

General Description

The MAX4644 is a single-pole/double-throw (SPDT) switch that operates from a single supply ranging from +1.8V to +5.5V. It provides low 4Ω on-resistance (RoN) as well as 1Ω R_{ON} flatness over the entire analog-signal range. The MAX4644 offers fast switching times of less than 20ns while ensuring break-before-make operation. It typically consumes only 0.01µW of guiescent power, making it suitable for use in low-power, portable applications.

The MAX4644's features include low leakage currents over the entire temperature range, TTL/CMOS-compatible digital logic, and excellent AC characteristics. It is packaged in either a small 8-pin µMAX® or a tiny 6-pin SOT23.

Applications

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

µMAX is a registered trademark of Maxim Integrated Products, Inc.

Features

- ♦ +1.8V to +5.5V Single-Supply Operation
- ♦ Rail-to-Rail Analog-Signal Range
- **♦ Guaranteed Ron**

 4Ω max (+5V Supply)

8 Ω max (+3V Supply)

♦ +1.8V Operation

Ron 30 Ω (typ) Over Temperature ton 18ns (typ), toff 12ns typ

- ♦ Guaranteed Ron Flatness: 0.75Ω (typ) (+5V Supply)
- **♦** Guaranteed Ron Match Between Channels: 0.1Ω typ (+5V Supply)
- ♦ Low Leakage (< 0.35nA) Over Entire Temperature Range
- **♦ Excellent AC Characteristics**

Low Crosstalk: -82dB at 1MHz High Off-Isolation: -80dB at 1MHz 0.018% Total Harmonic Distortion

♦ Low Power Consumption: < 0.01μW

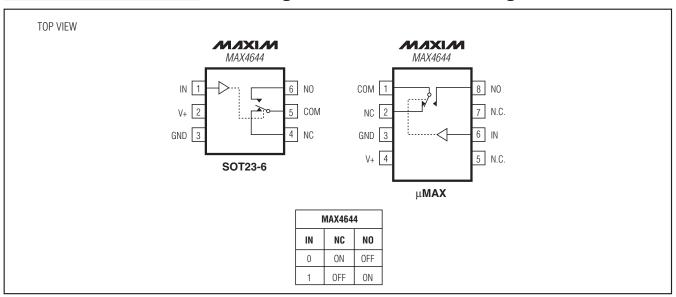
Ordering Information

PART	TEMP. RANGE PIN-PACKAGE		TOP MARK	
MAX4644EUT+T	-40°C to +85°C	6 SOT23	AAHQ	
MAX4644EUA+T	-40°C to +85°C	8 µMAX	_	

+Denotes a lead(Pb)-free/RoHS-compliant package.

T = Tape and reel.

Pin Configurations/Functional Diagrams/Truth Table



MIXIM

ABSOLUTE MAXIMUM RATINGS

(All voltages referenced to GND.)	
V+	0.3V to +6V
IN, COM, NO, NC (Note 1)	-0.3V to $(V+ + 0.3V)$
Continuous Current (any terminal)	±20mA
Continuous Current (NO, NC, and COM)	
Peak Current (NO, NC, and COM, pulsed at	t 1ms,
10% duty cycle)	±100mA

Continuous Power Dissipation ($T_A = +70^{\circ}$ C	C)
6-Pin SOT23 (derate 8.70mW/°C above	+70°C) 696mW
8-Pin μMAX (derate 4.5mW/°C above +	70°C) 362mW
Operating Temperature Range	40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Soldering Temperature (reflow)	+260°C

Note 1: Signals on NO, NC, COM, or IN exceeding V+ or GND are clamped by internal diodes. 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—Single +5V Supply

 $(V+ = +4.5V \text{ to } +5.5V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted.}$ Typical values are at $T_A = +25^{\circ}C.$)

