

Low-Voltage, Single-Supply, 10Ω SPST CMOS Analog Switches

ABSOLUTE MAXIMUM RATINGS

(Voltages Referenced to GND)

V+	-0.3V to +6V
Voltage into Any Terminal (Note 1)	-0.3V to (V+ + 0.3V)
Continuous Current into Any Terminal	±20mA
Peak Current, NO, NC, or COM (pulsed at 1ms, 10% duty cycle)	±40mA

Continuous Power Dissipation (T_A = +70°C)

5-Pin SC70 (derate 3.1mW/°C above +70°C)	247mW
6-Pin μDFN (derate 2.1mW/°C above +70°C)	168mW
Operating Temperature Range	
MAX459_EXK	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C

Note 1: Voltages exceeding V+ or GND on any signal terminal 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—+5V Supply

(V+ = +4.5V to +5.5V, V_{IH} = +2.4V, V_{IL} = +0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V+ = +5V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
ANALOG SWITCH							
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}		0		V+	V	
On-Resistance	R _{ON}	V+ = 4.5V, V _{NO} , or V _{NC} = 3.5V; I _{COM} = 10mA	T _A = +25°C	6.5	10	Ω	
			T _A = T _{MIN} to T _{MAX}		12		
On-Resistance Flatness (Note 4)	R _{FLAT(ON)}	V _{NO} or V _{NC} = 1.5V, 2.5V, 3.5V; V+ = 4.5V; I _{COM} = 10mA	T _A = +25°C	0.5	1.5	Ω	
			T _A = T _{MIN} to T _{MAX}		2		
NO or NC Off-Leakage Current	I _{NO(OFF)} I _{NC(OFF)}	V+ = 5.5V; V _{COM} = 1V, 4.5V; V _{NO} or V _{NC} = 4.5V, 1V	T _A = +25°C	-0.5	0.01	0.5	nA
			T _A = T _{MIN} to T _{MAX}	-5		5	
COM Off-Leakage Current	I _{COM(OFF)}	V+ = 5.5V; V _{COM} = 1V, 4.5V; V _{NO} or V _{NC} = 4.5V, 1V	T _A = +25°C	-0.5	0.01	0.5	nA
			T _A = T _{MIN} to T _{MAX}	-5		5	
COM On-Leakage Current	I _{COM(ON)}	V+ = 5.5V; V _{COM} = 1V; 4.5V; V _{NO} or V _{NC} = 1V, 4.5V, or floating	T _A = +25°C	-1	0.01	1	nA
			T _A = T _{MIN} to T _{MAX}	-10		10	
DIGITAL I/O							
Input Logic High	V _{IH}		2.4			V	
Input Logic Low	V _{IL}				0.8	V	
Input Logic Current	I _{IH} , I _{IL}	V _{IN} = V+, 0	-1	0.03	1	μA	
DYNAMIC							
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 3V, R _L = 300Ω, C _L = 35pF, Figure 3	T _A = +25°C	20	35	ns	
			T _A = T _{MIN} to T _{MAX}		45		
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 3V, R _L = 300Ω, C _L = 35pF, Figure 3	T _A = +25°C	25	40	ns	
			T _A = T _{MIN} to T _{MAX}		50		
On-Channel -3dB Bandwidth	BW	Signal = 0dBm, 50Ω in and out, Figure 4	T _A = +25°C	300		MHz	

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MAX4594-MAX4597

ELECTRICAL CHARACTERISTICS—+5V Supply (continued)

