19-1782; Rev 2; 2/04

MAXIM

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_{ON}) 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 t_{ON} and 7ns t_{OFF}. 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 R_{ON}**
  3.5Ω (+5V or ±2.5V Supplies)
  6Ω (+3V Supply)
- **Guaranteed 0.4Ω R_{ON} Match Between Channels**
- **Guaranteed 1Ω R_{ON} Flatness Over Signal Range**
- **Guaranteed Low Leakage Currents**
  0.25nA at +25°C
- **Switching Times: t_{ON} = 18ns, t_{OFF} = 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)**

Ordering Information

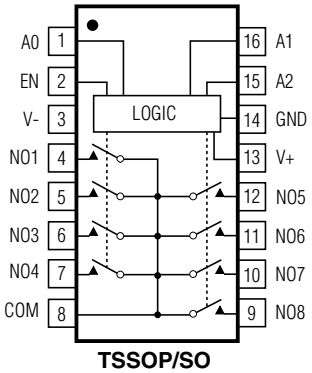
PART	TEMP RANGE	PIN-PACKAGE
MAX4638ETE	-40°C to +85°C	16 Thin QFN (4 × 4)
MAX4638EUE	-40°C to +85°C	16 TSSOP
MAX4638ESE	-40°C to +85°C	16 SO
MAX4638ETP	-40°C to +85°C	20 Thin QFN (4 × 4)

Ordering Information continued at end of data sheet.

Pin Configurations/Functional Diagrams

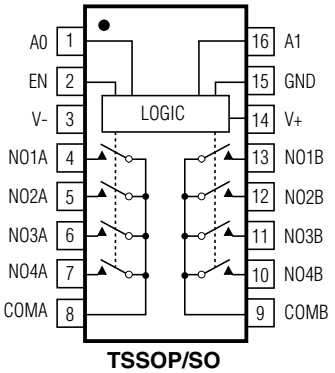
TOP VIEW

MAXIM
MAX4638



TSSOP/SO

MAXIM
MAX4639



TSSOP/SO

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 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_, 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_{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)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	$V_{COM_}$, $V_{NO_}$			0		V+	V
On-Resistance	R_{ON}	V+ = +4.5V, $I_{COM_}$ = 10mA, $V_{NO_}$ = +3.5V	T_A = +25°C		2.5	3.5	Ω
			T_A = T_{MIN} to T_{MAX}			4.5	
On-Resistance Match Between Channels (Notes 3, 8)	ΔR_{ON}	V+ = +4.5V, $I_{COM_}$ = 10mA, $V_{NO_}$ = +3.5V	T_A = +25°C		0.1	0.4	Ω
			T_A = T_{MIN} to T_{MAX}			0.5	
On-Resistance Flatness (Note 4)	$R_{FLAT(ON)}$	V+ = +4.5V; $I_{COM_}$ = 10mA; $V_{NO_}$ = +1V, +2V, +3.5V	T_A = +25°C		0.75	1	Ω
			T_A = T_{MIN} to T_{MAX}			1.2	
NO_ Off-Leakage Current (Note 5)	$I_{NO_(OFF)}$	V+ = +5.5V; $V_{COM_}$ = +1V, +4.5V; $V_{NO_}$ = +4.5V, +1V	T_A = +25°C	-0.25	±0.01	0.25	nA
			T_A = T_{MIN} to T_{MAX}	-0.35		0.35	
COM_ Off-Leakage Current (Note 5)	$I_{COM_(OFF)}$	V+ = +5.5V; $V_{COM_}$ = +1V, +4.5V; $V_{NO_}$ = +4.5V, +1V	T_A = +25°C	-0.25	±0.01	0.25	nA
			T_A = T_{MIN} to T_{MAX}	-0.75		0.75	
COM_ On-Leakage Current (Note 5)	$I_{COM_(ON)}$	V+ = +5.5V; $V_{COM_}$ = +1V, +4.5V; $V_{NO_}$ = +1V, +4.5V, or floating	T_A = +25°C	-0.25	±0.01	0.25	nA
			T_A = T_{MIN} to T_{MAX}	-0.75		0.75	
DIGITAL I/O							
Input Logic High	V_{IH}			2.4			V
Input Logic Low	V_{IL}					0.8	V
Input Leakage Current	I_{IH}, I_{IL}	$V_{IN_}$ = 0 or V+		-0.1	0.005	0.1	µA
Digital Input Capacitance	C_{IN}				2		pF
DYNAMIC							
Transition Time (Note 5)	t_{TRANS}	R_L = 100Ω, C_L = 35pF, V_{NO1} = +3V or 0, V_{NO8} = 0 or +3V, Figure 2	T_A = +25°C		14	18	ns
			T_A = T_{MIN} to T_{MAX}			20	

ELECTRICAL CHARACTERISTICS—+5V Single Supply (continued)

