MAXIM

Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches

MAX4729/MAX4730

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

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

SWITCHES SHOWN FOR LOGIC 0 INPUT.

MAXIM _____ **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.

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

MAXIM

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: ΔR_{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.

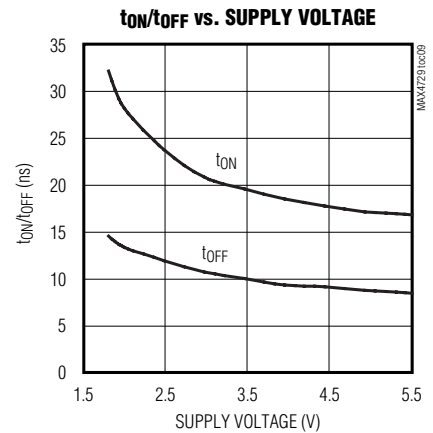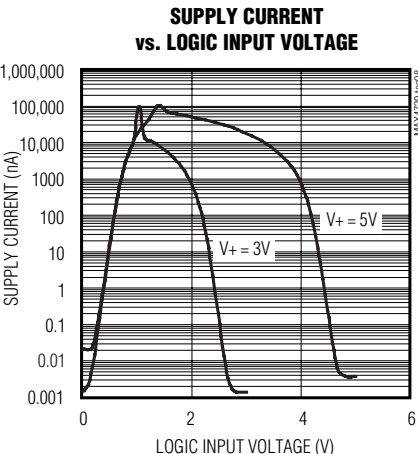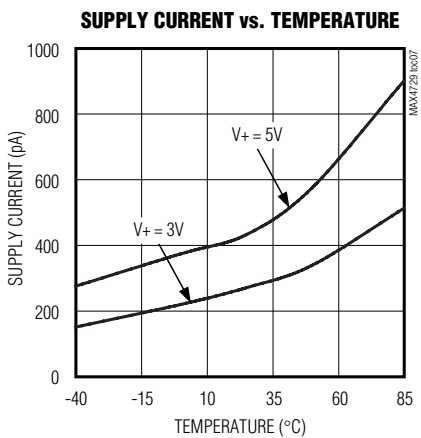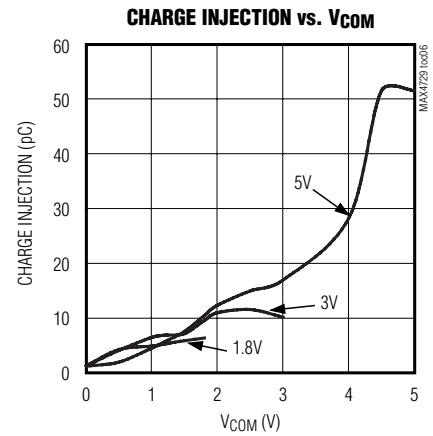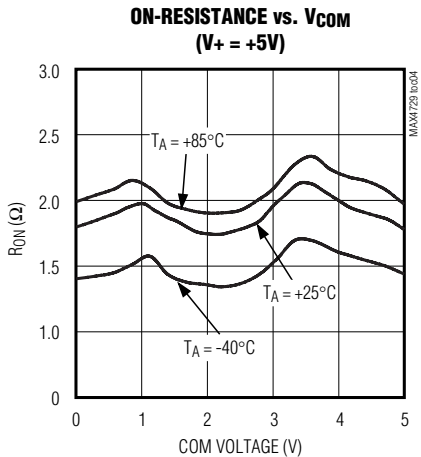**Note 5:** Guaranteed by design.