(V₊ = +4.5V to +5.5V, V_{IH} = +2.4V, V_{IL} = +0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V₊ = +5V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Charge Injection (Note 5)	Q	V _{NO} or V _{NC} = 0, C _L = 1nF, Figure 2	T _A = +25°C		2	5	pC
Off-Isolation (Note 6)	VISO	V _{NO} or V _{NC} = 1V _{RMS} , R _L = 50Ω, C _L = 5pF, f = 1MHz, Figure 4	T _A = +25°C		80		dB
					83		
NO or NC Off-Capacitance	C _{NO(OFF)} , C _{NC(OFF)}	V _{NO} or V _{NC} = 0, f = 1MHz, Figure 5	T _A = +25°C		8		pF
COM Off-Capacitance	C _{COM(OFF)}	V _{COM} = 0, f = 1MHz, Figure 5	T _A = +25°C		8		pF
COM On-Capacitance	C _{COM(ON)}	V _{COM} = 0, f = 1MHz, Figure 5	T _A = +25°C		20		pF
Total Harmonic Distortion Plus Noise	THD	V = 5Vp-p, R _L = 600Ω, f = 20Hz to 20kHz	T _A = +25°C		0.05		%
POWER SUPPLY							
Power-Supply Range	V ₊			2.0		5.5	V
V ₊ Supply Current	I ₊	V ₊ = 5.5V, V _{IN} = 0 or V ₊	T _A = T _{MIN} to T _{MAX}	-1		1	μA

ELECTRICAL CHARACTERISTICS—+3V Supply

(V₊ = +2.7V to +3.6V, V_{IH} = +2.0V, V_{IL} = +0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V₊ = +3.0V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}			0		V ₊	V
On-Resistance	R _{ON}	V _{NO} or V _{NC} = 1.5V, I _{COM} = 10mA, V ₊ = 2.7V	T _A = +25°C		10	20	Ω
			T _A = T _{MIN} to T _{MAX}			25	
DIGITAL I/O							
Input Logic High	V _{IH}			2.0			V
Input Logic Low	V _{IL}					0.8	V
Input Logic Current	I _{IH} , I _{IL}	V _{IN} = V ₊ , 0		-1	0.03	1	μA
DYNAMIC							
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 2V, R _L = 300Ω, C _L = 35pF, Figure 3	T _A = +25°C		25	45	ns
			T _A = T _{MIN} to T _{MAX}			55	
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 2V, R _L = 300Ω, C _L = 35pF, Figure 3	T _A = +25°C		30	50	ns
			T _A = T _{MIN} to T _{MAX}			60	
Charge Injection (Note 5)	Q	V _{NO} or V _{NC} = 0, C _L = 1nF, Figure 2	T _A = +25°C		2	4	pC

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ELECTRICAL CHARACTERISTICS—+3V Supply (continued)