(V+ = +5V ±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)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP (Note 2)	MAX	UNITS
Break-Before-Make (Note 5)	t_{BBM}	R_L = 100Ω, C_L = 35pF, $V_{NO_}$ = +3V, Figure 3		T_A = +25°C		8		ns
				T_A = T_{MIN} to T_{MAX}	1			
Enable Turn-On Time (Note 5)	$t_{ON(EN)}$	R_L = 100Ω, C_L = 35pF, V_{NO1} = +3V, V_{NO2} to V_{NO8} = 0, Figure 4		T_A = +25°C		14	18	ns
				T_A = T_{MIN} to T_{MAX}			20	
Enable Turn-Off Time (Note 5)	$t_{OFF(EN)}$	R_L = 100Ω, C_L = 35pF, V_{NO1} = +3V, V_{NO2} to V_{NO8} = 0, Figure 4		T_A = +25°C		5	7	ns
				T_A = T_{MIN} to T_{MAX}			8	
On-Channel -3dB Bandwidth	BW	Signal = 0dBm, C_L = 5pF, 50Ω in and out, Figure 6	MAX4638	T_A = +25°C		50		MHz
			MAX4639	T_A = +25°C		85		
Charge Injection	Q	V_{GEN} = +2.5V, R_{GEN} = 0, C_L = 1.0nF, Figure 5		T_A = +25°C		13		pC
NO_ Off-Capacitance	$C_{NO_(OFF)}$	$V_{NO_}$ = 0V, f = 1MHz, Figure 8		T_A = +25°C		9		pF
COM_ Off-Capacitance	$C_{COM_(OFF)}$	$V_{COM_}$ = 0V, f = 1MHz, Figure 8	MAX4638	T_A = +25°C		40		pF
			MAX4639	T_A = +25°C		20		
Switch On-Capacitance	$C_{(ON)}$	$V_{COM_}$ = $V_{NO_}$ = 0V, f = 1MHz, Figure 8	MAX4638	T_A = +25°C		54		pF
			MAX4639	T_A = +25°C		34		
Off-Isolation (Note 6)	V_{ISO}	C_L = 5pF, R_L = 50Ω, f = 1MHz, $V_{NO_}$ = 1V_{RMS}, Figure 6		T_A = +25°C		-55		dB
		C_L = 5pF, R_L = 50Ω, f = 10MHz, $V_{NO_}$ = 1V_{RMS}, Figure 6		T_A = +25°C		-75		
Crosstalk (Note 7)	V_{CT}	C_L = 5pF, R_L = 50Ω, f = 10MHz, $V_{NO_}$= 1V_{RMS}, Figure 7		T_A = +25°C		-65		dB
		C_L = 5pF, R_L = 50Ω, f = 1MHz, $V_{NO_}$ = 1V_{RMS}, Figure 7		T_A = +25°C		-85		
Total Harmonic Distortion	THD	R_L = 600Ω, $R_{FLAT(ON)}/R_L$		T_A = +25°C		0.5		%
SUPPLY								
Positive Supply Current	I+	V+ = +5.5V, V_{IN} = 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_{IH} = +2.0V, V_{IL} = +0.4V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V+ = +3V and T_A = +25°C.) (Note 9)

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

ELECTRICAL CHARACTERISTICS—+3.0V Single Supply (continued)

(V+ = +2.7V to +3.3V, V- = 0, V_{IH} = +2.0V, V_{IL} = +0.4V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V+ = +3V and T_A = +25°C.) (Note 9)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP (Note 2)	MAX	UNITS
Off-Isolation (Note 6)	V_{ISO}	C_L = 5pF, R_L = 50Ω, f = 10MHz, $V_{NO_}$ = +1V_{RMS}, Figure 6		T_A = +25°C		55		dB
		C_L = 5pF, R_L = 50Ω, f = 1MHz, $V_{NO_}$ = 1V_{RMS}, Figure 6		T_A = +25°C		-75		
Crosstalk (Note 7)	V_{CT}	C_L = 5pF, R_L = 50Ω, f = 10MHz, $V_{NO_}$ = 1V_{RMS}, Figure 7		T_A = +25°C		-65		dB
		C_L = 5pF, R_L = 50Ω, f = 1MHz, $V_{NO_}$ = 1V_{RMS}, Figure 7		T_A = +25°C		-85		
On-Channel -3dB Bandwidth	BW	Signal = 0dBm, 50Ω in and out, Figure 6	MAX4638	T_A = +25°C		50		MHz
			MAX4639	T_A = +25°C		85		
NO_ Off-Capacitance	$C_{NO_(OFF)}$	$V_{NO_}$ = 0V, f = 1MHz, Figure 8		T_A = +25°C		9		pF
COM_ Off-Capacitance	$C_{COM_(OFF)}$	$V_{COM_}$ = 0V, f = 1MHz, Figure 8	MAX4638	T_A = +25°C		40		pF
			MAX4639	T_A = +25°C		20		
Switch On-Capacitance	$C_{(ON)}$	V_{COM} = $V_{NO_}$ = 0V, f = 1MHz, Figure 8	MAX4638	T_A = +25°C		54		pF
			MAX4639	T_A = +25°C		34		
SUPPLY								
Positive Supply Current	I+	V+ = +3.3V, $V_{IN_}$ = 0 or V+				0.001	1	µA

