19-3284; Rev 0; 5/04

Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

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 µDFN 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

Features

- **Low 3.5Ω R_{ON} (+2.7V Supply)**
- **0.45Ω R_{ON} Flatness (+2.7V Supply)**
- **0.05Ω R_{ON} 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**

Ordering Information

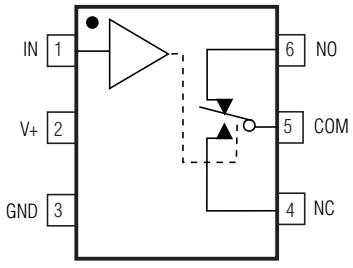
PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX4729EXT-T	-40°C to +85°C	6 SC70-6	ABU
MAX4729ELT-T*	-40°C to +85°C	6 µDFN-6	—
MAX4730EXT-T	-40°C to +85°C	6 SC70-6	ABV
MAX4730ELT-T*	-40°C to +85°C	6 µDFN-6	—

**Future product—contact factory for availability.*

Pin Configurations/Functional Diagrams/Truth Table

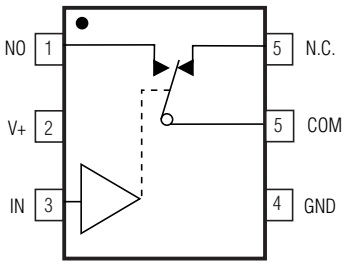
TOP VIEW

MAXIM MAX4729



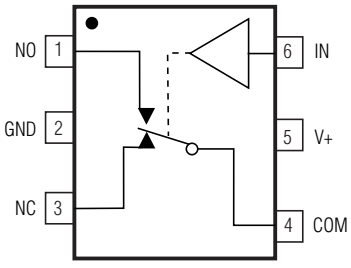
SC70

MAXIM MAX4729



µDFN

MAXIM MAX4730



SC70
µDFN

MAX4729/MAX4730		
IN	**NC**	**NO**
0	ON	OFF
1	OFF	ON

SWITCHES SHOWN FOR LOGIC 0 INPUT.

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.

Low-Voltage 3.5Ω, 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°C)
6-Pin µDFN (derate 2.1mW/°C above +70°C) 168mW
6-Pin 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

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 to +3.6V, V_{IH} = +2.0V, V_{IL} = +0.4V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{COM}, V_{NO}, V_{NC}			0		V+	V
On-Resistance (Note 6)	R_{ON}	V+ = 2.7V, I_{COM} = 10mA, V_{NO} or V_{NC} = 0V to V+	+25°C		3.5	5.5	Ω
			T_{MIN} to T_{MAX}			5.7	
On-Resistance Match Between Channels (Notes 3, 6)	ΔR_{ON}	V+ = 2.7V, I_{COM} = 10mA, V_{NO} or V_{NC} = 0.7V, 1.2V, 2V (MAX4729)	+25°C		0.05	0.15	Ω
			T_{MIN} to T_{MAX}			0.2	
		V+ = 2.7V, I_{COM} = 10mA, V_{NO} or V_{NC} = 0.7V, 1.2V, 2V (MAX4730)	+25°C		0.2	0.34	
			T_{MIN} to T_{MAX}			0.37	
On-Resistance Flatness (Note 4)	$R_{FLAT(ON)}$	V+ = 2.7V, I_{COM} = 10mA, V_{NO} or V_{NC} = 0.7V, 1.2V, 2V (MAX4729)	+25°C		0.8	1.5	Ω
			T_{MIN} to T_{MAX}			2.2	
		V+ = 2.7V, I_{COM} = 10mA, V_{NO} or V_{NC} = 0.7V, 1.2V, 2V (MAX4730)	+25°C		0.45	0.95	
			T_{MIN} to T_{MAX}			1.3	
NO, NC Off-Leakage Current	$I_{NO (OFF)}$, $I_{NC (OFF)}$	V+ = 3.3V, V_{COM} = 1V, 3V, V_{NO} or V_{NC} = 3V, 1V	+25°C	-2	+0.01	+2	nA
			T_{MIN} to T_{MAX}	-3		+3	
COM On-Leakage Current	$I_{COM (ON)}$	V+ = 3.3V, V_{COM} = 1V or 3V, V_{NO} or V_{NC} = 1V, 3V, or float	+25°C	-3	+0.01	+3	nA
			T_{MIN} to T_{MAX}	-4		+4	
DIGITAL INPUTS							
Input Logic High	V_{IH}		T_{MIN} to T_{MAX}	2.0			V
Input Logic Low	V_{IL}		T_{MIN} to T_{MAX}			0.4	V
Input Leakage Current	I_{IN}	V_{IN} = 0V or 3.6V	T_{MIN} to T_{MAX}	-1	+0.005	+1	µA

