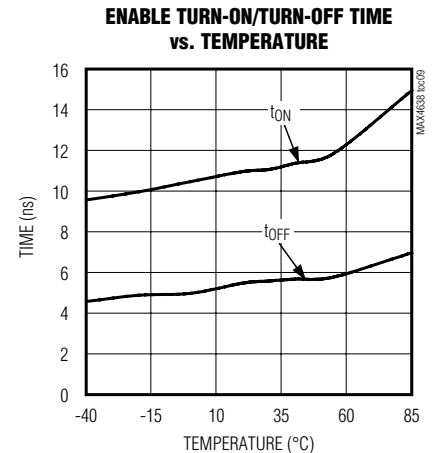
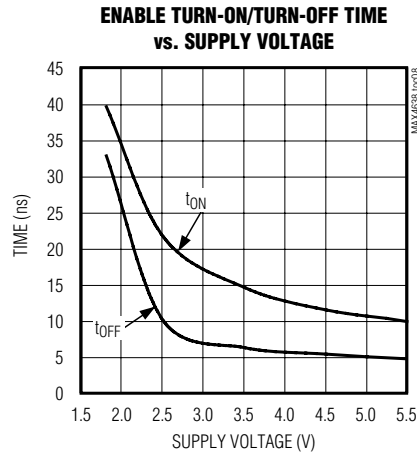
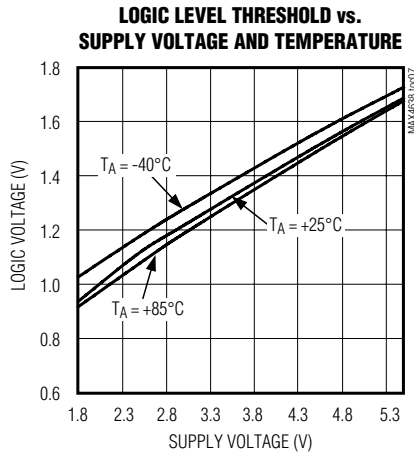
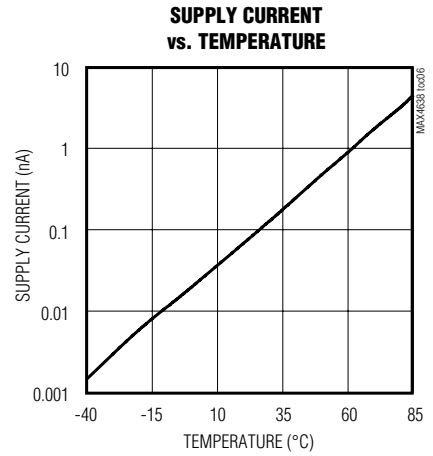
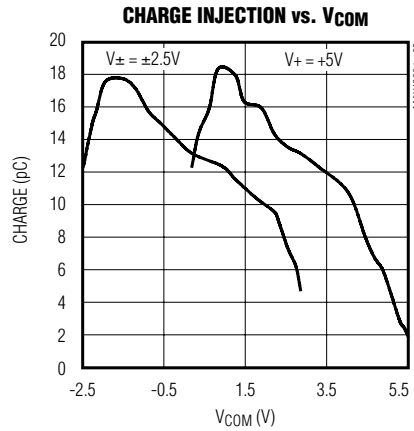
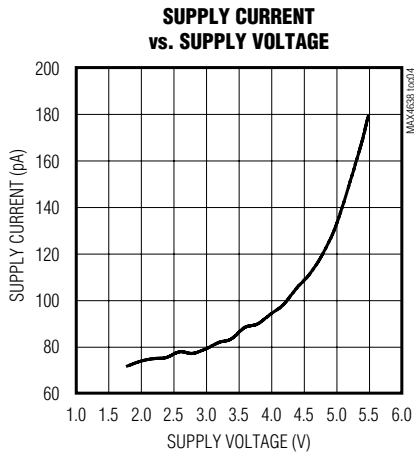
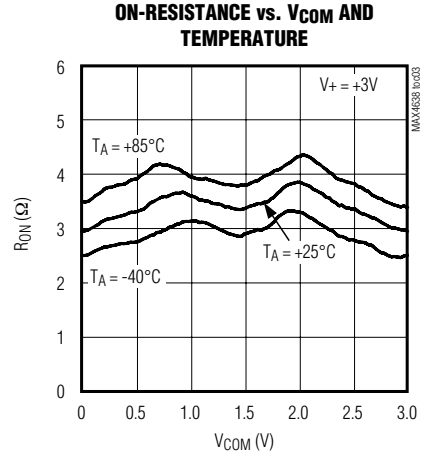
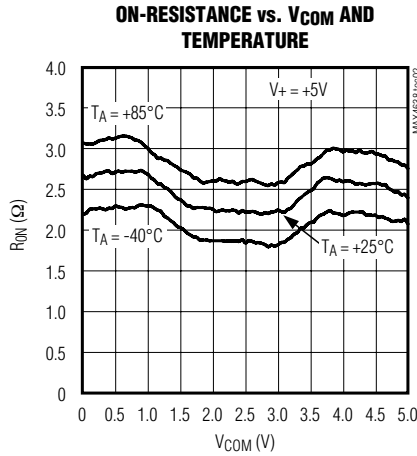
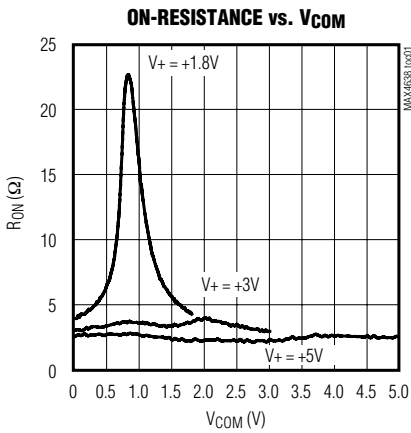
**Note 9:** Parts are tested at +85°C and guaranteed by design over the entire temperature range.