ELECTRICAL CHARACTERISTICS—±2.5V Dual Supplies

(V+ = +2.5 ±10%, V- = -2.5V ±10%, V_{IH} = +2.0V, V_{IL} = +0.4V, T_A =T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V± = ±2.5V and T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	$V_{COM_}$, $V_{NO_}$			V-		V+	V
On-Resistance	R_{ON}	$I_{COM_}$ = 10mA, $V_{NO_}$ = ±1.5V, V+ = +2.25V, V- = -2.25V	T_A = +25°C		2.5	3.5	Ω
			T_A = T_{MIN} to T_{MAX}			4.5	
On-Resistance Match Between Channels (Notes 3, 8)	ΔR_{ON}	$I_{COM_}$ = 10mA, $V_{NO_}$ = ±1.5V, V+ = +2.25V, V- = -2.25V	T_A = +25°C		0.2	0.4	Ω
			T_A = T_{MIN} to T_{MAX}			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%, V_{IH} = +2.0V, V_{IL} = +0.4V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V± = ±2.5V and T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
On-Resistance Flatness (Note 4)	$R_{FLAT(ON)}$	$I_{COM_}$ = 10mA; $V_{NO_}$ = ±1.5V, 0; V+ = +2.25V; V- = -2.25V	T_A = +25°C		0.75	1	Ω
			T_A = T_{MIN} to T_{MAX}			1.2	
NO_ Off-Leakage Current (Note 5)	$I_{NO_(OFF)}$	V+ = +2.75V; V- = -2.75V; $V_{COM_}$ = +1V, +2.5V; $V_{NO_}$ = +2.5V, +1V	T_A = +25°C	-0.25	±0.01	0.25	nA
			T_A = T_{MIN} to T_{MAX}	-0.35		0.35	
COM_ Off-Leakage Current (Note 5)	$I_{COM_(OFF)}$	V+ = +2.75V; V- = -2.75; $V_{COM_}$ = +1V, +2.5V; $V_{NO_}$ = +2.5V, +1V	T_A = +25°C	-0.25	±0.01	0.25	nA
			T_A = T_{MIN} to T_{MAX}	-0.35		0.35	
COM_ On-Leakage Current (Note 5)	$I_{COM_(ON)}$	V+ = +2.5V; V- = -2.5; $V_{COM_}$ = +1V, +2.5V; $V_{NO_}$ = +1V, +2.5V, or floating	T_A = +25°C	-0.25	±0.01	0.25	nA
			T_A = T_{MIN} to T_{MAX}	-0.35		0.35	
DIGITAL I/O							
Input Logic High	V_{IH}			2.0			V
Input Logic Low	V_{IL}					0.4	V
Input Leakage Current	I_{IH}, I_{IL}	$V_{IN_}$ = 0 or V+		-0.1	0.005	0.1	µA
Digital Input Capacitance	C_{IN}				2		pF
DYNAMIC							
Transition Time (Note 5)	t_{TRANS}	$V_{NO_}$ = +1.2V, C_L = 35pF, R_L = 100Ω, Figure 2	T_A = +25°C		16	20	ns
			T_A = T_{MIN} to T_{MAX}			24	
Enable Turn-On Time (Note 5)	$t_{ON(EN)}$	$V_{NO_}$ = +1.2V, C_L = 35pF, R_L = 100Ω, Figure 4	T_A = +25°C		14	18	ns
			T_A = T_{MIN} to T_{MAX}			20	
Enable Turn-Off Time (Note 5)	$t_{OFF(EN)}$	$V_{NO_}$ = +1.2V, C_L = 35pF, R_L = 100Ω, Figure 4	T_A = +25°C		5	7	ns
			T_A = T_{MIN} to T_{MAX}			8	
Break-Before-Make (Note 5)	t_{BBM}	$V_{NO_}$ = +1.2V, C_L = 35pF, R_L = 100Ω, Figure 3	T_A = +25°C		8		ns
			T_A = T_{MIN} to T_{MAX}	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 = $20\log_{10}$ ($V_{COM_}$ / $V_{NO_}$), $V_{COM_}$ = output, $V_{NO_}$ = input to off switch.

Note 7: Between any two switches.

Note 8: ΔR_{ON} matching specifications for thin QFN packaged parts are guaranteed by design.

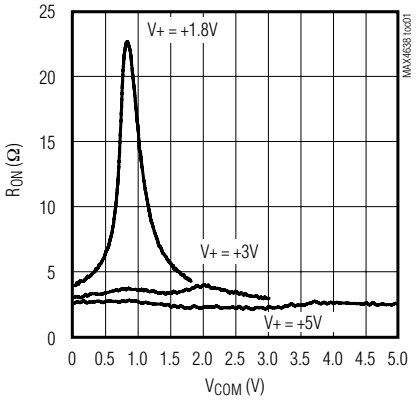
Note 9: Parts are tested at +85°C and guaranteed by design over the entire temperature range.

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

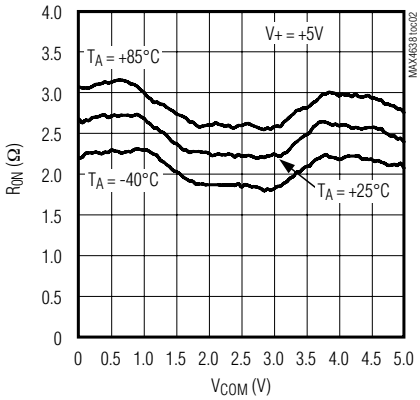
Typical Operating Characteristics

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

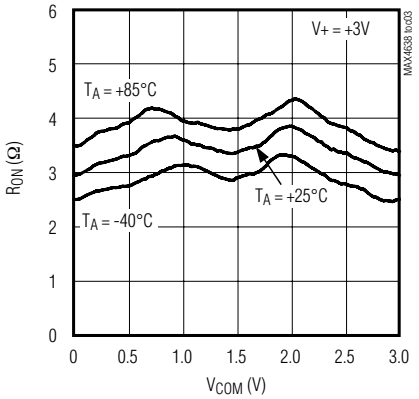
ON-RESISTANCE vs. V_{COM}



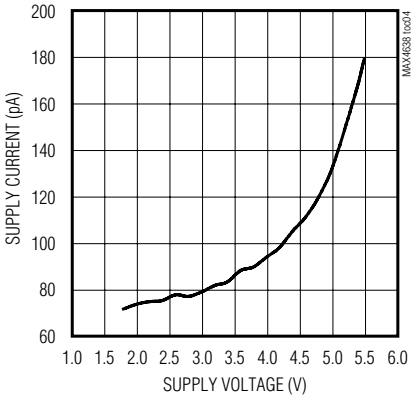
ON-RESISTANCE vs. V_{COM} AND TEMPERATURE



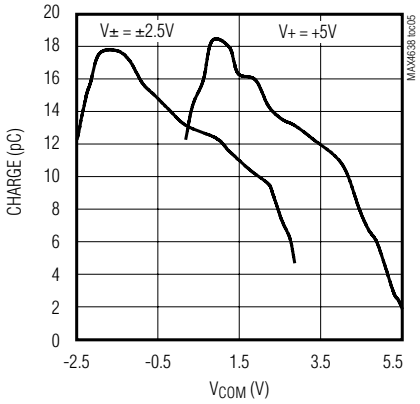
ON-RESISTANCE vs. V_{COM} AND TEMPERATURE