PARAMETER	SYMBOL	CONI	MIN	TYP	MAX	UNITS	
ANALOG SWITCH		I		l			
Analog-Signal Range	VCOM, VNO, VNC			0		V+	V
On Registenes	Davi	V+ = 4.5V, ICOM =	T _A = +25°C		2.5	4	Ω
On-Resistance	Ron	10mA, V_{NO} or $V_{NC} = 0$ to V_{+}	$T_A = T_{MIN}$ to T_{MAX}			4.75	
On-Resistance Match		V+ = 4.5V, I _{COM} =	T _A = +25°C		0.1		
Between Channels (Note 2)	ΔR _{ON}	10mA , V_{NO} or $V_{\text{NC}} = 0$ to $V_{\text{+}}$	TA = TMIN to TMAX			0.4	Ω
On-Resistance Flatness (Note 3)		V+ = 4.5V, ICOM =	T _A = +25°C		0.75	1	Ω
	RFLAT	10mA, V _{NO} or V _{NC} = 0 to V+	TA = TMIN to TMAX			1.2	
NO, NC Off-Leakage	I _{NO(OFF)} ,	V+ = 5.5V, V _{COM} =	T _A = +25°C	-0.25	0.01	0.25	
Current (Note 4)	INC(OFF)	$1V \text{ or } 4.5V, V_{NO} \text{ or } V_{NC} = 4.5V \text{ or } 1V$	$T_A = T_{MIN}$ to T_{MAX}	-0.35		0.35	– nA
COM Off-Leakage Current		V+ = 5.5V, V _{COM} =	T _A = +25°C	-0.25	0.01	0.25	
(Note 4)	ICOM(OFF)	F) 1V or 4.5V, V_{NO} or $V_{NC} = 4.5V$ or 1V	TA = TMIN to TMAX	-0.35		0.35	- nA
COM On-Leakage Current	1	V+ = 5.5V, VCOM =	T _A = +25°C	-0.25	0.01	0.25	nA
(Notes 4, 5)	ICOM(ON)	1V or 4.5V	$T_A = T_{MIN}$ to T_{MAX}	-0.35		0.35	IIA
DIGITAL INPUTS							
Input-Logic High	VIH			2.4			V
Input-Logic Low	VIL					0.8	V
Input Current	I _{IN}	$V_{IN} = 0.8V \text{ or } 2.4V$		-0.1	0.005	0.1	μΑ

ELECTRICAL CHARACTERISTICS —Single +5V Supply (continued)

 $(V+ = +4.5V \text{ to } +5.5V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted.}$ Typical values are at $T_A = +25^{\circ}C.$)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DYNAMIC							ı
Turn-On Time (Note 4)	ton	$R_L = 300\Omega$; $C_L = 35pF$; V_{NO} , $V_{NC} = 3V$;	T _A = +25°C		11	15	ne
Tuiti-Oil Tillie (Note 4)	TON	Figure 2	TA = TMIN to TMAX			18	ns ns pC pF
Turn Off Time (Note 4)	torr	$R_L = 300\Omega$; $C_L = 35pF$; V_{NO} , $V_{NC} = 3V$;	T _A = +25°C		3	5	ne
Turn-Off Time (Note 4)	toff	Figure 2	$T_A = T_{MIN}$ to T_{MAX}			6	1115
Break-Before-Make (Note 4)	topus	$R_L = 300\Omega;$	T _A = +25°C		8		- ns
	t _{BBM}	$C_L = 35pF; V_{NO} \text{ or } V_{NC} = +3V; Figure 2$	TA = TMIN to TMAX	1			
Charge Injection	Q	VGEN = 0V, RGEN = 0V	, C _L = 1nF, Figure 4		5		рС
NO, NC Off-Capacitance	C _{NO} (OFF), C _{NC} (OFF)	NO or NC = GND, f = ⁻	1MHz, Figure 5		12		рF
Switch On-Capacitance	C _(ON)	f = 1MHz, Figure 5			34		рF
Off-Isolation (Note 6)	Viac	$C_L = 5pF$, $R_L = 50\Omega$,	f = 10MHz		-55		dB
OII-ISOIALIOII (Note 0)	V _{ISO}	Figure 3	f = 1MHz		-80		ив
Crosstally (Note 7)	$C_L = 5pF, R_L = 509$	$C_L = 5pF, R_L = 50\Omega,$	f = 10MHz		-62		dB
Crosstalk (Note 7)	VCT	Figure 3	f = 1MHz		-82		l ub
Total Harmonic Distortion	THD	$R_L = 600\Omega$, 0.5Vp-p, f = 20Hz to 20kHz			0.018		%
SUPPLY							
Positive Supply Current	l+	$V+ = 5.5V$, $V_{IN} = 0V$ or	$V + = 5.5V$, $V_{IN} = 0V$ or $V +$		0.001	1.0	μΑ