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

## Typical Operating Characteristics

( $V_+ = +5V$ ,  $V_- = 0$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

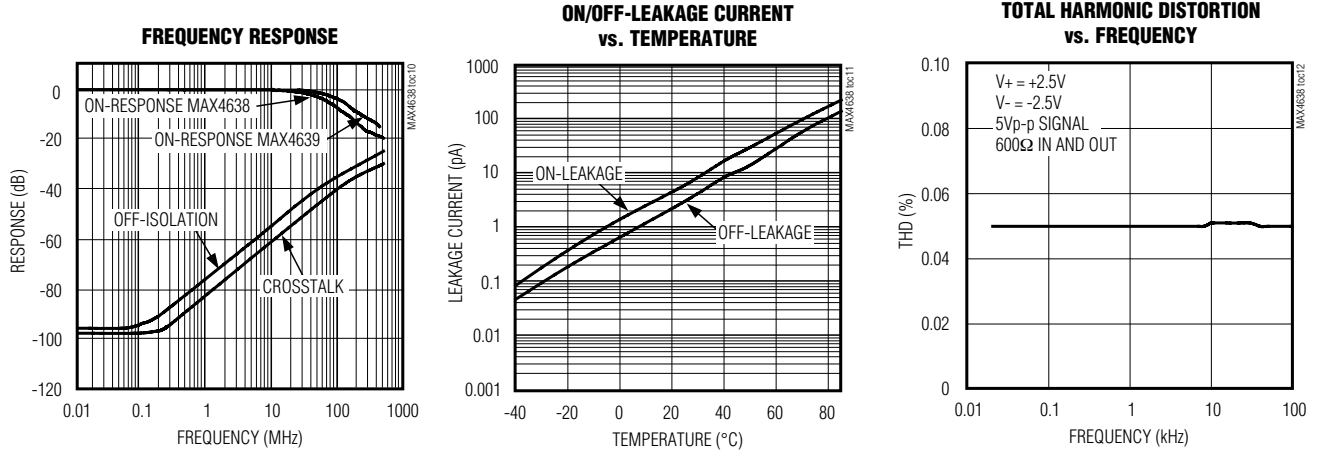
MAX4638/MAX4639



# 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	THIN QFN		DIP/SO	THIN 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-NO4	Bidirectional Analog Inputs
—	—	—	4-7	2-5	3-6	NO1A-NO4A	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. Not internally connected.
—	EP	EP	—	EP	EP	PAD	Exposed Pad. Connect to V-.