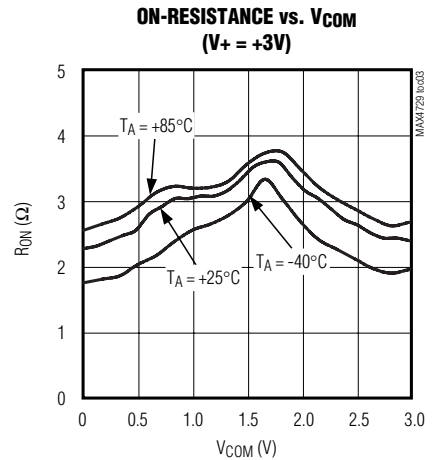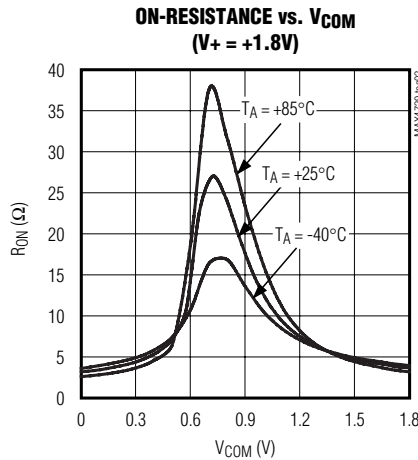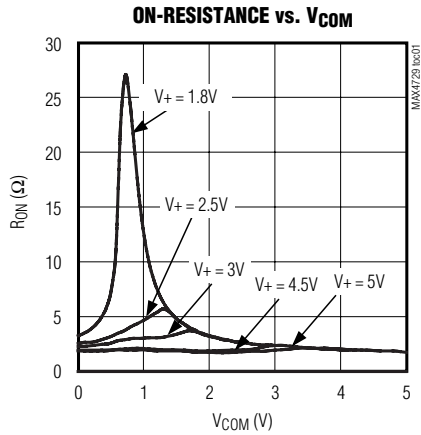**Note 6:** μDFN is guaranteed by design.

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.

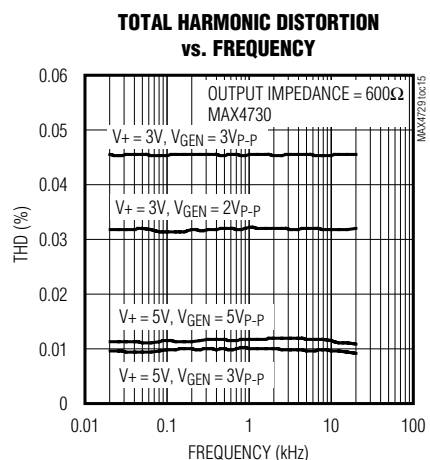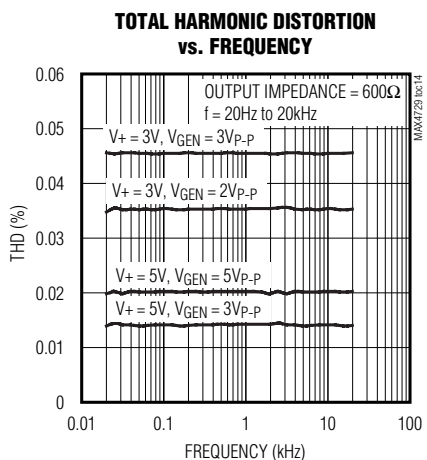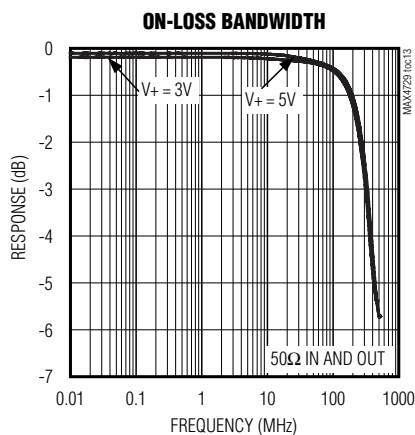# Low-Voltage 3.5Ω, SPDT, CMOS Analog Switches
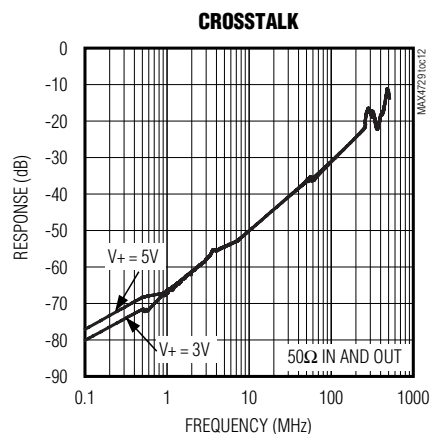
_____*Typical Operating Characteristics*