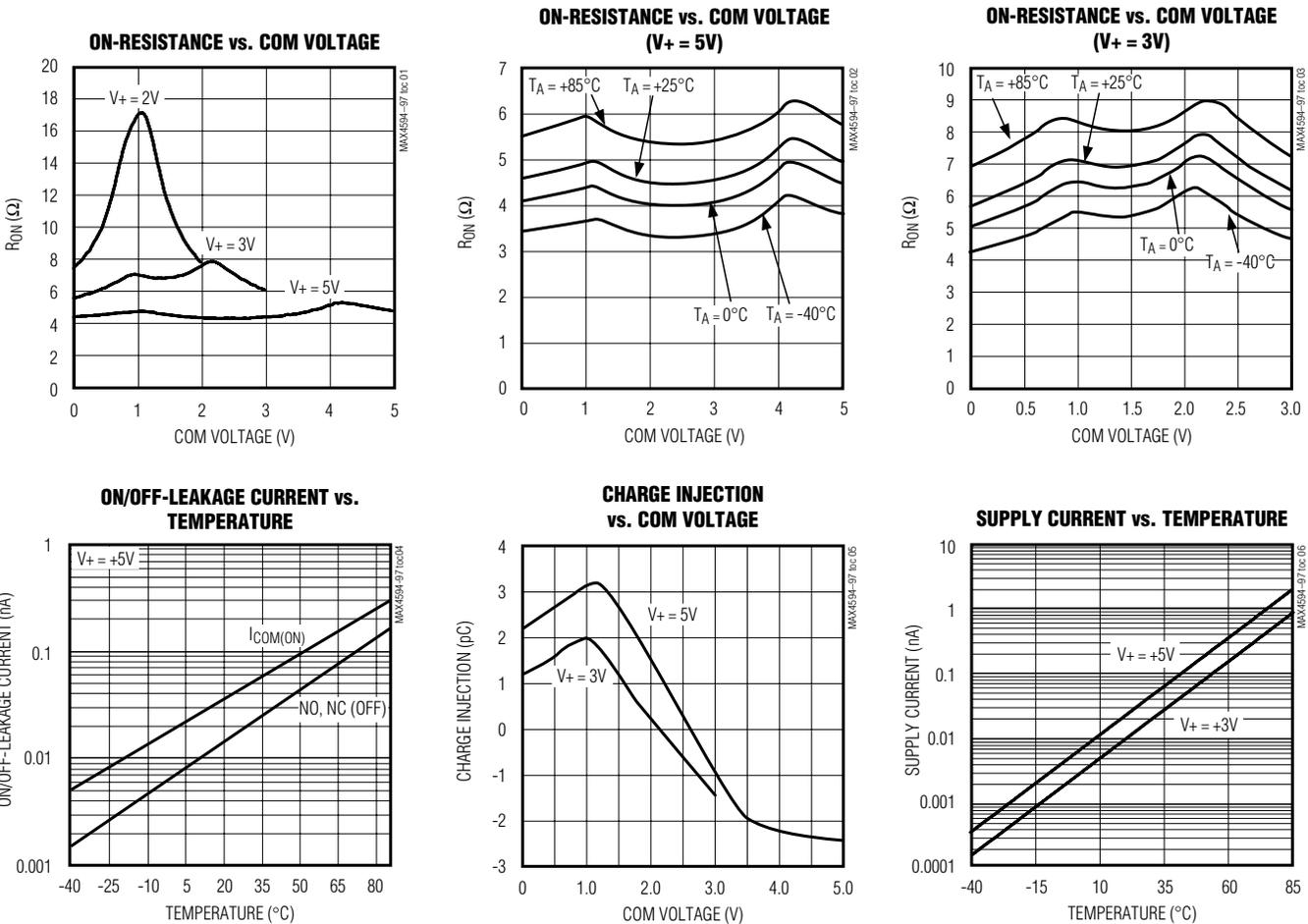
($V_+ = +2.7V$ to $+3.6V$, $V_{IH} = +2.0V$, $V_{IL} = +0.8V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $V_+ = +3.0V$, $T_A = +25^\circ C$.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLY						
V+ Supply Current	I+	$V_+ = 3.6V$, $V_{IN} = 0$ or V_+	$T_A = T_{MIN}$ to T_{MAX}	-1	1	μA

- Note 2:** Parameters are 100% tested at $+25^\circ C$ only, and guaranteed by correlation at the full-rated temperature.
- Note 3:** Algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.
- Note 4:** Flatness is defined as the difference between the maximum and minimum values 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.