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

**MAX4638/MAX4639**

## 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.

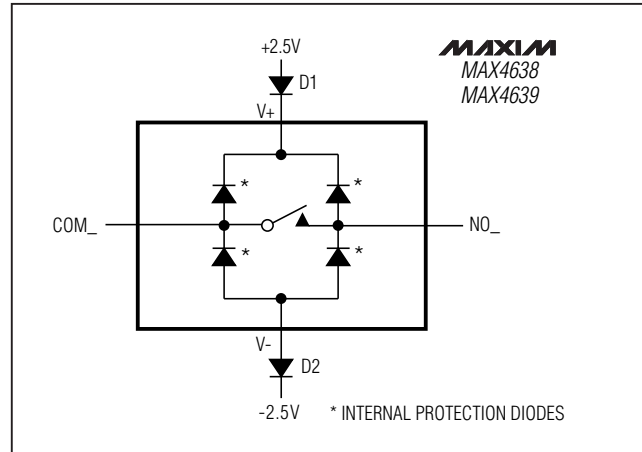


Figure 1. Overvoltage Protection Using External Blocking Diodes

## Ordering Information (continued)

PART	TEMP RANGE	PIN-PACKAGE
MAX4639ETE	-40°C to +85°C	16 Thin QFN (4 × 4)
MAX4639EUE	-40°C to +85°C	16 TSSOP
MAX4639ESE	-40°C to +85°C	16 SO
MAX4639ETP	-40°C to +85°C	20 Thin QFN (4 × 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