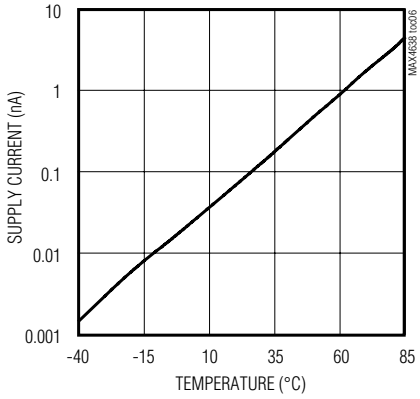
SUPPLY CURRENT vs. SUPPLY VOLTAGE



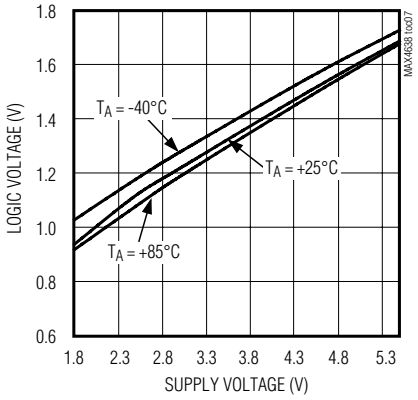
CHARGE INJECTION vs. V_{COM}



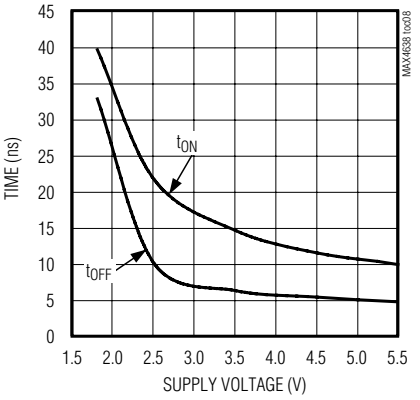
SUPPLY CURRENT vs. TEMPERATURE



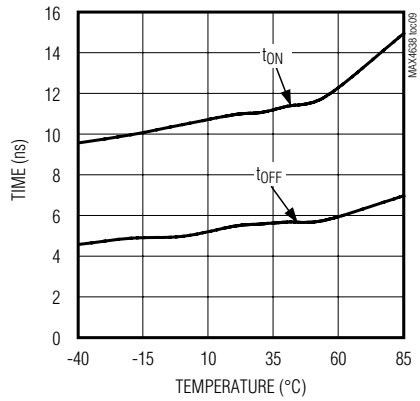
LOGIC LEVEL THRESHOLD vs. SUPPLY VOLTAGE AND TEMPERATURE



ENABLE TURN-ON/TURN-OFF TIME vs. SUPPLY VOLTAGE



ENABLE TURN-ON/TURN-OFF TIME vs. TEMPERATURE

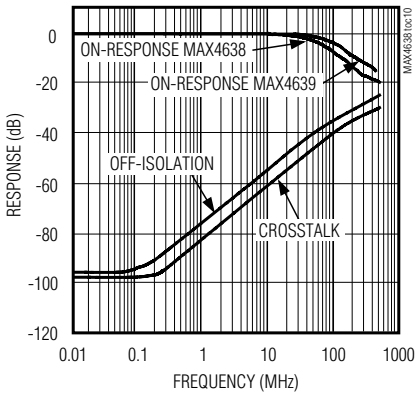


3.5Ω, Single 8:1 and Dual 4:1, Low-Voltage Analog Multiplexers

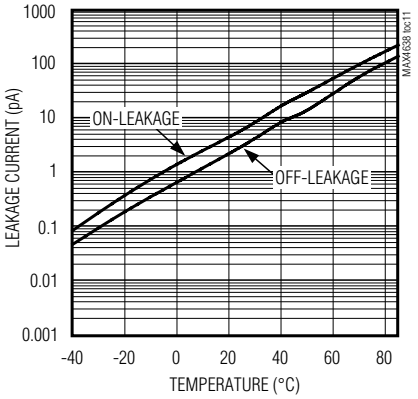
Typical Operating Characteristics (continued)

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

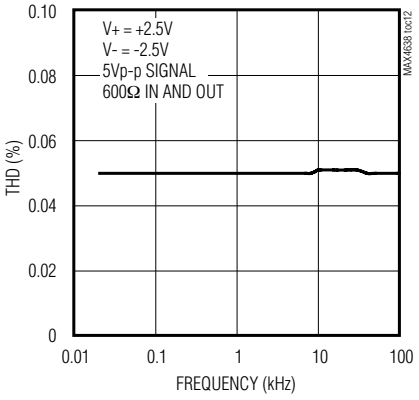
FREQUENCY RESPONSE



ON/OFF-LEAKAGE CURRENT vs. TEMPERATURE



TOTAL HARMONIC DISTORTION vs. FREQUENCY



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–N04	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-.

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.