ELECTRICAL CHARACTERISTICS—Single +3V Supply

 $(V+=+2.7V \text{ to } +3.3V, V_{INH}=2.0V, V_{INL}=0.4V, T_A=T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted.}$ Typical values are at $T_A=+25^{\circ}C.)$

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog-Signal Range	V _{COM} , V _{NO} , V _{NC}			0		V+	>
On-Resistance	Ron	V+ = 2.7V, I _{COM} = 10mA, V _{NO} or	T _A = +25°C		6	8	Ω
	HON	$V_{NC} = 0 \text{ to } V_{+}$	$T_A = T_{MIN}$ to T_{MAX}			9	
On-Resistance Match	ΔRon	V+ = 2.7V, I _{COM} = 10mA, V _{NO} or	T _A = +25°C		0.1		Ω
Between Channels (Note 2)	ΔΠΟΝ	$V_{NC} = 0 \text{ to } V_{+}$	$T_A = T_{MIN}$ to T_{MAX}			0.4	22
On-Resistance Flatness (Note 3)	RFLAT	V+ = 2.7V, ICOM = 10mA, V _{NO} or	T _A = +25°C		1.5	3	Ω
	TIPLAT	$V_{NC} = 0 \text{ to } V_{+}$	$T_A = T_{MIN}$ to T_{MAX}			3.5	Ω

ELECTRICAL CHARACTERISTICS—Single +3V Supply (continued)

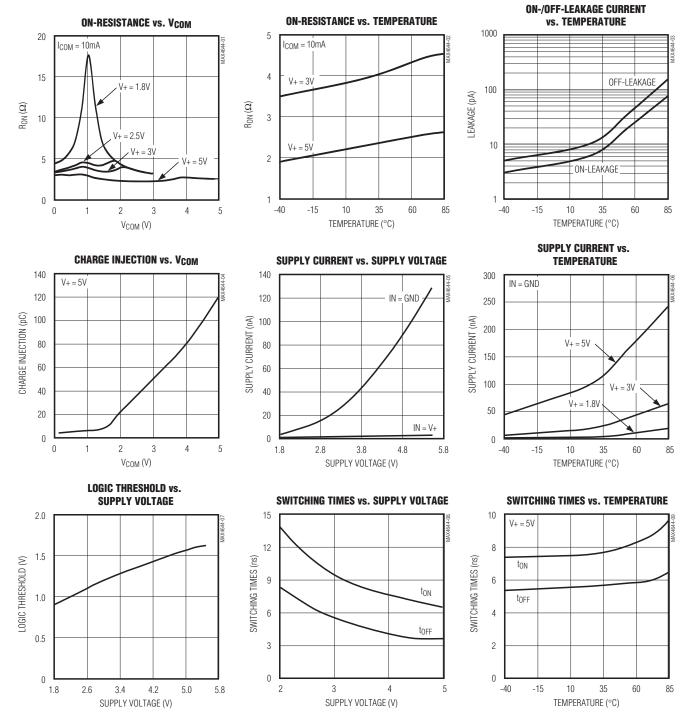
 $(V + = +2.7 \text{V to } +3.3 \text{V}, V_{\text{INH}} = 2.0 \text{V}, V_{\text{INL}} = 0.4 \text{V}, T_{\text{A}} = T_{\text{MIN}} \text{ to } T_{\text{MAX}}, \text{ unless otherwise noted.}$ Typical values are at $T_{\text{A}} = +25 ^{\circ}\text{C.}$)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DIGITAL INPUTS				<u>'</u>			
Input-Logic High	VIH			2.0			V
Input-Logic Low	V _I L					0.4	V
Input Current	liN	V _{IN} = 0.4V or 2.0V		-0.1	0.005	0.1	μA
DYNAMIC							
Turn-On Time (Note 4)	ton	$R_L = 300\Omega; C_L = 35pF; V_{NO}, V_{NC} = 2V;$	T _A = +25°C		14	20	ns
Turn-On Time (Note 4)	TON	Figure 2	$T_A = T_{MIN}$ to T_{MAX}			22	113
T Off Time - (NI-t- 4)	+055	$R_L = 300\Omega$; $C_L =$	T _A = +25°C		4	7.5	no
Turn-Off Time (Note 4)	_ I	35pF; V _{NO} , V _{NC} = 2V; T _A	TA = TMIN to TMAX			8	ns
D D (M (N : 1)	*	$R_L = 300\Omega$; $C_L =$	T _A = +25°C		8		20
Break-Before-Make (Note 4)	t _{BBM}	35pF; V_{NO} , $V_{NC} = 2V$; Figure 2	TA = TMIN to TMAX	1			ns
Charge Injection	Q	VGEN = 0V, RGEN = 0V	, C _L = 1nF, Figure 4		5		рС
NO, NC Off-Capacitance	CNO(OFF), CNC(OFF)	NO or NC = GND, f =	1MHz, Figure 5		12		pF
Switch On-Capacitance	C _(ON)	f = 1MHz, Figure 5			34		pF
Off-Isolation (Note 6)	V _{ISO}	$C_L = 5pF, R_L = 50\Omega,$	f = 10MHz		-55		dB
On-isolation (Note 6)	VISO	Figure 3	f = 1MHz		-80		ub
Crosstalk (Note 7)	Vст	$C_L = 5pF, R_L = 50\Omega,$	f = 10MHz		-62		- dB
Orosotalit (Note 1)	VC1	Figure 3	f = 1MHz		-82		QD
SUPPLY							
Positive Supply Current	I+	$V+ = 3.3V, V_{IN} = 0V \text{ or}$	V+		0.001	1.0	μΑ