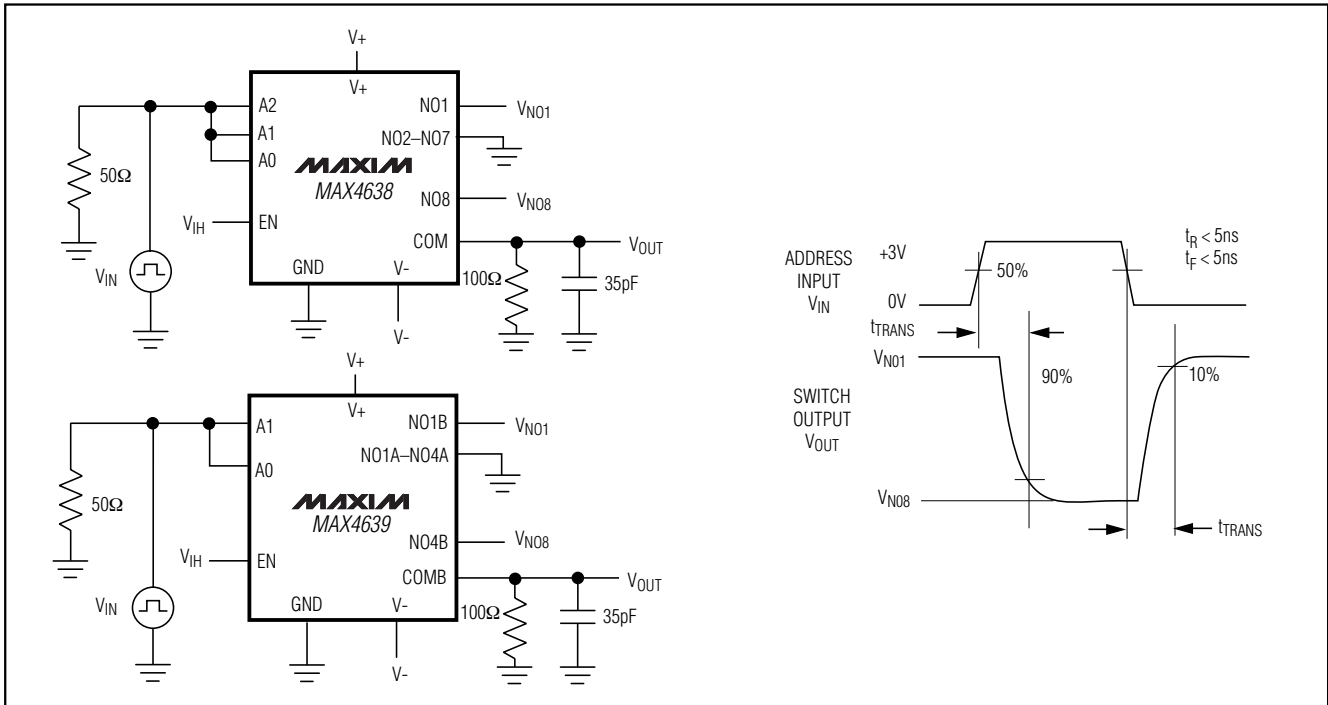


Figure 2. Transition Time

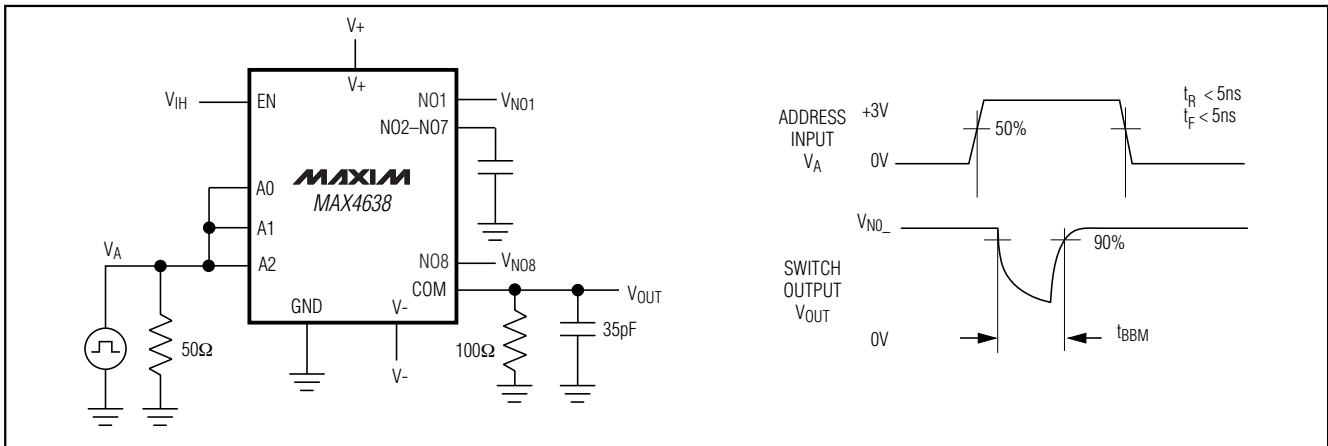


Figure 3. MAX4638 Break-Before-Make Interval

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

## Test Circuits/Timing Diagrams (continued)

MAX4638/MAX4639

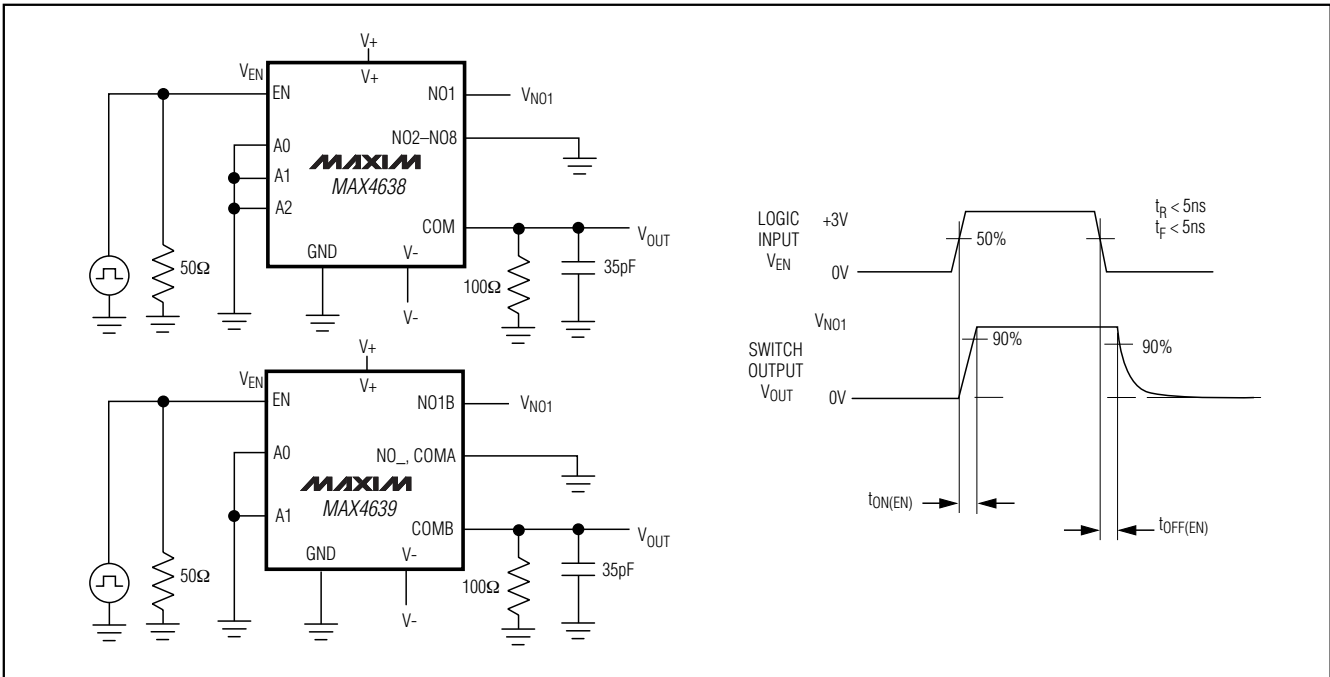


