

MAX4729/MAX4730

Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

Features

General Description

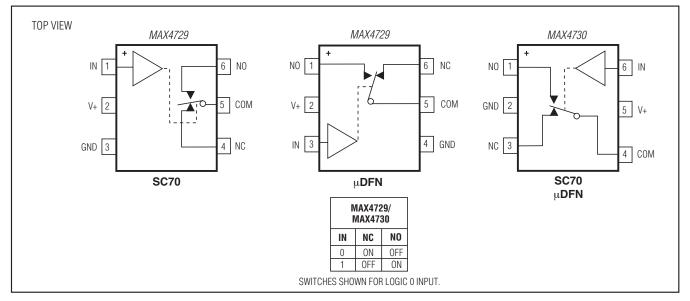
The MAX4729/MAX4730 single-pole/double-throw (SPDT) switches operate from a single supply ranging from +1.8V to +5.5V. These switches provide low 3.5Ω on-resistance (R_{ON}), as well as 0.45Ω R_{ON} flatness with a +2.7V supply. These devices typically consume only 1nA of supply current, making them ideal for use in low-power, portable applications. The MAX4729/MAX4730 feature low-leakage currents over the extended temperature range, TTL/CMOS-compatible digital logic, and excellent AC characteristics.

The MAX4729/MAX4730 are available in small 6-pin SC70 and 6-pin μ DFN packages. The MAX4729/MAX4730 are offered in three pinout configurations to ease design. The MAX4729/MAX4730 are specified over the extended -40°C to +85°C temperature range.

Applications

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

- Low 3.5Ω RON (+2.7V Supply)
- ♦ 0.45Ω Ron Flatness (+2.7V Supply)
- 0.05Ω RON Match Between Channels (+2.7V Supply)
- Tiny SC70 and µDFN Packages
- -3dB Bandwidth: 300MHz
- Low On-Capacitance: 19.5pF
- 0.036% Total Harmonic Distortion
- Low Supply Current: 1nA
- +1.8V to +5.5V Single-Supply Operation



For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at www.maximintegrated.com.

Pin Configurations/Functional Diagrams/Truth Table

MAX4729/MAX4730

Low-Voltage 3.5 Ω , SPDT, CMOS Analog Switches

ABSOLUTE MAXIMUM RATINGS

(All voltages referenced to ground.)

V+, IN	0.3V to +6V
COM, NO, NC (Note 1)	0.3V to (V+ +0.3V)
Continuous Current (IN, V+, GND)	±30mA
Continuous Current (COM, NO, NC)	±80mA
Peak Current COM, NO, NC	
(Pulsed at 1ms, 10% Duty Cycle)	±150mA

Continuous Power Dissipation ($T_A = +70^{\circ}C$)	
µDFN (derate 2.1mW/°C above +70°C)	168mW
SC70 (derate 3.1mW/°C above +70°C)	245mW
Operating Temperature Range	40°C to +85°C
Maximum Junction Temperature	+150°C
Storage Temperature Range	65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Soldering Temperature (reflow)	

Note 1: Signals on NO, NC, or COM exceeding V+ or GND are clamped by internal diodes. Signals on IN exceeding GND are clamped by an internal diode. 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