- **Note 2:** $\Delta R_{ON} = R_{ON(MAX)} R_{ON(MIN)}$.
- **Note 3:** R_{ON} flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog-signal range.
- Note 4: Guaranteed by design.
- Note 5: On-Leakage performed with voltage applied to COM, with NO and NC left unconnected.
- Note 6: Off-Isolation = $20log_{10}$ (V_O / V_I), where V_O is V_{COM} and V_I is either V_{NC} or V_{NO} from the network analyzer.
- Note 7: Crosstalk is measured between the two switches.

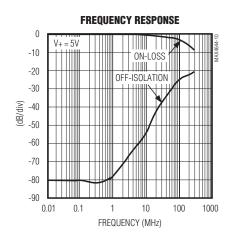
Typical Operating Characteristics

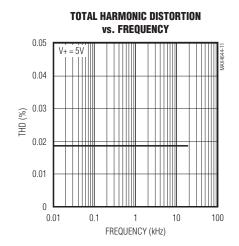
 $(V+ = +5V \text{ or } +3V, V_{INH} = V+, INL = GND, T_A = +25^{\circ}C, \text{ unless otherwise noted.})$



Typical Operating Characteristics (continued)

 $(V+ = +5V \text{ or } +3V, V_{INH} = V+, INL = GND, T_A = +25^{\circ}C, unless otherwise noted.)$





Pin Description

MA	X4644	NAME	FUNCTION
SOT23	μМАХ	NAME	FUNCTION
1	6	IN	Logic-Controlled Input
2	4	V+	Positive Supply Voltage Input. Bypass with a 0.1µF capacitor to GND.
3	3	GND	Ground
_	5, 7	N.C.	No Connection. Not internally connected.
4	2	NC	Analog-Switch Normally Closed Terminal
5	1	COM	Analog-Switch Common Terminal
6	8	NO	Analog-Switch Normally Open Terminal

Note: The switches are bidirectional, which means that a signal can be passed through either side of the on switch. However, the typical off-capacitances differ as shown in the *Electrical Characteristics*.

6 ______ /I/XI/M

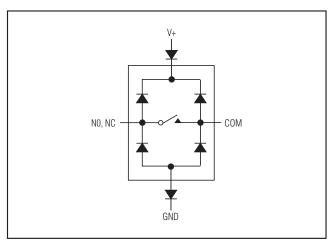


Figure 1. Overvoltage Protection Using External Blocking Diodes

Applications Information

The MAX4644 operates from a single supply ranging from +1.8V to +5.5V. The device is guaranteed to be functional over that supply range, but TTL/CMOS compatibility is only valid for operation using a +5V supply. All voltage levels are referenced to GND. Positive and negative DC analog inputs or AC signals can be accommodated by shifting V+ and GND.