ELECTRICAL CHARACTERISTICS (continued)

(V+ = +2.7V to +3.6V, V_{IH} = +2.0V, V_{IL} = +0.4V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
DYNAMIC							
Turn-On Time (Note 5)	t_{ON}	V_{NO}, V_{NC} = 2V, R_L = 300Ω, C_L = 35pF, Figure 1	+25°C		18	45	ns
			T_{MIN} to T_{MAX}			45	
Turn-Off Time (Note 5)	t_{OFF}	V_{NO}, V_{NC} = 2V, R_L = 300Ω, C_L = 35pF, Figure 1	+25°C		10	26	ns
			T_{MIN} to T_{MAX}			26	
Break-Before-Make (Note 5)		V_{NO}, V_{NC} = 2V, R_L = 300Ω, C_L = 35pF, Figure 1	+25°C		5		ns
			T_{MIN} to T_{MAX}	1			
Charge Injection	Q	V_{GEN} = 0V, R_{GEN} = 0, C_L = 1.0nF, Figure 3			3		pC
NO, NC Off-Capacitance	$C_{NO(OFF)}$, $C_{NC(OFF)}$	f = 1MHz, Figure 4			6.5		pF
Switch On-Capacitance	C_{ON}	f = 1MHz, Figure 4			19.5		pF
Off-Isolation (Note 7)	V_{ISO}	V_{NO} = V_{NC} = $1V_{RMS}$, R_L = 50Ω, C_L = 5pF, Figure 2	f = 1MHz		-67		dB
			f = 10MHz		-45		
On-Channel Bandwidth -3dB	BW	Signal = 0dBm, 50Ω in and out, Figure 2			300		MHz
Crosstalk (Note 8)	V_{CT}	NO or NC = $1V_{RMS}$, C_L = 5pF, R_L = 50Ω, Figure 2	f = 1MHz		-67		dB
			f = 10MHz		-52		
Total Harmonic Distortion	THD	R_L = 600Ω, V_{NC} or V_{NO} = $2V_{P-P}$, f = 20Hz to 20kHz	+25°C		0.035		%
POWER SUPPLY							
Power-Supply Range	V+			1.8		5.5	V
Positive Supply Current	I+	V+ = 5.5V, V_{IN} = 0V or 5.5V	+25°C		0.001		µA
			T_{MIN} to T_{MAX}			1	

Note 2: SC70 and µDFN 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.

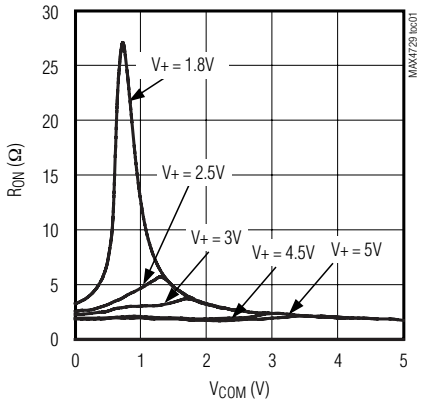
Note 8: Crosstalk is measured between the two switches.

Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

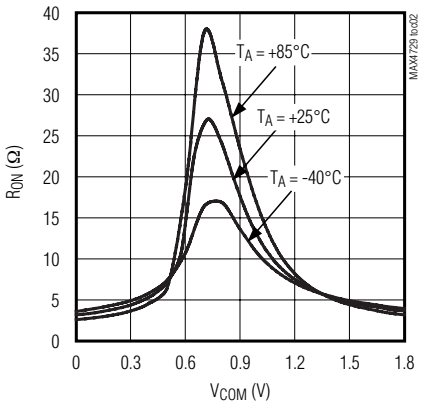
Typical Operating Characteristics

(T_A = +25°C, unless otherwise noted.)