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

ON-RESISTANCE vs. V_COM

MAX4729 toc01

R_ON (Ω) vs V_COM (V)

V+ = 1.8V
V+ = 2.5V
V+ = 3V
V+ = 4.5V
V+ = 5V

ON-RESISTANCE vs. V_COM (V+ = +1.8V)

MAX4729 toc02

R_ON (Ω) vs V_COM (V)

T_A = +85°C
T_A = +25°C
T_A = -40°C

ON-RESISTANCE vs. V_COM (V+ = +3V)

MAX4729 toc03

R_ON (Ω) vs V_COM (V)

T_A = +85°C
T_A = +25°C
T_A = -40°C

ON-RESISTANCE vs. V_COM (V+ = +5V)

MAX4729 toc04

R_ON (Ω) vs COM VOLTAGE (V)

T_A = +85°C
T_A = +25°C
T_A = -40°C

ON/OFF-LEAKAGE CURRENT vs. TEMPERATURE

MAX4729 toc05

ON/OFF-LEAKAGE CURRENT (pA) vs TEMPERATURE (°C)

ON, V_CC = 5V
OFF, V_CC = 5V
ON, V_CC = 3V
OFF, V_CC = 3V

CHARGE INJECTION vs. V_COM

MAX4729 toc06

CHARGE INJECTION (pC) vs V_COM (V)

5V
3V
1.8V

SUPPLY CURRENT vs. TEMPERATURE

MAX4729 toc07

SUPPLY CURRENT (pA) vs TEMPERATURE (°C)

V+ = 5V
V+ = 3V

SUPPLY CURRENT vs. LOGIC INPUT VOLTAGE

MAX4729 toc08

SUPPLY CURRENT (nA) vs LOGIC INPUT VOLTAGE (V)

V+ = 5V
V+ = 3V

t_ON/t_OFF vs. SUPPLY VOLTAGE

MAX4729 toc09

t_ON/t_OFF (ns) vs SUPPLY VOLTAGE (V)

t_ON
t_OFF

MAXIM

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
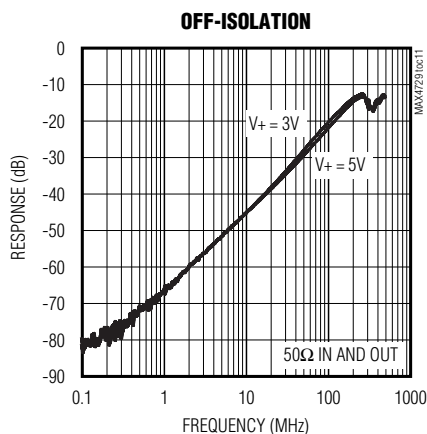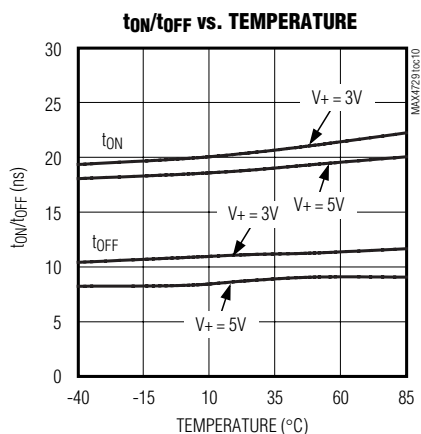
Pin Description