 $(V + = +2.7V \text{ to } +3.6V, V_{IH} = +2.0V, V_{IL} = +0.4V, T_A = -40^{\circ}C \text{ to } +85^{\circ}C, \text{ unless otherwise noted. Typical values are at T_A = +25^{\circ}C.)$ (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	ТҮР	МАХ	UNITS
ANALOG SWITCH							
Analog Signal Range	V _{COM} , V _{NO,} V _{NC}			0		V+	V
On-Resistance (Note 6)	Ron	V+ = 2.7V, I _{COM} = 10mA,	$T_A = +25^{\circ}C$		3.5	5.5	Ω
On-nesisiance (Note 0)	HON	$V_{NO} \text{ or } V_{NC} = 0V \text{ to } V+$	$T_A = -40^{\circ}C \text{ to } +85$			5.7	52
		$V_{+} = 2.7V, I_{COM} = 10mA, V_{NO} \text{ or } V_{NC} = 0.7V, 1.2V, 2V$	$T_A = +25^{\circ}C$		0.05	0.15	
On-Resistance Match Between Channels	ΔR _{ON}	(MAX4729)	$T_A = -40^{\circ}C \text{ to } +85$			0.2	0
(Notes 3, 6)	AHON	$V_{+} = 2.7V, I_{COM} = 10mA,$	$T_A = +25^{\circ}C$		0.2	0.34	Ω
		V _{NO} or V _{NC} = 0.7V, 1.2V, 2V (MAX4730)	$T_A = -40^{\circ}C \text{ to } +85$			0.37	
	Rflat(on)	$V_{+} = 2.7V, I_{COM} = 10mA, V_{NO} \text{ or } V_{NC} = 0.7V, 1.2V, 2V$ (MAX4729)	$T_A = +25^{\circ}C$		0.8	1.5	Ω
On-Resistance Flatness (Note 4)			$T_A = -40^{\circ}C \text{ to } +85$			2.2	
		$V_{+} = 2.7V, I_{COM} = 10mA, V_{NO} \text{ or } V_{NC} = 0.7V, 1.2V, 2V$ (MAX4730)	$T_A = +25^{\circ}C$		0.45	0.95	
			$T_A = -40^{\circ}C \text{ to } +85$			1.3	
NO, NC Off-Leakage	I _{NO} (OFF),	V+ = 3.3V, V _{COM} = 1V, 3V,	$T_A = +25^{\circ}C$	-2	+0.01	+2	
Current	INC (OFF)	$V_{NO} \text{ or } V_{NC} = 3V, 1V$	$T_A = -40^{\circ}C \text{ to } +85$	-3		+3	nA
		$3V$, V_{NO} or $V_{NC} = 1V$, $3V$, or	$T_A = +25^{\circ}C$	-3	+0.01	+3	nA
COM On-Leakage Current	ICOM (ON)		$T_A = -40^{\circ}C \text{ to } +85$	-4		+4	
DIGITAL INPUTS							
Input Logic High	VIH		$T_A = -40^{\circ}C \text{ to } +85$	2.0			V
Input Logic Low	VIL		$T_A = -40^{\circ}C \text{ to } +85$			0.4	V
Input Leakage Current	lin	V _{IN} = 0V or 3.6V	$T_A = -40^{\circ}C \text{ to } +85$	-1	+0.005	+1	μA

ELECTRICAL CHARACTERISTICS (continued)

 $(V + = +2.7V \text{ to } +3.6V, V_{IH} = +2.0V, V_{IL} = +0.4V, T_A = -40^{\circ}\text{C} \text{ to } +85^{\circ}\text{C}, \text{ unless otherwise noted}. Typical values are at T_A = +25^{\circ}\text{C}.)$ (Note 2)

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	ТҮР	МАХ	UNITS	
DYNAMIC							•	
		$V_{NO}, V_{NC} = 2V, R_{L} = 300\Omega,$	$T_A = +25^{\circ}C$		18	45	ns	
Turn-On Time (Note 5)	ton	C _L = 35pF, Figure 1	$T_A = -40^{\circ}C \text{ to } +85$			45		
Turn-Off Time (Note 5)	torr	$V_{NO}, V_{NC} = 2V, R_L = 300\Omega,$	$T_A = +25^{\circ}C$		10	26		
rum-On nine (Note 5)	tOFF	$C_L = 35 pF$, Figure 1	$T_A = -40^{\circ}C \text{ to } +85$			26	ns	
Break-Before-Make (Note 5)		$V_{NO}, V_{NC} = 2V, R_L = 300\Omega,$	$T_A = +25^{\circ}C$		5		00	
Dicar Defore Mare (Note 5)		$C_L = 35 pF$, Figure 1	$T_A = -40^{\circ}C \text{ to } +85$	1			ns	
Charge Injection	Q	$V_{GEN} = 0V, R_{GEN} = 0, C_{L} = 1$	I.0nF, Figure 3		3		рС	
NO, NC Off-Capacitance	C _{NO(OFF)} , C _{NC(OFF)}	f = 1MHz, Figure 4		6.5		рF		
Switch On-Capacitance	CON	f = 1MHz, Figure 4			19.5		рF	
Off-Isolation (Note 7)	VISO	$V_{NO} = V_{NC} = 1V_{RMS}$, $R_L =$	f = 1MHz		-67		dB	
	VISO	50Ω , C _L = 5pF, Figure 2	f = 10MHz		-45		uв	
On-Channel Bandwidth -3dB	BW	Signal = 0dBm, 50Ω in and o	Signal = 0dBm, 50Ω in and out, Figure 2		300		MHz	
Crosstalk (Note 8)	V _{CT}	NO or NC = $1V_{RMS}$, C _L =	f = 1MHz		-67		dB	
	VCT	5pF, R _L = 50 Ω , Figure 2	f = 10MHz		-52		GD	
Total Harmonic Distortion	THD	$ \begin{array}{l} R_L = 600\Omega, V_{NC} \text{or} V_{NO} = \\ 2V_{P\text{-}P}, f = 20 \text{Hz} \text{to} 20 \text{KHz} \end{array} + 25^\circ \text{C} \end{array} $			0.035		%	
POWER SUPPLY								
Power-Supply Range	V+			1.8		5.5	V	
Positive Supply Current	+	V+ = 5.5V, V _{IN} = 0V or 5.5V	$T_A = +25^{\circ}C$		0.001			
r ositive supply current	1+	v + - 3.5v, v N = 0v 01 5.5v	$T_A = -40^{\circ}C \text{ to } +85$			1	μA	

Note 2: SC70 and μ DFN parts are 100% tested at T_A = +25°C. Limits across the full-temperature range are guaranteed by design and correlation.