Figure 4. Enable Switching Time

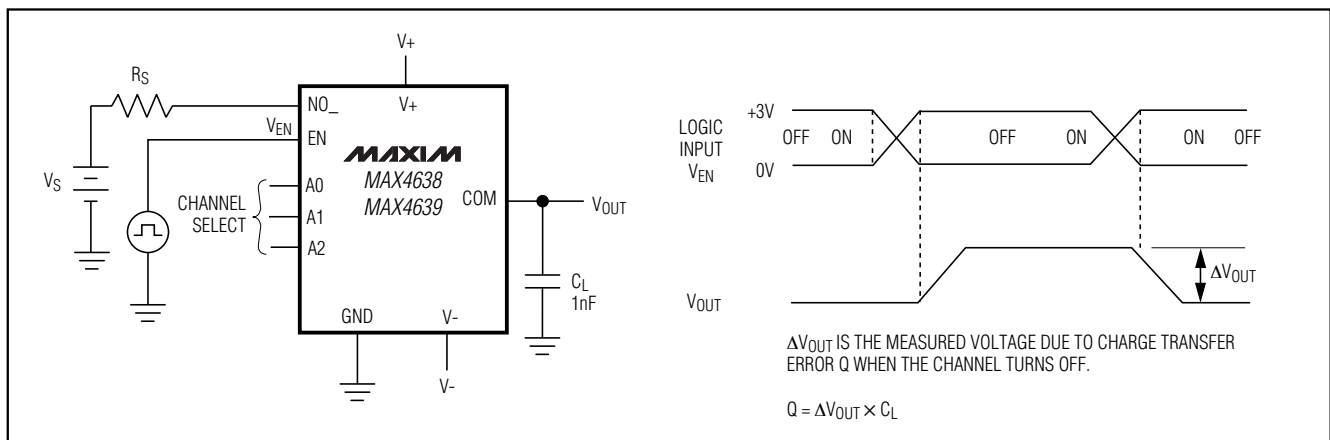


Figure 5. Charge Injection

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

## Test Circuits/Timing Diagrams (continued)

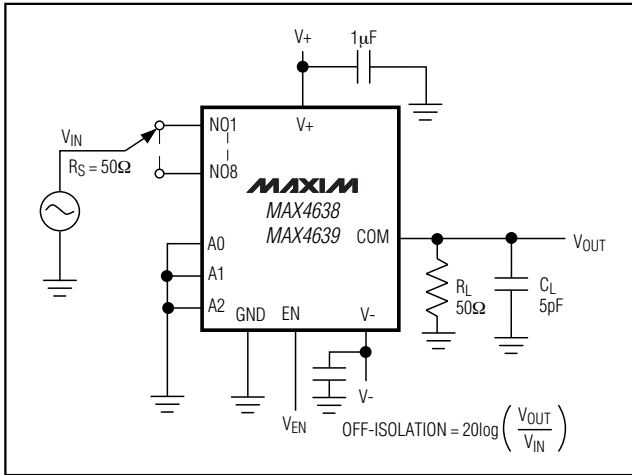


Figure 6. Off-Isolation/On-Channel Bandwidth