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

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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.
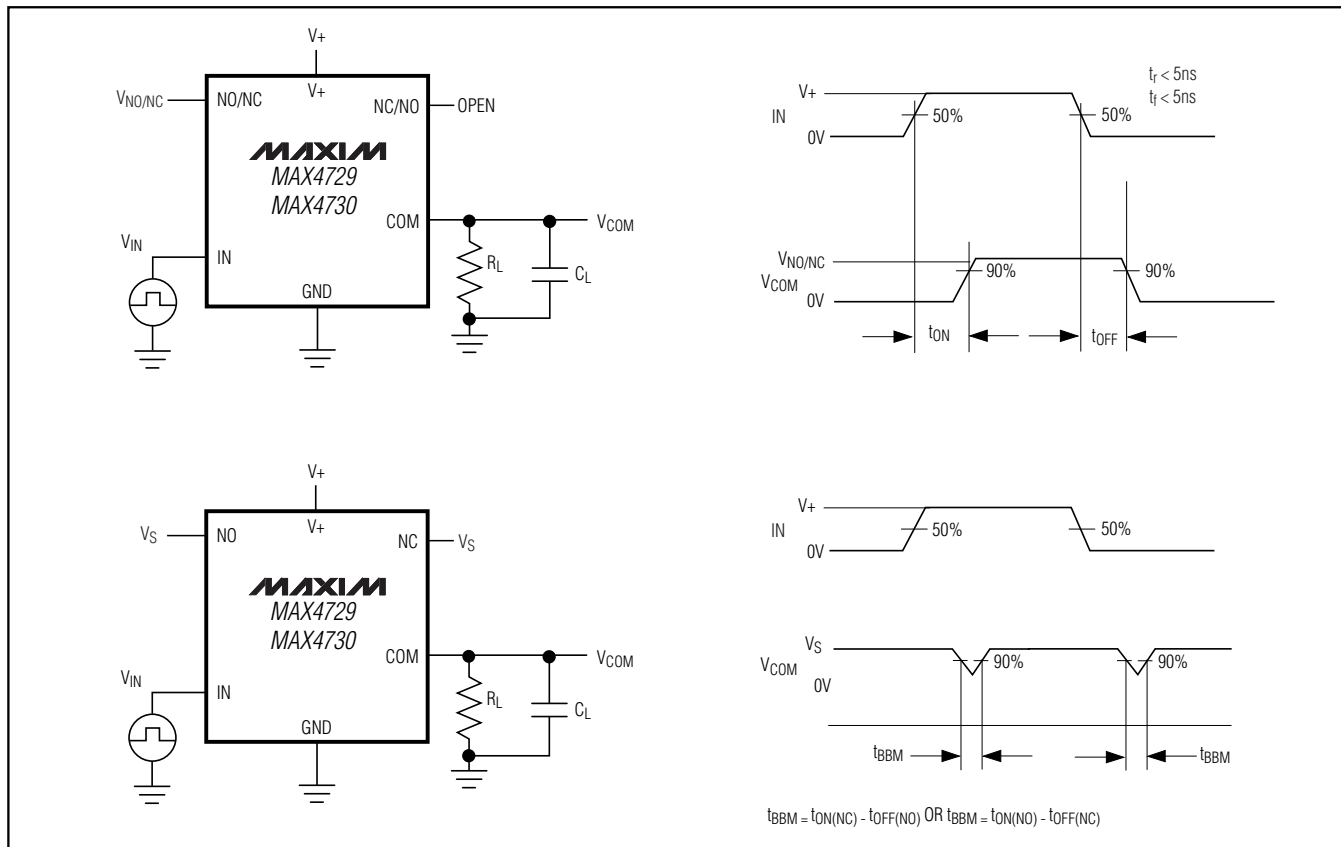

Figure 1. Switching Times

MAX4729/MAX4730

MEASUREMENTS ARE STANDARDIZED AGAINST SHORT AT SOCKET TERMINALS. OFF-ISOLATION IS MEASURED BETWEEN COM AND "OFF" NO OR NC TERMINAL ON EACH SWITCH. ON-LOSS IS MEASURED BETWEEN COM AND "ON" TERMINAL ON EACH SWITCH. CROSSTALK IS MEASURED FROM ONE CHANNEL TO ALL OTHER CHANNELS. SIGNAL DIRECTION THROUGH SWITCH IS REVERSED; WORST VALUES ARE RECORDED.