Note 3: $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$.

Note 4: R_{ON} flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

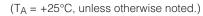
Note 5: Guaranteed by design.

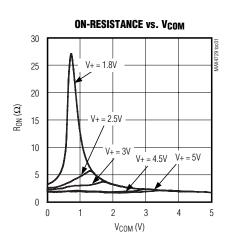
Note 6: µDFN is guaranteed by design.

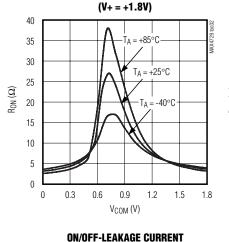
Note 7: Off-Isolation = 20log10 (VO / VI), where VO is V_{COM} and VI is either V_{NC} or V_{NO} from the network analyzer.

Note 8: Crosstalk is measured between the two switches.

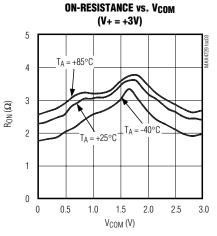
Typical Operating Characteristics



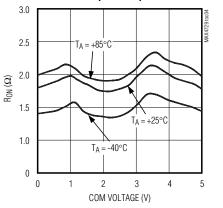


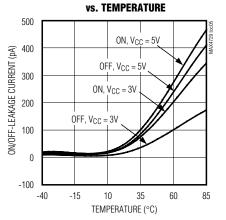


ON-RESISTANCE vs. VCOM

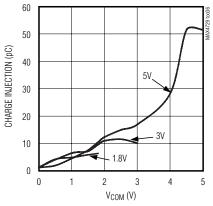


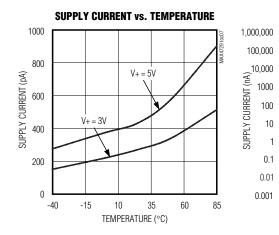
ON-RESISTANCE vs. V_{COM} (V+ = +5V)



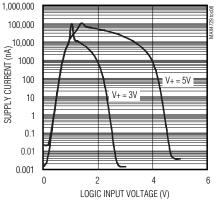


CHARGE INJECTION vs. V_{COM}

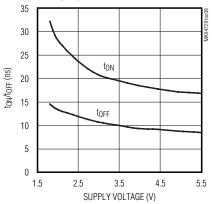


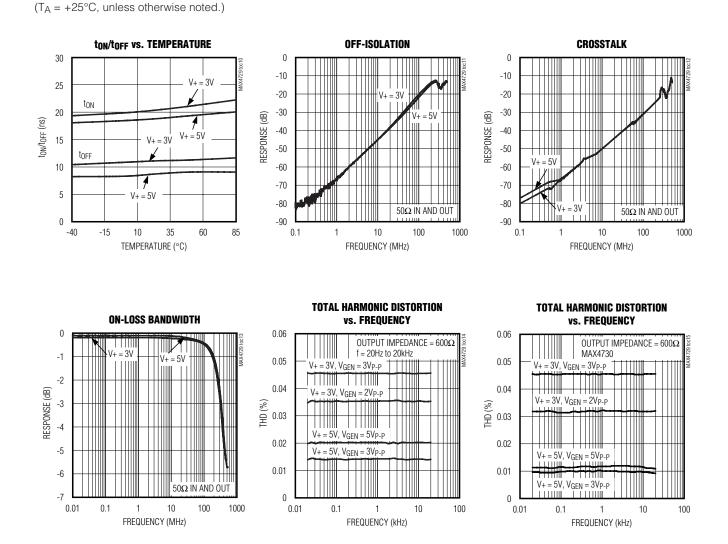






ton/toff vs. SUPPLY VOLTAGE





Typical Operating Characteristics (continued)

Pin Description

	PIN				
MAX	4729	MAX4730	NAME	FUNCTION	
SC70	μDFN	SC70/µDFN			
1	3	6	IN	Logic-Control Input	
2	2	5	V+	Positive Supply Voltage	
3	4	2	GND	Ground	
4	6	3	NC	Analog Switch Normally Closed Terminal	
5	5	4	COM	Analog Switch Common Terminal	
6	1	1	NO	Analog Switch Normally Open Terminal	

Detailed Description

The MAX4729/MAX4730 single-pole/double-throw (SPDT) switches operate from a single supply ranging from +1.8V to +5.5V. These switches provide low 3.5Ω on-resistance (R_{ON}), as well as 0.45Ω R_{ON} flatness with a 2.7V supply. These devices typically consume only 1nA of supply current, making them suitable for use in low-power, portable applications. The MAX4729/MAX4730 feature low-leakage currents over the entire temperature range, TTL/CMOS-compatible digital logic, and excellent AC characteristics.