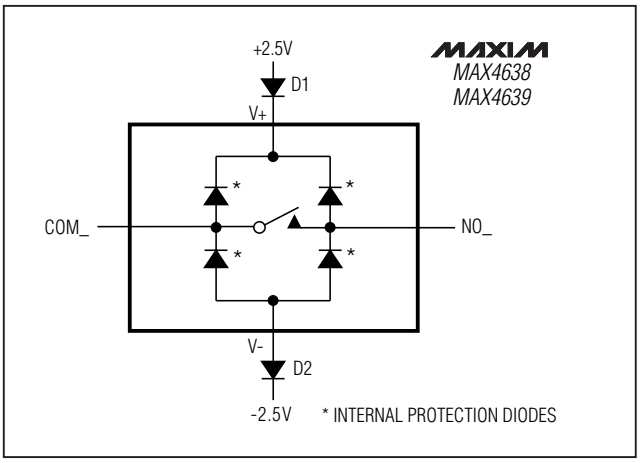


Figure 1. Overvoltage Protection Using External Blocking Diodes

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

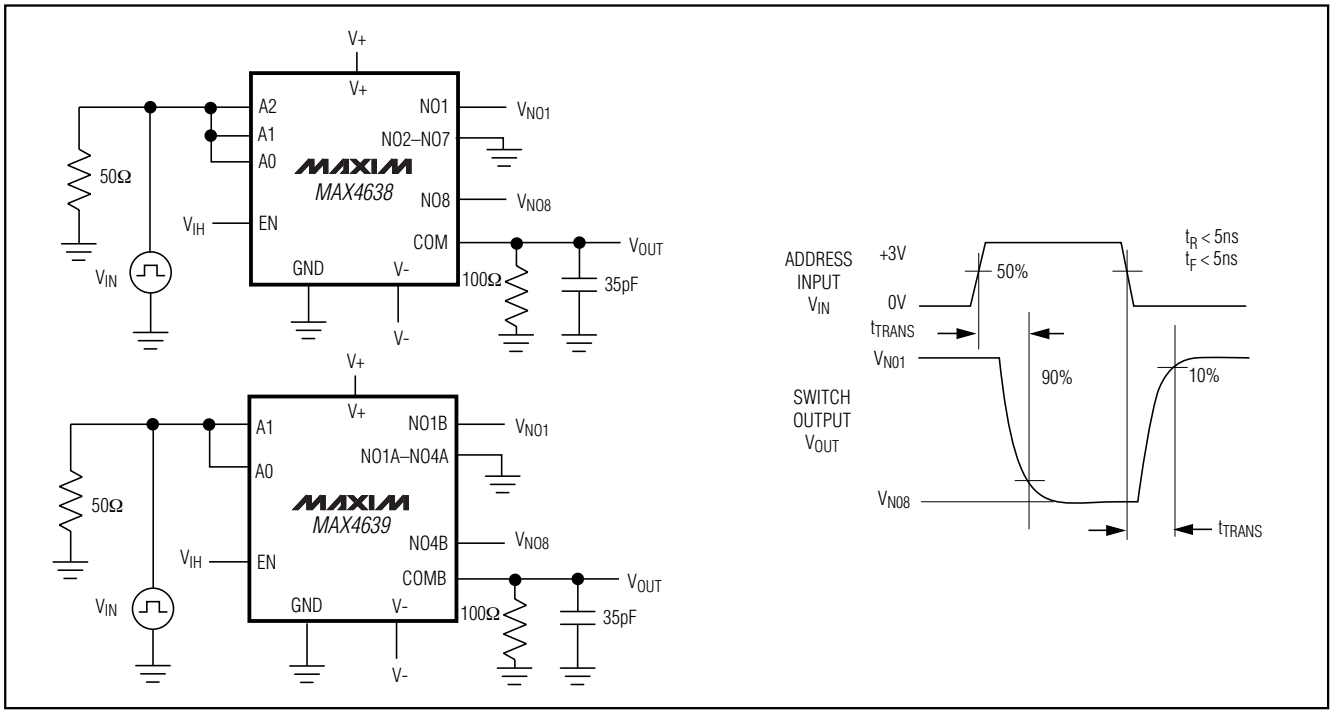


Figure 2. Transition Time

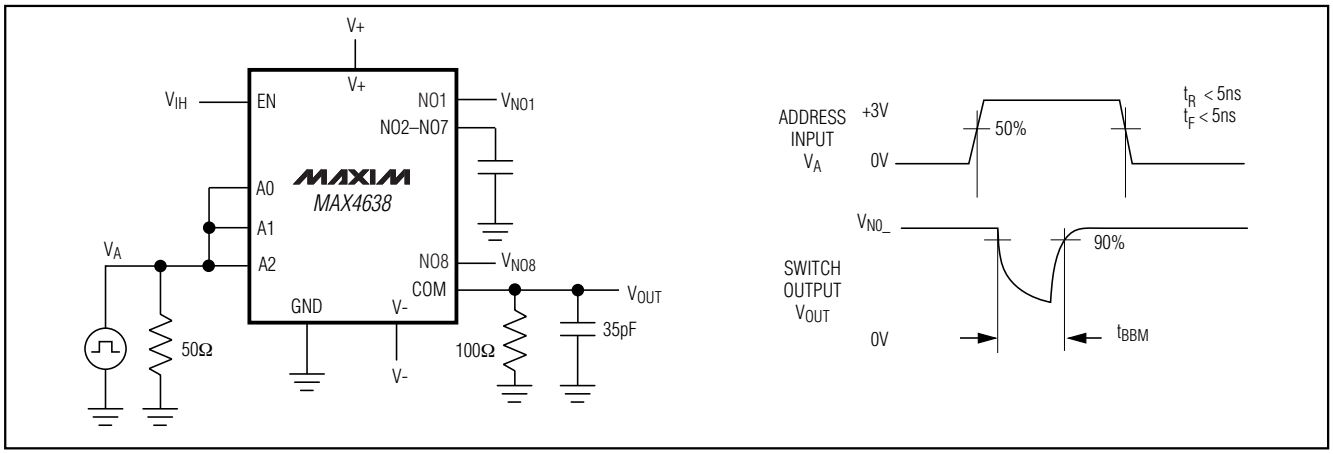


Figure 3. MAX4638 Break-Before-Make Interval

Test Circuits/Timing Diagrams (continued)