$$\text{OFF-ISOLATION} = 20\log \frac{V_{MEAS}}{V_{REF}}$$

$$\text{ON-LOSS} = 20\log \frac{V_{MEAS}}{V_{REF}}$$

$$\text{CROSSTALK} = 20\log \frac{V_{MEAS}}{V_{REF}}$$
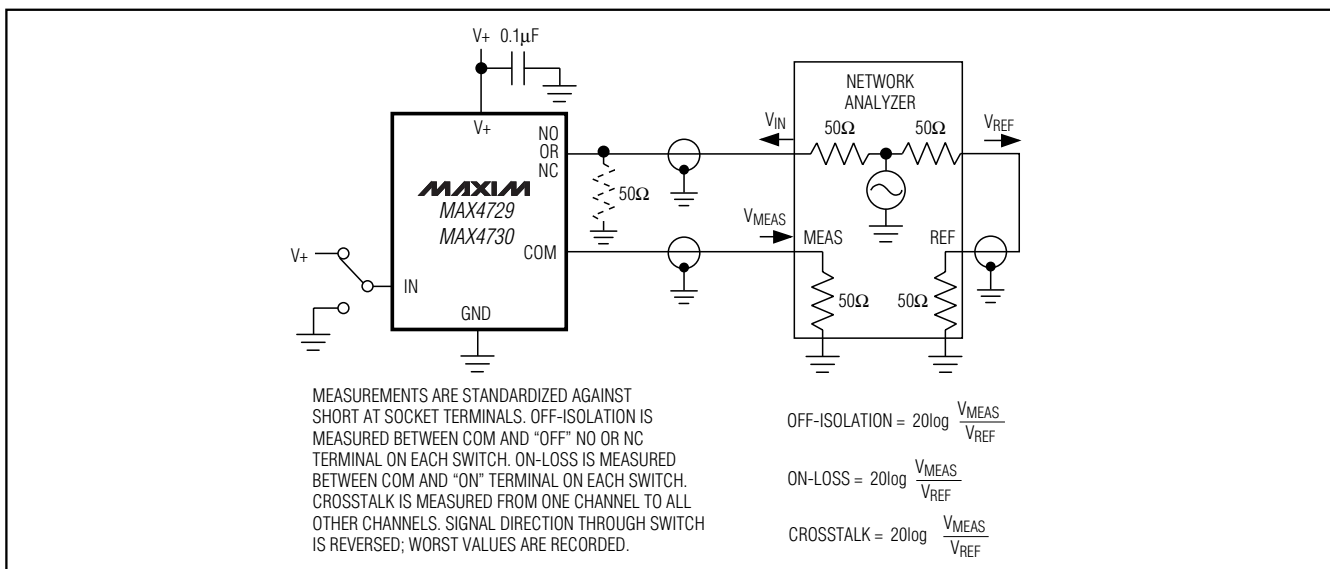
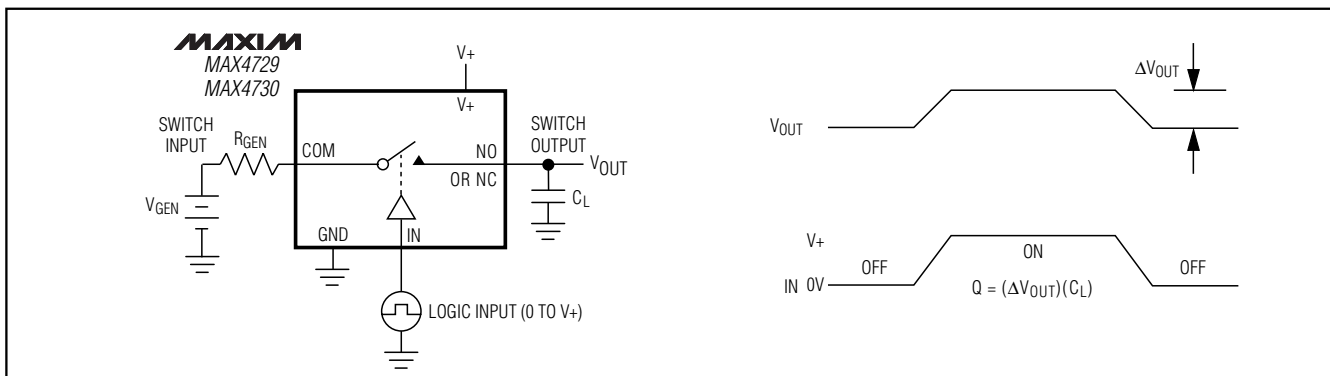Figure 2. Off-Isolation/On-Loss Bandwidth, Crosstalk