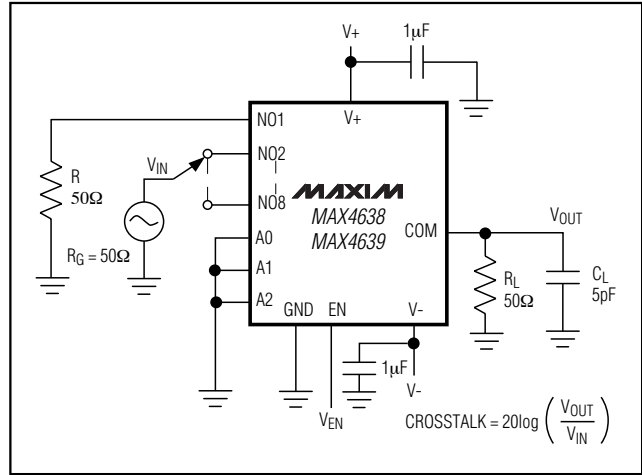


Figure 7. Crosstalk

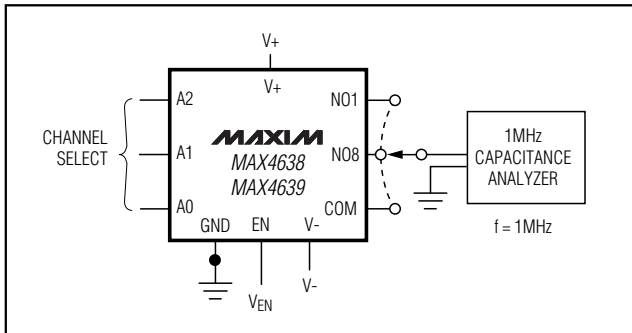


Figure 8. Channel Off/On-Capacitance

## Chip Information

TRANSISTOR COUNT: 632

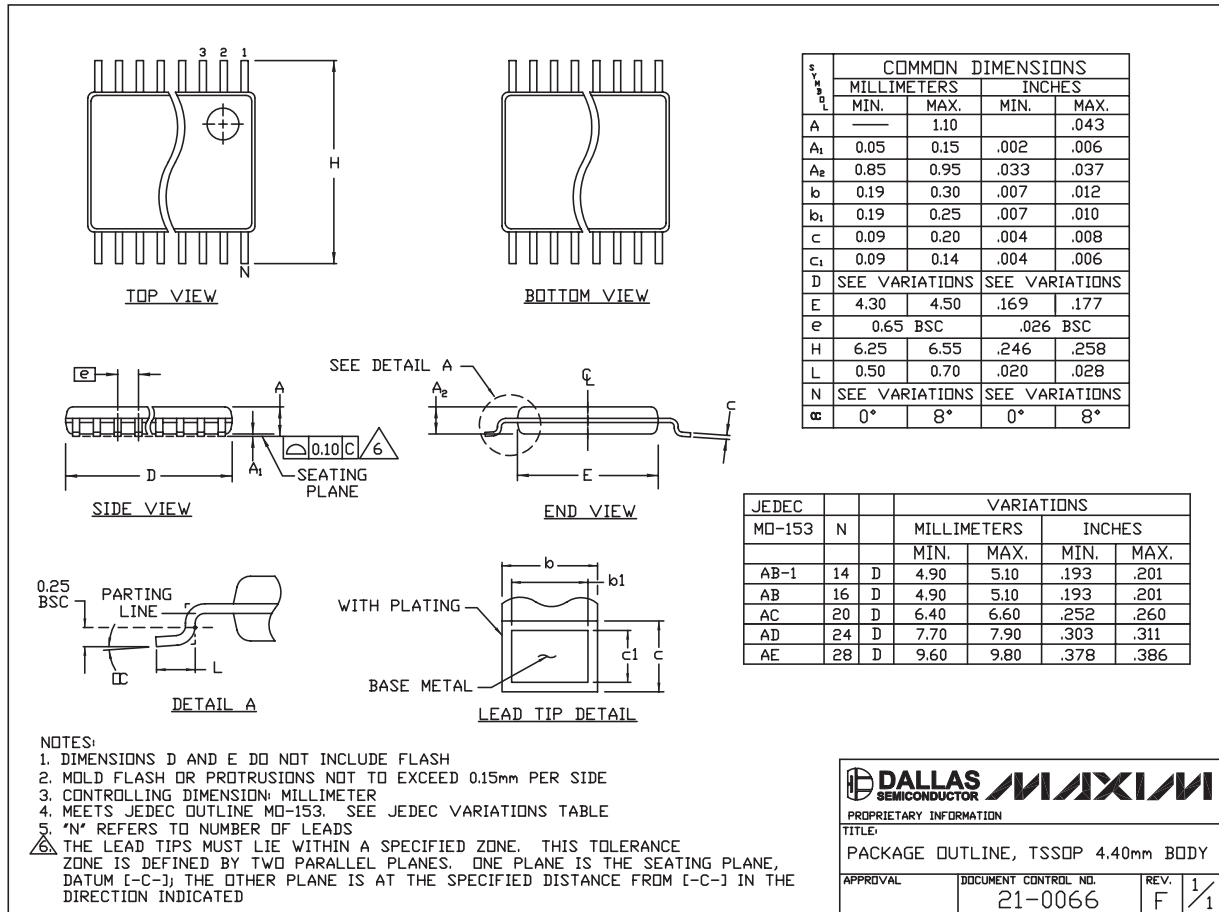
**Note:** Exposed pad on thin QFN packages is connected to V-.



# 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).)