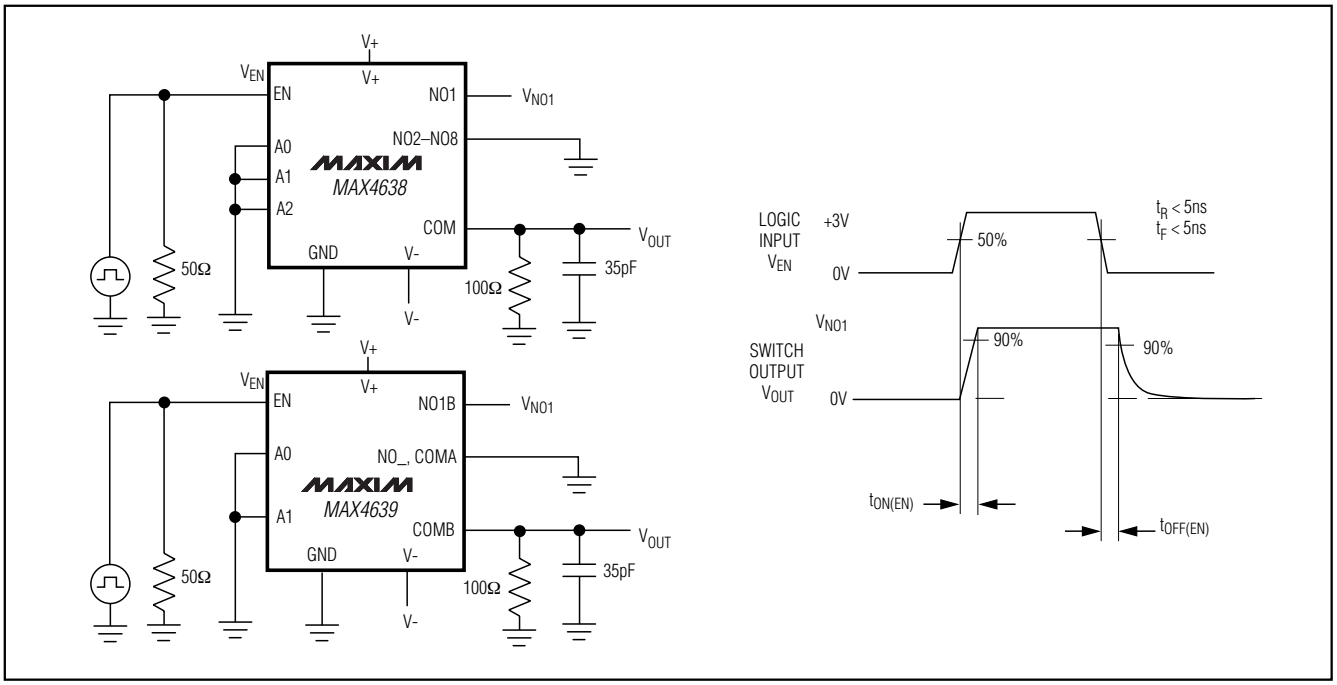


Figure 4. Enable Switching Time

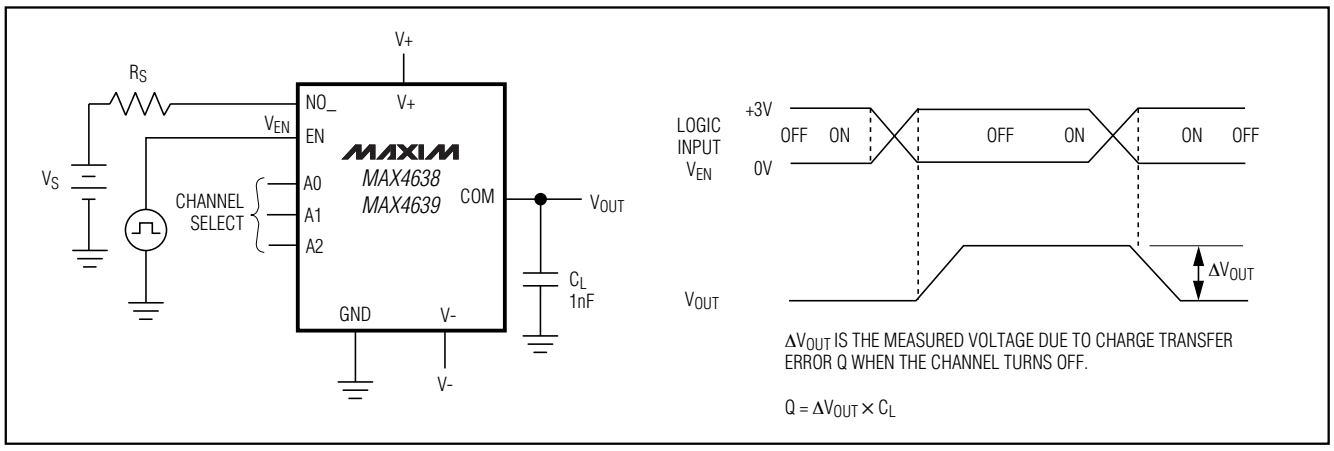


Figure 5. Charge Injection

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

Test Circuits/Timing Diagrams (continued)