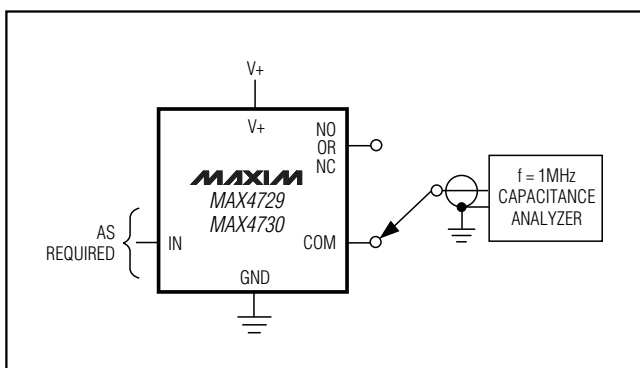

Figure 3. Charge Injection

Figure 4. NO, NC, and COM Capacitance
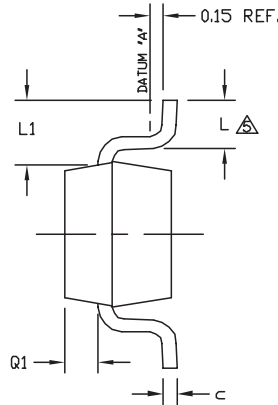
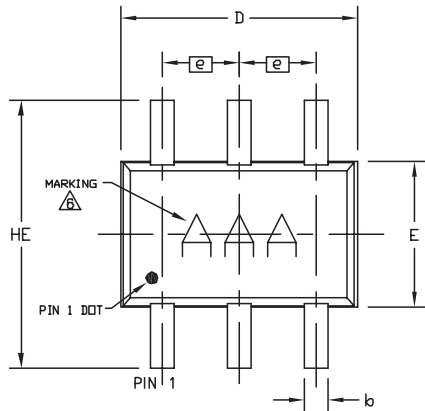## _____Chip Information

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**.)

COMMON DIMENSIONS		
SYMBOL	MIN	MAX
A	0.80	1.10
A1	0.00	0.10
A2	0.80	1.00
b	0.15	0.30
c	0.10	0.18
D	1.80	2.20
e	0.65 BSC.	
E	1.15	1.35
HE	1.80	2.40
L	0.10	0.41
L1	0.425 TYP.	
Q1	0.10	0.40
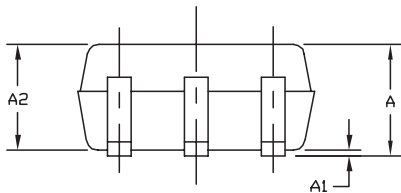
NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONS ARE INCLUSIVE OF PLATING.
3. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH & METAL BURR.
4. COPLANARITY 4 MILS. MAX.
5. FOOT LENGTH MEASURED AT INTERCEPT POINT BETWEEN DATUM "A" AND LEAD SURFACE.
6. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
7. LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ±0.05.

DALLAS SEMICONDUCTOR **/ʌ/ʌXI/ʌ/**

TITLE
PACKAGE OUTLINE, 6L SC70

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0077	C	1/1

-DRAWING NOT TO SCALE-

SC70, 6L.EPS

8 _____ **/ʌ/ʌXI/ʌ/**

MAX4729/MAX4730

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**.)