ESD-protection diodes are internally connected between each analog-signal pin and both V+ and GND. One of these diodes conducts if any analog signal exceeds V+ or GND (Figure 1). Virtually all of the analog leakage current comes from the ESD diodes to V+

or GND. Although the ESD diodes on a given signal pin are identical, and therefore fairly well balanced, they are reverse biased differently. Each is biased by either V+ or GND and the analog signal. This means their leakages will vary as the signal varies. The difference in the two diode leakages to the V+ and GND pins constitutes the analog-signal-path leakage current. All analog leakage current flows between each pin and one of the supply terminals, not to the other switch terminal. This is why both sides of a given switch can show leakage currents of the same or opposite polarity.

There is no normal current path between the analog-signal paths and V+ or GND. V+ and GND also power the internal logic and logic-level translators. The logic-level translators convert the logic level into switched V+ and GND signals to drive the analog signal gates.

_____Chip Information

PROCESS: BiCMOS

Package Information

For the latest package outline information and land patterns (footprints), go to **www.maxim-ic.com/packages**. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	OUTLINE NO.	LAND PATTERN NO.
6 SOT23	U6+4	21-0058	<u>90-0175</u>
8 µMAX	U8+1	21-0036	90-0092

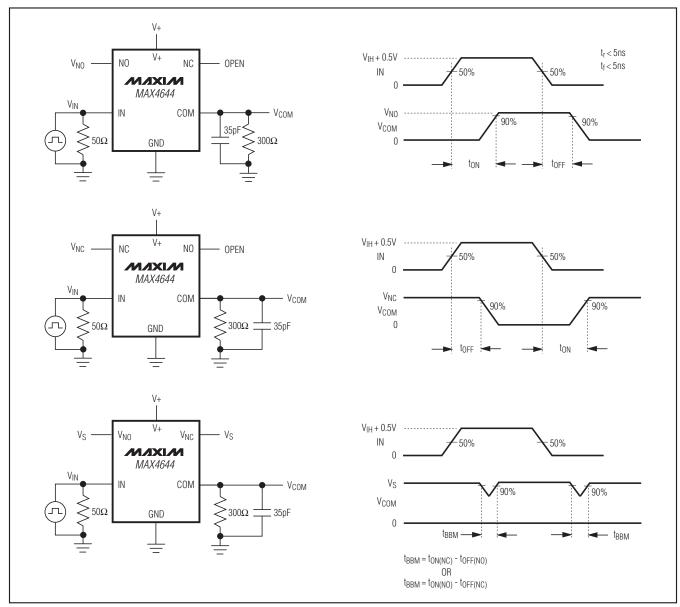


Figure 2. Switching Times

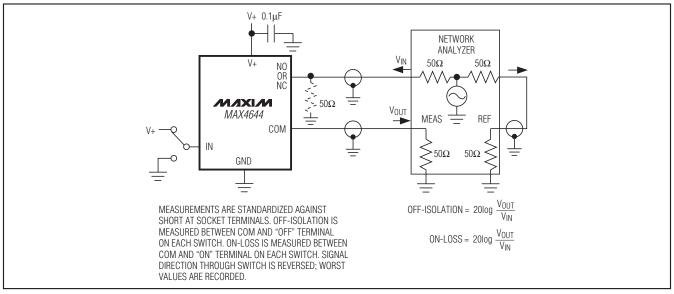


Figure 3. Off-Isolation and On-Loss

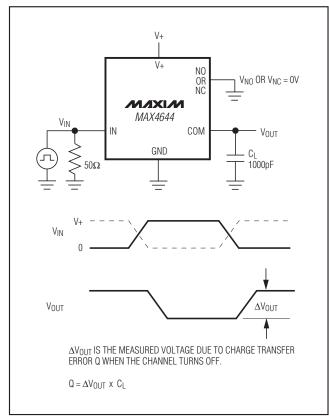


Figure 4. Charge Injection

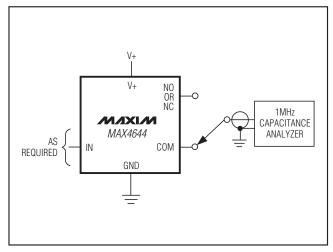


Figure 5. NO, NC, and COM Capacitance

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/00	Initial release	_
1	1/11	Added lead-free parts to the Ordering Information table	1

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ПОСТАВКА ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

многоканальный

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