Applications Information

Digital Control Inputs

The MAX4729/MAX4730 logic inputs accept up to +5.5V, regardless of supply voltage. For example, with a +3.3V

supply, IN can be driven low to GND and high to +5.5V, allowing for mixing of logic levels in a system. With a 2.7V to 3.6V power-supply voltage range, the logic thresholds are set so $V_{IL} = 0.4V$ (max) and $V_{IH} = 2V$ (min).

Power-Supply Sequencing and Overvoltage Protection

Caution: Do not exceed the absolute maximum ratings because stresses beyond the listed ratings can cause permanent damage to the device. Proper power-supply sequencing is recommended for all CMOS devices. Always apply V+ before applying analog signals, especially if the analog signal is not current limited.

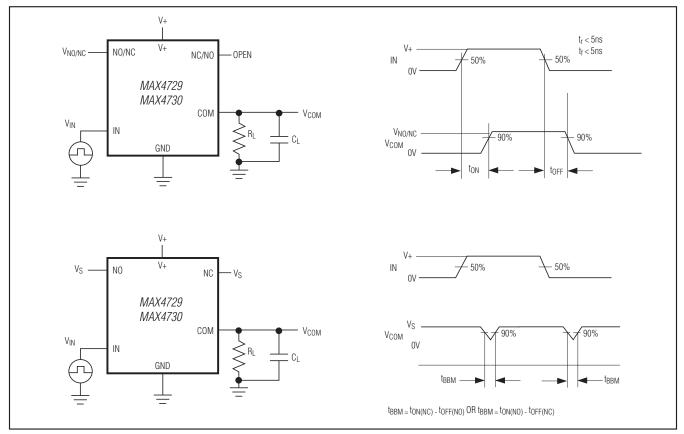


Figure 1. Switching Times

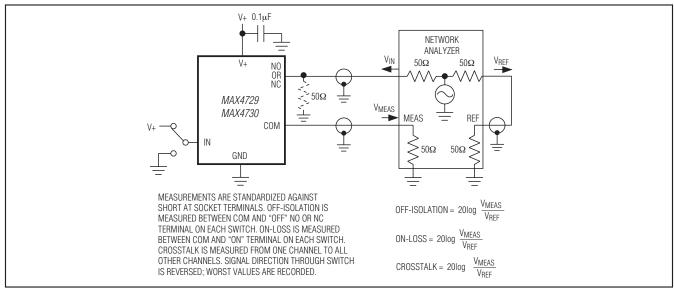


Figure 2. Off-Isolation/On-Loss Bandwidth, Crosstalk

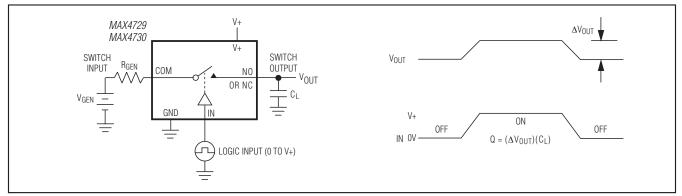


Figure 3. Charge Injection

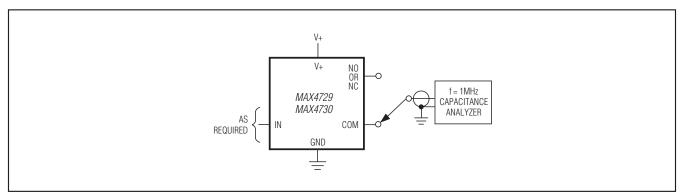


Figure 4. NO, NC, and COM Capacitance

Chip Information

PROCESS: CMOS

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX4729EXT+T	-40°C to +85°C	6 SC70
MAX4729ELT+T	-40°C to +85°C	6 µDFN
MAX4730EXT+T	-40°C to +85°C	6 SC70
MAX4730ELT+T	-40°C to +85°C	6 µDFN

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

Package Information

For the latest package outline information and land patterns (footprints), go to <u>www.maximintegrated.com/packages</u>. 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 SC70	X6SN+1	<u>21-0077</u>	<u>90-0189</u>
6 µDFN	L611+1	<u>21-0147</u>	<u>90-0080</u>

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
2	6/14	ELT+ production status corrected	—



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