S Y M B O L	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 BSC.		

NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
3. LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ±0.05.
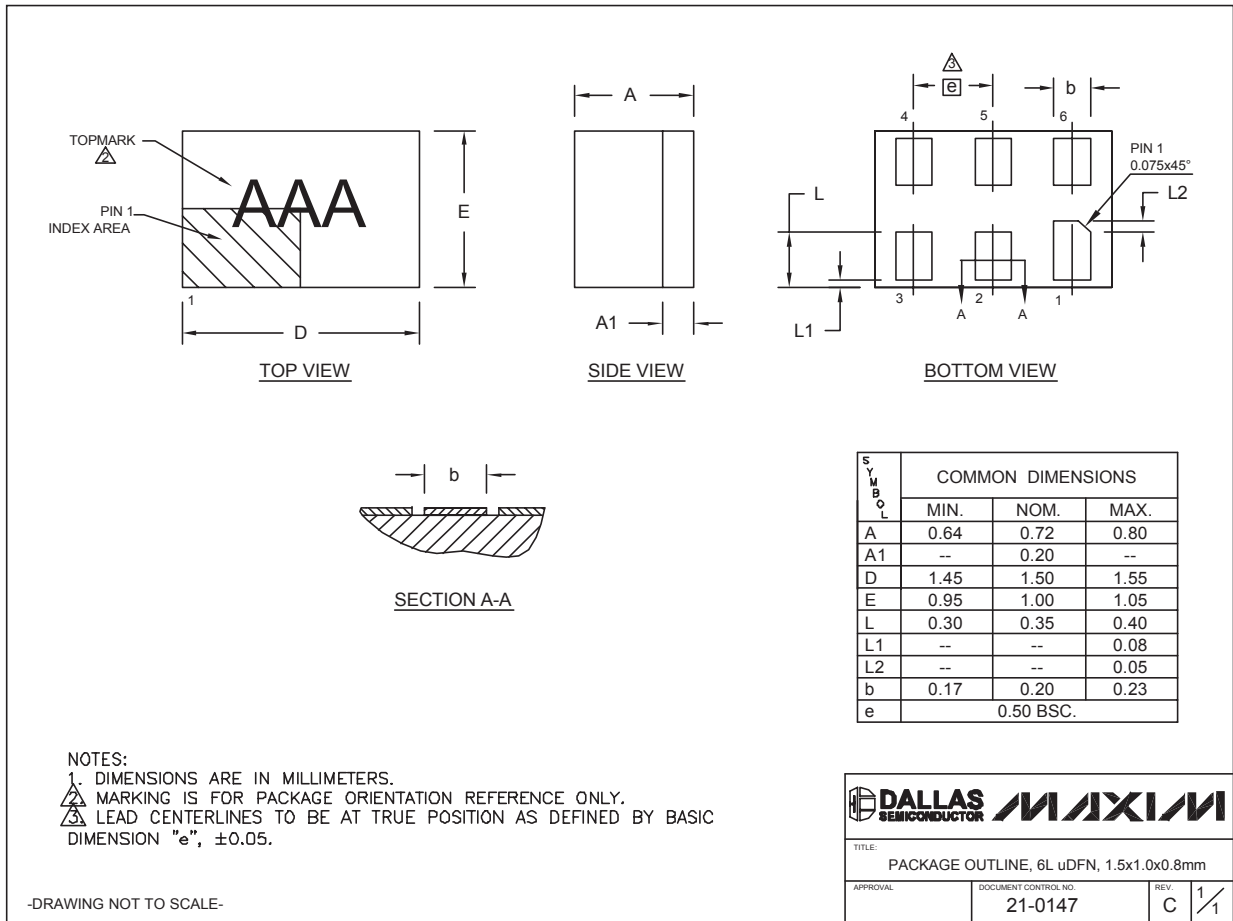
-DRAWING NOT TO SCALE-

DALLAS SEMICONDUCTOR ***MAXIM***

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

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0147	C	1/1

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