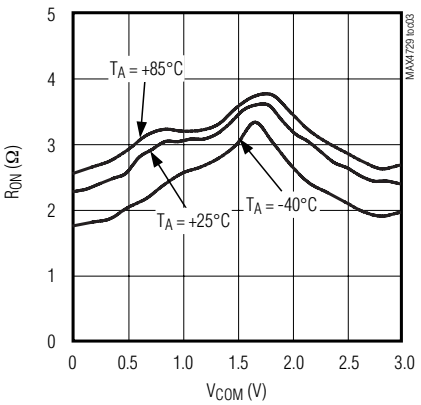
ON-RESISTANCE vs. V_{COM}



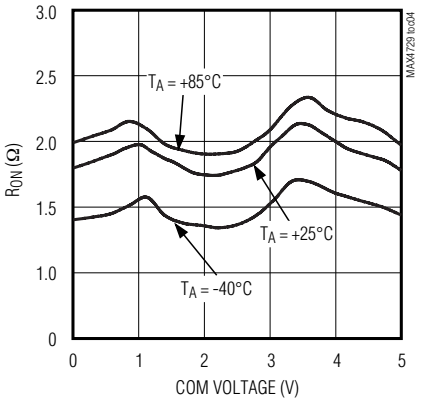
ON-RESISTANCE vs. V_{COM} (V+ = +1.8V)



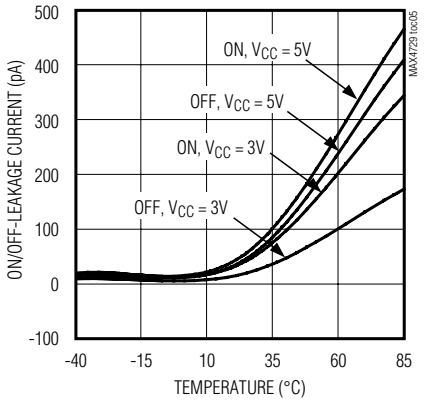
ON-RESISTANCE vs. V_{COM} (V+ = +3V)



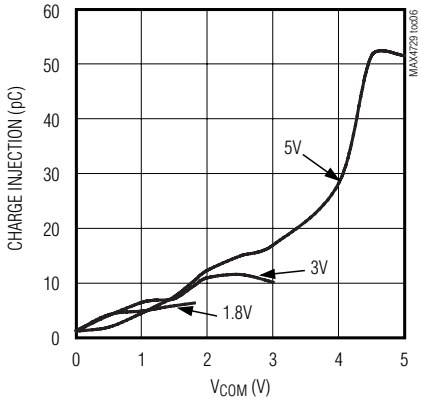
ON-RESISTANCE vs. V_{COM} (V+ = +5V)