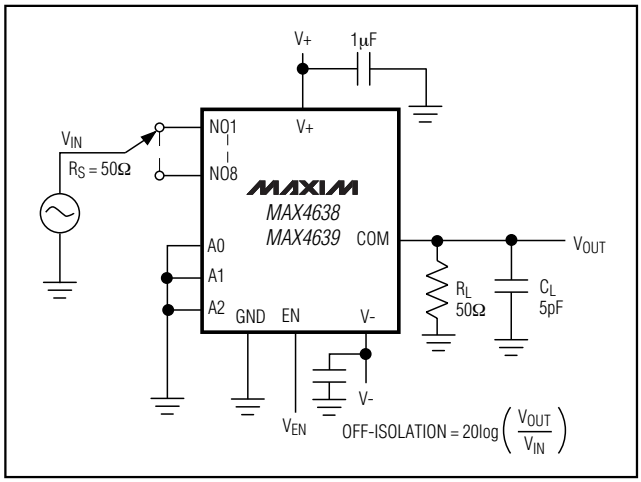


Figure 6. Off-Isolation/On-Channel Bandwidth

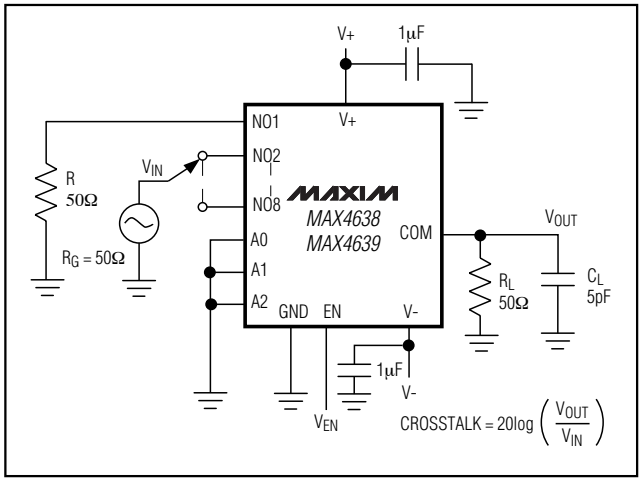


Figure 7. Crosstalk

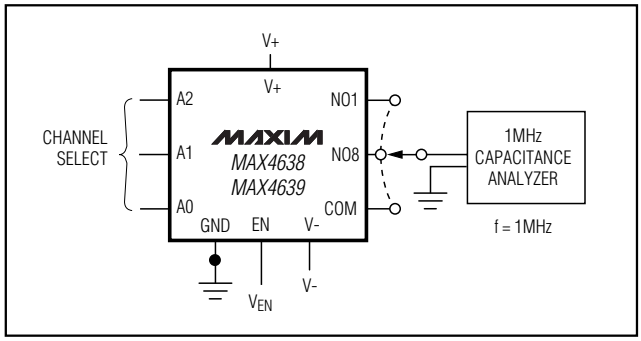


Figure 8. Channel Off/On-Capacitance

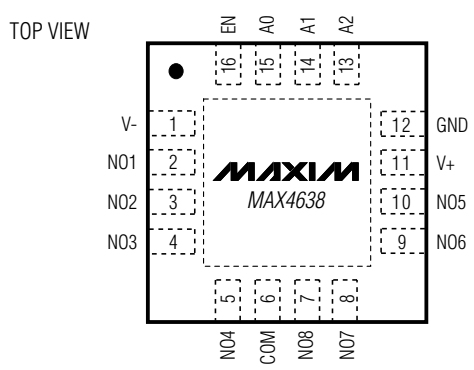
Chip Information

TRANSISTOR COUNT: 632

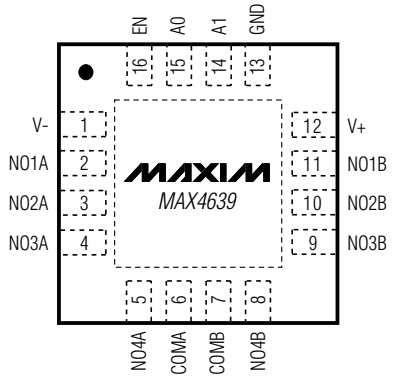
Note: *Exposed pad on thin QFN packages is connected to V-.*

Pin Configurations (continued)

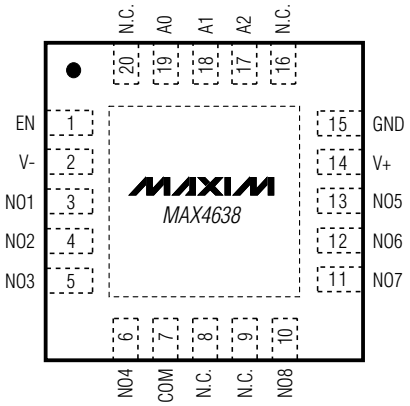
TOP VIEW



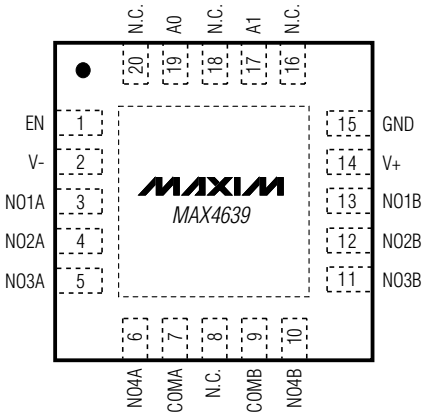
THIN QFN



THIN QFN



THIN QFN



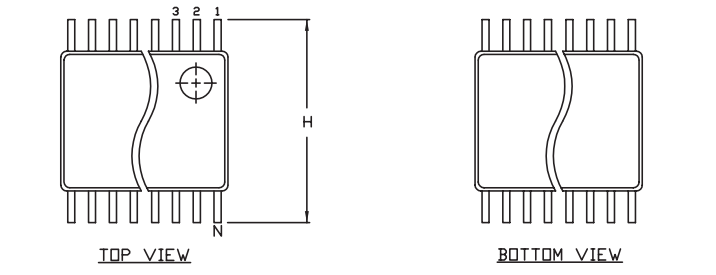
THIN QFN

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

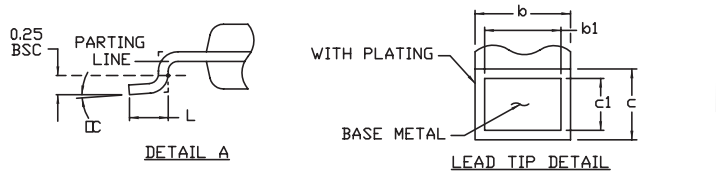
Package Information

(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**.)