Typical Operating Characteristics

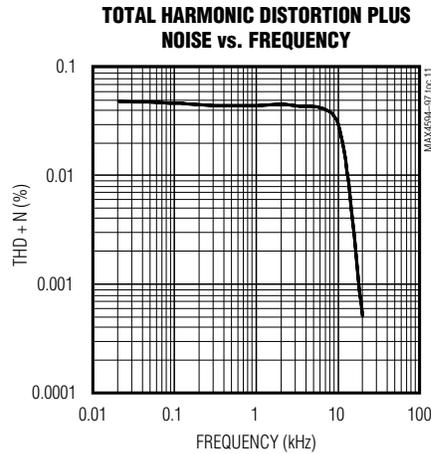
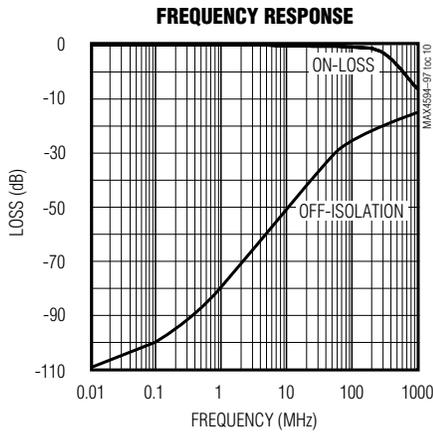
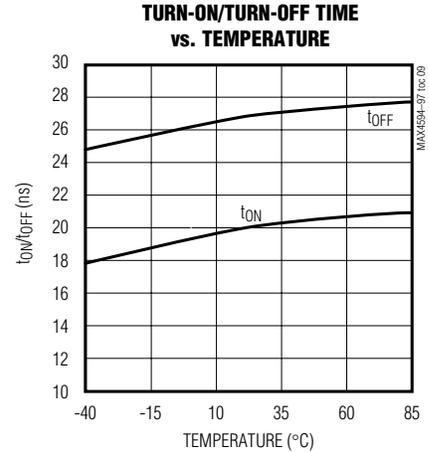
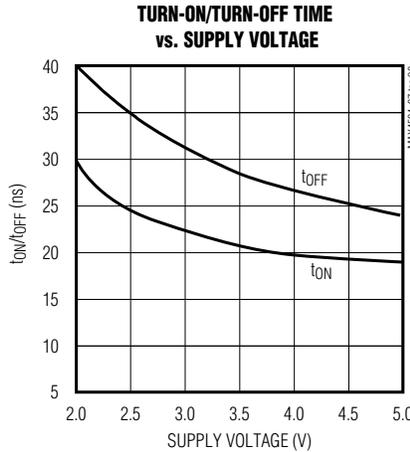
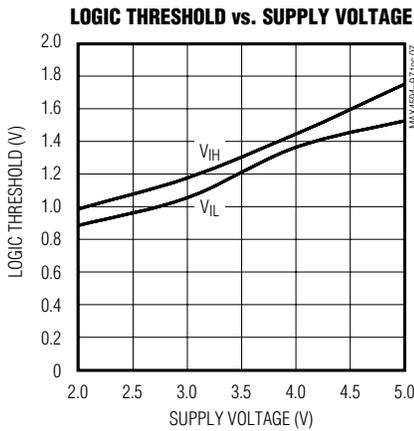
($V_+ = +5V$, $T_A = +25^\circ C$, unless otherwise noted.)



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Typical Operating Characteristics (continued)

(V+ = +5V, TA = +25°C, unless otherwise noted.)



MAX4594-MAX4597

Pin Description

PIN								NAME	FUNCTION
MAX4594		MAX4595		MAX4596		MAX4597			
SC70	μDFN	SC70	μDFN	SC70	μDFN	SC70	μDFN		
1	1	1	1	2	2	2	2	COM	Analog Switch, Common
2	2	—	—	4	4	—	—	NO	Analog Switch, Normally Open
3	3	3	3	3	3	3	3	GND	Ground
4	4	4	4	1	1	1	1	IN	Digital Control Input
5	6	5	6	5	6	5	6	V+	Positive Supply Voltage
—	—	2	2	—	—	4	4	NC	Analog Switch, Normally Closed
—	5	—	5	—	5	—	5	N.C.	No Connection. Not internally connected.
EP	EP	EP	EP	EP	EP	EP	EP	PAD	Exposed Pad. Connect to GND (μDFN only.)

Note: NO, NC, and COM pins are identical and interchangeable. Any pin may be considered as an input or an output; signals pass equally well in both directions.

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Applications Information

Analog Signal Levels

Analog signals can range over the supply voltage (V_+ to GND) with on-resistance changing very little over the entire range (see *Typical Operating Characteristics*). The MAX4594-MAX4597 are bidirectional, so the NO, NC, and COM pins can be used either as inputs or outputs.