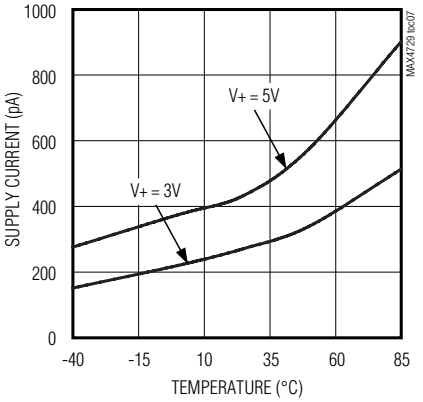
ON/OFF-LEAKAGE CURRENT vs. TEMPERATURE



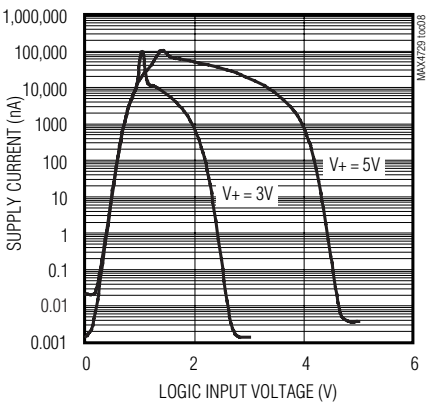
CHARGE INJECTION vs. V_{COM}



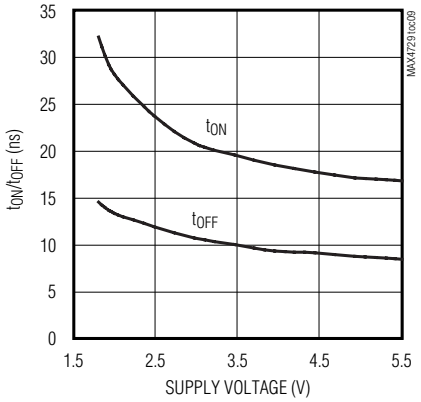
SUPPLY CURRENT vs. TEMPERATURE



SUPPLY CURRENT vs. LOGIC INPUT VOLTAGE



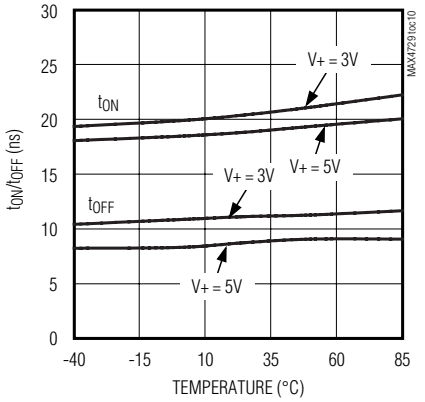
t_{ON}/t_{OFF} vs. SUPPLY VOLTAGE



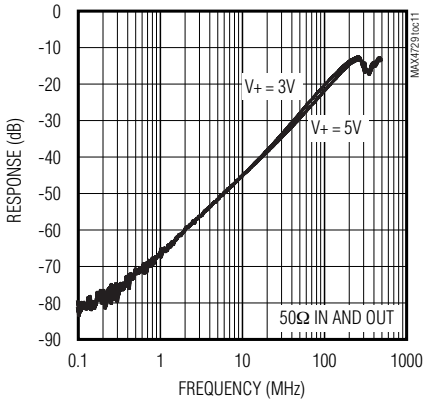
Typical Operating Characteristics (continued)

(T_A = +25°C, unless otherwise noted.)

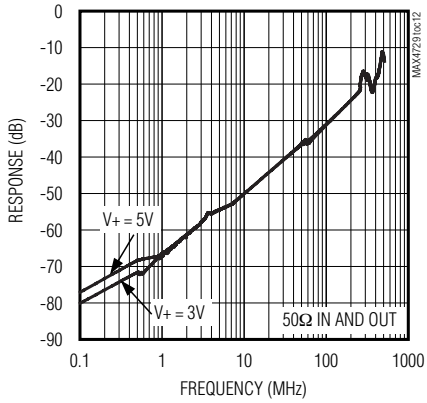
t_{ON}/t_{OFF} vs. TEMPERATURE



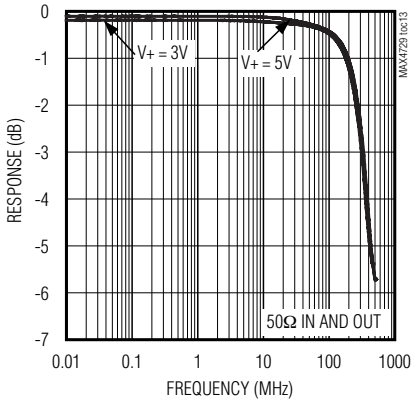
OFF-ISOLATION



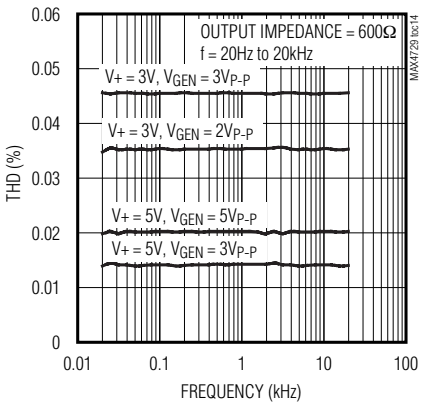
CROSSTALK



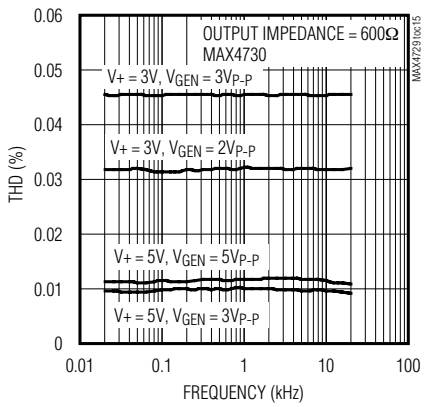
ON-LOSS BANDWIDTH



TOTAL HARMONIC DISTORTION vs. FREQUENCY



TOTAL HARMONIC DISTORTION vs. FREQUENCY



Pin Description

PIN			NAME	FUNCTION
MAX4729		MAX4730		
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

Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

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.