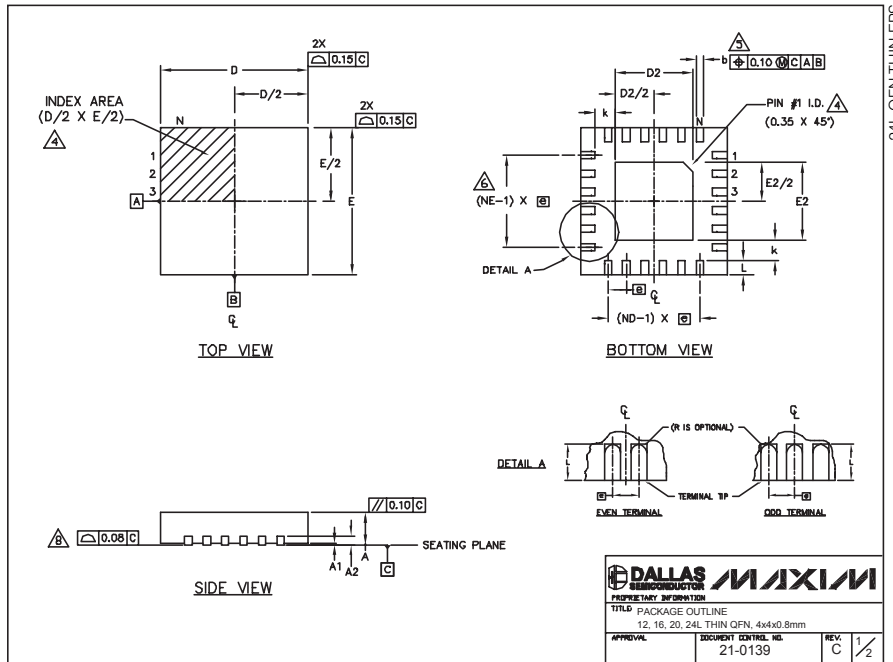
TSSOP4.40mm.EPS

# 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



**DALLAS SEMICONDUCTOR** **MAXIM**  
 PROPRIETARY INFORMATION  
 TITLE PACKAGE OUTLINE  
 12, 16, 20, 24L THIN QFN, 4x4x0.8mm  
 APPROVAL DOCUMENT CONTROL NO. 21-0139 REV. C 1/2