TSSOP4.40mm.EPS



SYMBOL	COMMON DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	———	1.10		.043
A_1	0.05	0.15	.002	.006
A_2	0.85	0.95	.033	.037
b	0.19	0.30	.007	.012
b_1	0.19	0.25	.007	.010
c	0.09	0.20	.004	.008
c_1	0.09	0.14	.004	.006
D	SEE VARIATIONS		SEE VARIATIONS	
E	4.30	4.50	.169	.177
e	0.65 BSC		.026 BSC	
H	6.25	6.55	.246	.258
L	0.50	0.70	.020	.028
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°



JEDEC			VARIATIONS			
MO-153	N		MILLIMETERS		INCHES	
			MIN.	MAX.	MIN.	MAX.
AB-1	14	D	4.90	5.10	.193	.201
AB	16	D	4.90	5.10	.193	.201
AC	20	D	6.40	6.60	.252	.260
AD	24	D	7.70	7.90	.303	.311
AE	28	D	9.60	9.80	.378	.386

NOTES:
1. DIMENSIONS D AND E DO NOT INCLUDE FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm PER SIDE
3. CONTROLLING DIMENSION: MILLIMETER
4. MEETS JEDEC OUTLINE MO-153. SEE JEDEC VARIATIONS TABLE
5. "N" REFERS TO NUMBER OF LEADS
6. THE LEAD TIPS MUST LIE WITHIN A SPECIFIED ZONE. THIS TOLERANCE ZONE IS DEFINED BY TWO PARALLEL PLANES. ONE PLANE IS THE SEATING PLANE, DATUM [-C-], THE OTHER PLANE IS AT THE SPECIFIED DISTANCE FROM [-C-] IN THE DIRECTION INDICATED

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

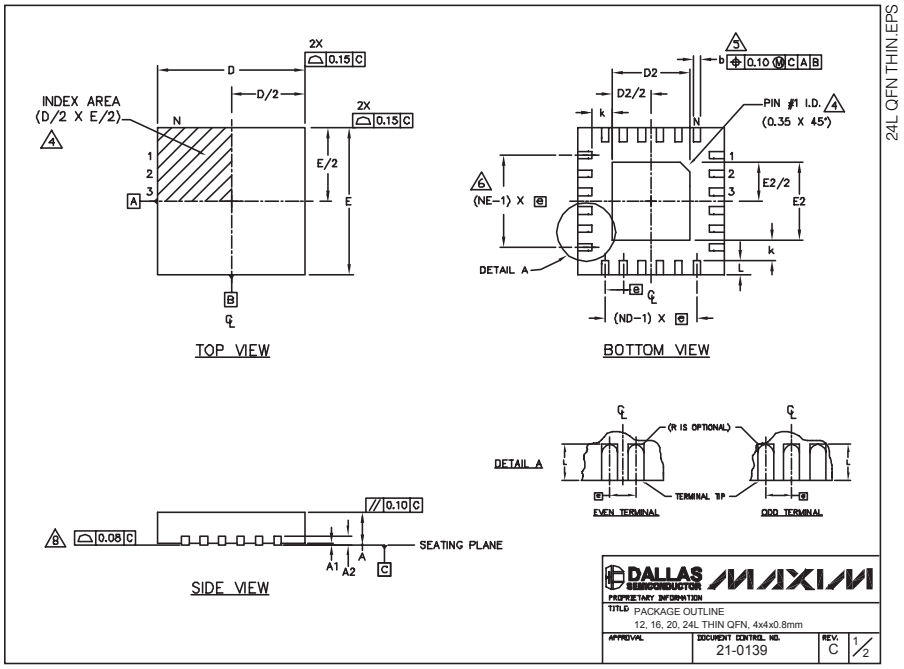
TITLE: PACKAGE OUTLINE, TSSOP 4.40mm BODY

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

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**.)

24L QFN THIN.EPS



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	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80
A1	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	0.45	0.55	0.65	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50
N	12			16			20			24		
ND	3			4			5			6		
NE	3			4			5			6		
Jedec Var.	WGGB			WGGC			WGGD-1			WGGD-2		

EXPOSED PAD VARIATIONS

PKG. CODES	D2			E2			DOWN BONDS ALLOWED
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	
T1244-2	1.95	2.10	2.25	1.95	2.10	2.25	NO
T1244-3	1.95	2.10	2.25	1.95	2.10	2.25	YES
T1244-4	1.95	2.10	2.25	1.95	2.10	2.25	NO
T1644-2	1.95	2.10	2.25	1.95	2.10	2.25	NO
T1644-3	1.95	2.10	2.25	1.95	2.10	2.25	YES
T1644-4	1.95	2.10	2.25	1.95	2.10	2.25	NO
T2044-1	1.95	2.10	2.25	1.95	2.10	2.25	NO
T2044-2	1.95	2.10	2.25	1.95	2.10	2.25	YES
T2044-3	1.95	2.10	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	2.10	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:

1. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 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.
5. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
6. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
8. COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
9. 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
2/2

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

Package Information (continued)

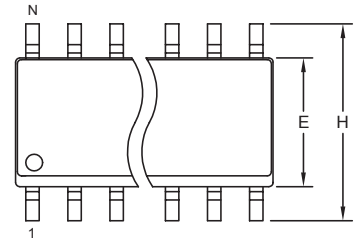
(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

SOICN .EPS

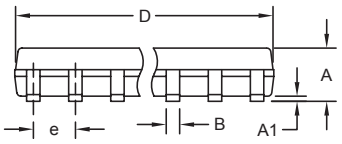
	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27

VARIATIONS:

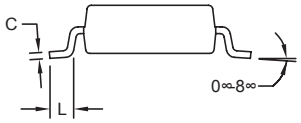
	INCHES		MILLIMETERS			
DIM	MIN	MAX	MIN	MAX	N	MS012
D	0.189	0.197	4.80	5.00	8	AA
D	0.337	0.344	8.55	8.75	14	AB
D	0.386	0.394	9.80	10.00	16	AC



TOP VIEW



FRONT VIEW



SIDE VIEW

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.

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, .150" SOIC

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0041	B	1/1

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