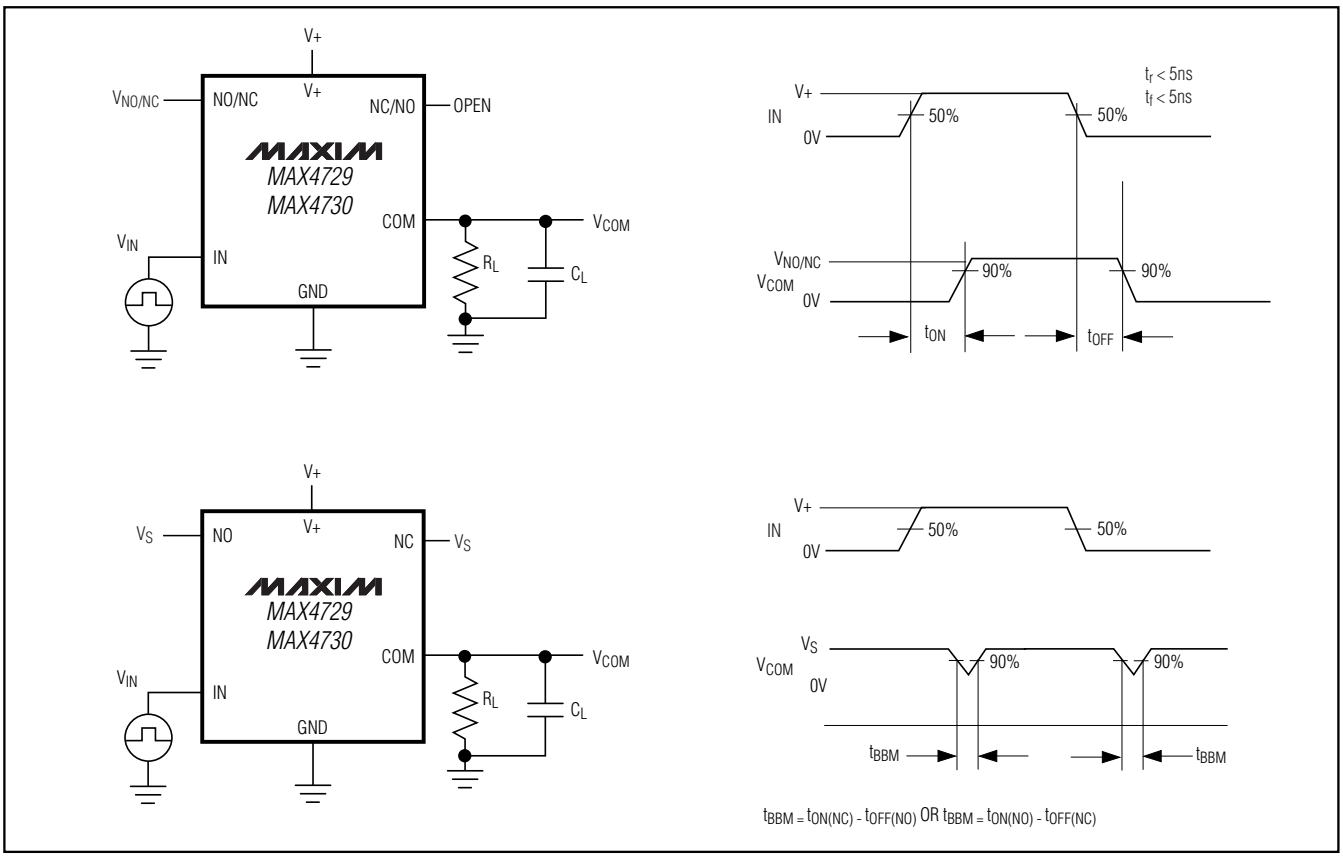


Figure 1. Switching Times

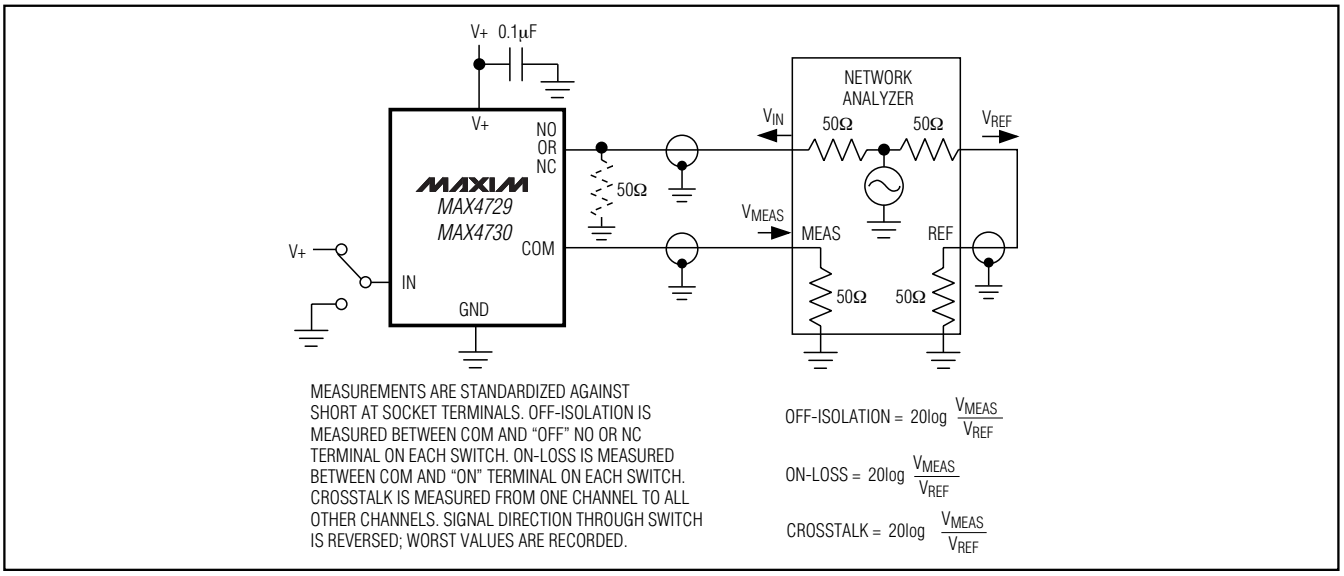


Figure 2. Off-Isolation/On-Loss Bandwidth, Crosstalk

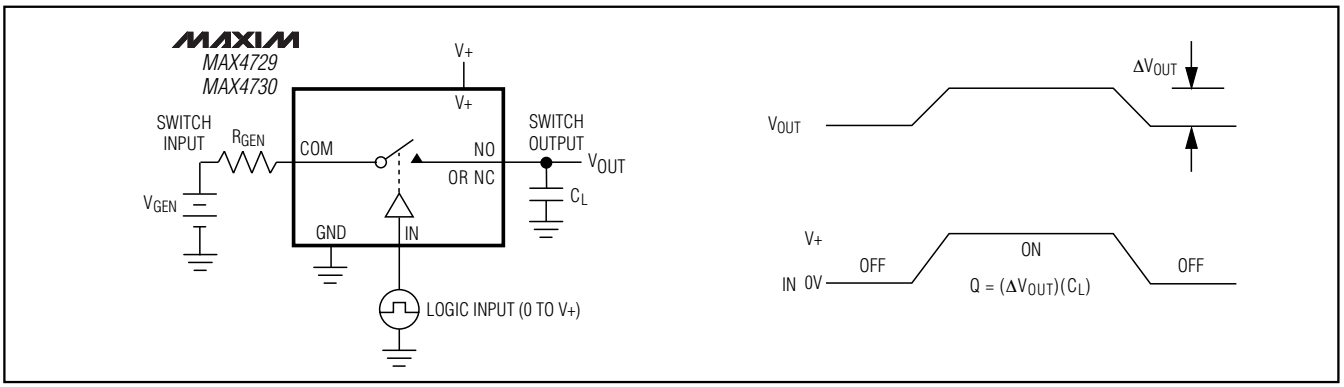


Figure 3. Charge Injection

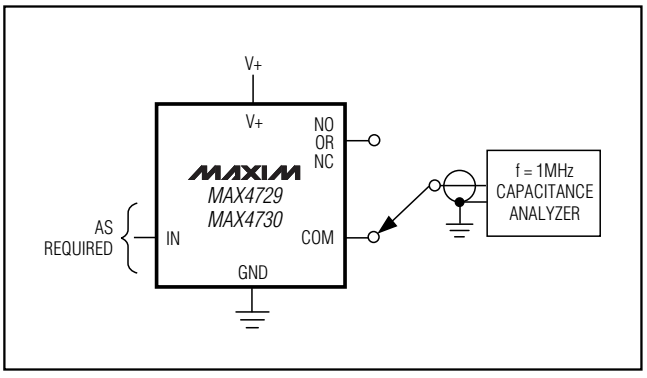


Figure 4. NO, NC, and COM Capacitance

Chip Information

TRANSISTOR COUNT: 190

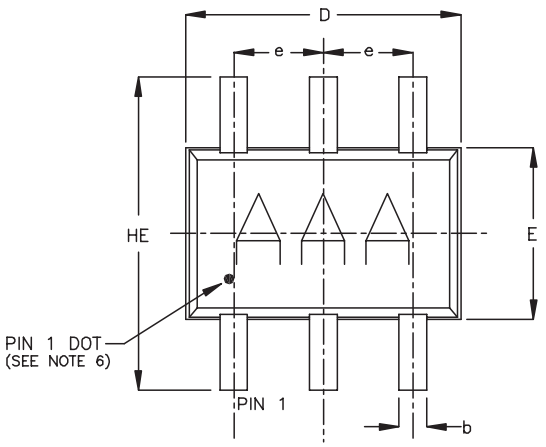
PROCESS: CMOS

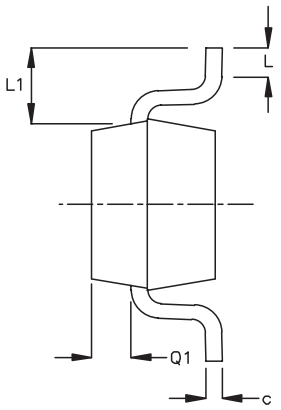
Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

Package Information

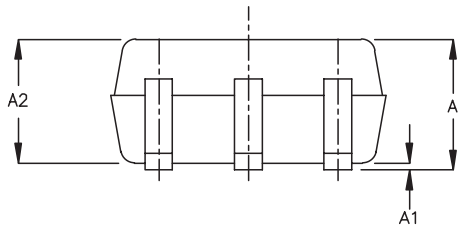
(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

SC70, 6L.EPS