COMMON DIMENSIONS												
PKG	12L 4x4			16L 4x4			20L 4x4			24L 4x4		
REF.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.75	0.80	0.85	0.70	0.75	0.80	0.70	0.75	0.80
AL	0.0	0.02	0.05	0.0	0.02	0.05	0.0	0.02	0.05	0.0	0.02	0.05
A2	0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.		
b	0.25	0.30	0.35	0.25	0.30	0.35	0.20	0.25	0.30	0.18	0.23	0.30
D	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10
E	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-
L	0.43	0.53	0.65	0.45	0.55	0.65	0.43	0.53	0.65	0.30	0.40	0.50
N	12			16			20			24		
ND	3			4			5			6		
NE	3			4			5			6		
Package Ver.	WGGB			WGGC			WGGD-1			WGGD-2		

EXPOSED PAD VARIATIONS							
PKG. CODES	D2			E2			BOND BONDS ALLOWED
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	
T1244-2	1.95	2.30	2.25	1.95	2.10	2.25	NO
T1244-3	1.95	2.30	2.25	1.95	2.10	2.25	YES
T1244-4	1.95	2.30	2.25	1.95	2.10	2.25	NO
T1644-2	1.95	2.30	2.25	1.95	2.10	2.25	NO
T1644-3	1.95	2.30	2.25	1.95	2.10	2.25	YES
T1644-4	1.95	2.30	2.25	1.95	2.10	2.25	NO
T2044-1	1.95	2.30	2.25	1.95	2.10	2.25	NO
T2044-2	1.95	2.30	2.25	1.95	2.10	2.25	YES
T2044-3	1.95	2.30	2.25	1.95	2.10	2.25	NO
T2444-1	2.45	2.60	2.63	2.45	2.60	2.63	NO
T2444-2	1.95	2.30	2.25	1.95	2.10	2.25	YES
T2444-3	2.45	2.60	2.63	2.45	2.60	2.63	YES
T2444-4	2.45	2.60	2.63	2.45	2.60	2.63	NO

NOTES:

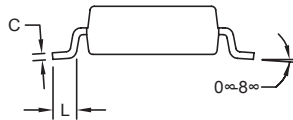
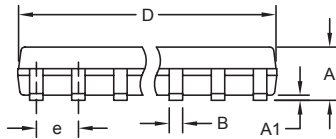
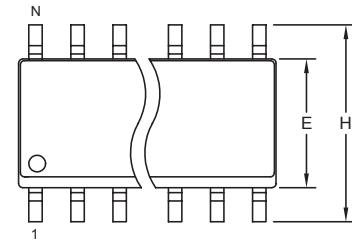
- DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS; ANGLES ARE IN DEGREES.
- N IS THE TOTAL NUMBER OF TERMINALS.
- THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JEDEC 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
- DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
- ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY. DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
- COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
- DRAWING CONFORMS TO JEDEC MO220, EXCEPT FOR T2444-1, T2444-3 AND T2444-4.

**DALLAS SEMICONDUCTOR** **MAXIM**  
 PROPRIETARY INFORMATION  
 TITLE PACKAGE OUTLINE  
 12, 16, 20, 24L THIN QFN, 4x4x0.8mm  
 APPROVAL DOCUMENT CONTROL NO. 21-0139 REV. C 1/2

# 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).)



DIM	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 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27

VARIATIONS:

DIM	INCHES		MILLIMETERS		N	MS012
	MIN	MAX	MIN	MAX		
D	0.189	0.197	4.80	5.00	8	AA
D	0.337	0.344	8.55	8.75	14	AB
D	0.386	0.394	9.80	10.00	16	AC

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.

<b>DALLAS SEMICONDUCTOR</b>		<b>MAXIM</b>	
<small>PROPRIETARY INFORMATION</small>			
TITLE: PACKAGE OUTLINE, .150" SOIC			
<small>APPROVAL</small>	<small>DOCUMENT CONTROL NO.</small> 21-0041	<small>REV.</small> B	<small>1/1</small>

SOICN EFS

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