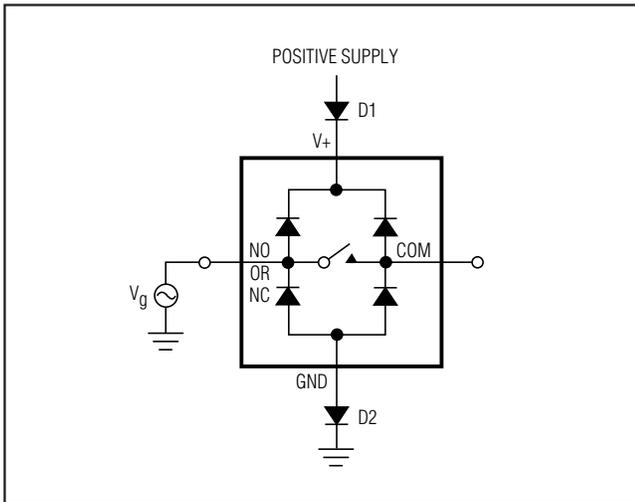


Figure 1. Overvoltage Protection Using Two External Blocking Diodes

Power-Supply Sequencing and Overvoltage Protection

Proper power-supply sequencing is recommended for all CMOS devices. Always apply V_+ before applying analog signals or logic inputs, especially if the analog or logic signals are not current limited. If this sequencing is not possible, and if the analog or logic inputs are not current limited to $<20\text{mA}$, add a small-signal diode (D1) as shown in Figure 1. If the analog signal can dip below GND, add D2. Adding protection diodes reduces the analog signal range to a diode drop (about 0.7V) below V_+ for D1 or to a diode drop above ground for D2. The addition of diodes does not affect leakage. On-resistance increases by a small amount at low supply voltages. Maximum supply voltage (V_+) must not exceed 6V.

Protection diodes D1 and D2 also protect against some overvoltage situations. A fault voltage up to the absolute maximum rating at an analog signal input does not damage the device, even if the supply voltage is below the signal voltage.

Test Circuits/Timing Diagrams

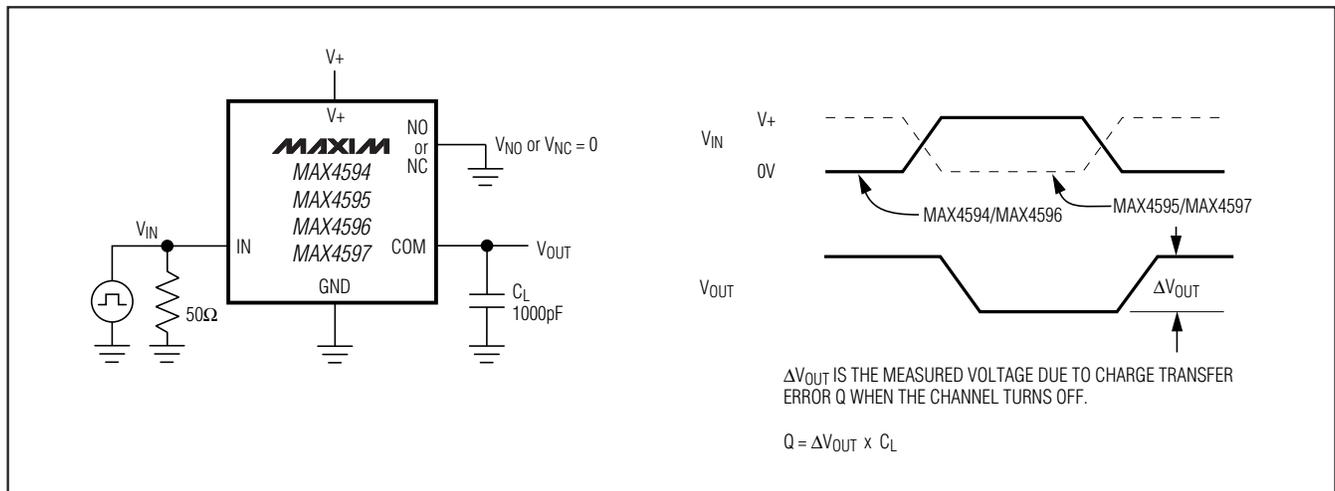


Figure 2. Charge Injection

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Test Circuits/Timing Diagrams (continued)