SYMBOL	MIN	MAX
e	0.65 BSC	
D	1.80	2.20
b	0.15	0.30
E	1.15	1.35
HE	1.80	2.40
Q1	0.10	0.40
A2	0.80	1.00
A1	0.00	0.10
A	0.80	1.10
c	0.10	0.18
L	0.10	0.30
L1	0.425 TYP.	



1. ALL DIMENSIONS ARE IN MILLIMETERS
2. DIMENSIONS ARE INCLUSIVE OF PLATING
3. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH & METAL BURR
4. ALL SPECIFICATIONS COMPLY TO EIAJ SC70
5. COPLANARITY 4 MILS. MAX.
6. PIN 1 I.D. DOT

MAXIM
PROPRIETARY INFORMATION

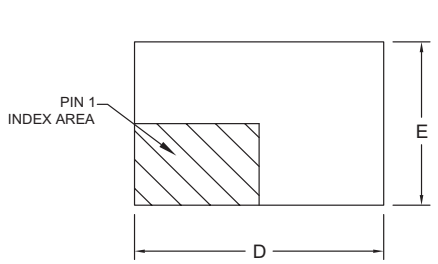
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PACKAGE OUTLINE, SC70, 6L

APPROVAL	DOCUMENT CONTROL NO.	REV	
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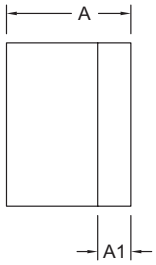
Package Information (continued)

(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**.)

6L UDFN.EPS

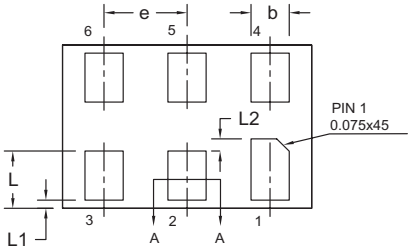


TOP VIEW

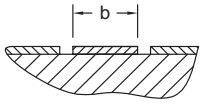


SIDE VIEW

SYMBOL	COMMON DIMENSIONS		
	MIN.	NOM.	MAX.
A	0.64	0.72	0.80
A1	--	0.20	--
D	1.45	1.50	1.55
E	0.95	1.00	1.05
L	0.30	0.35	0.40
L1	--	--	0.08
L2	--	--	0.05
b	0.17	0.20	0.23
e	--	0.50	--



BOTTOM VIEW



SECTION A-A

NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.

MAXIM
PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, 6L uDFN, 1.5x1.0x0.8mm

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