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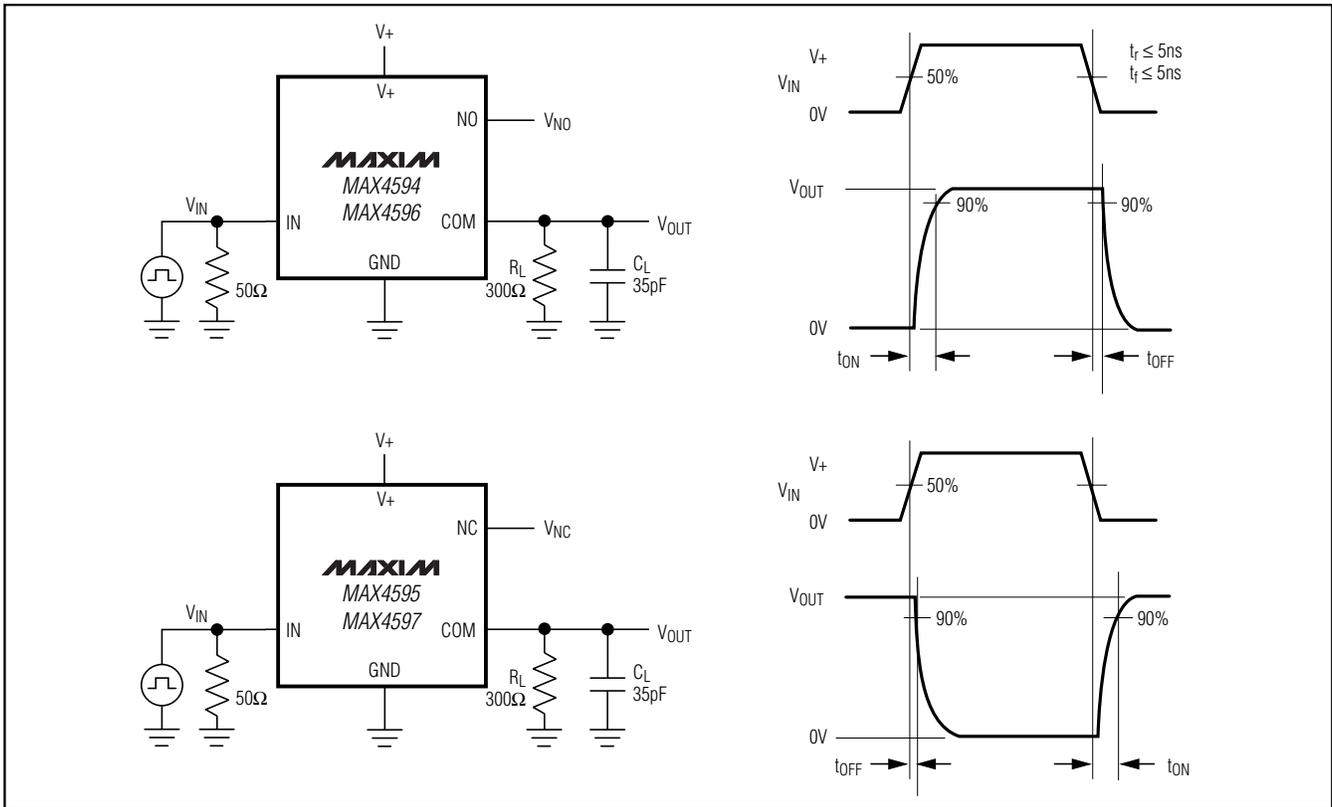


Figure 3. Switching Times

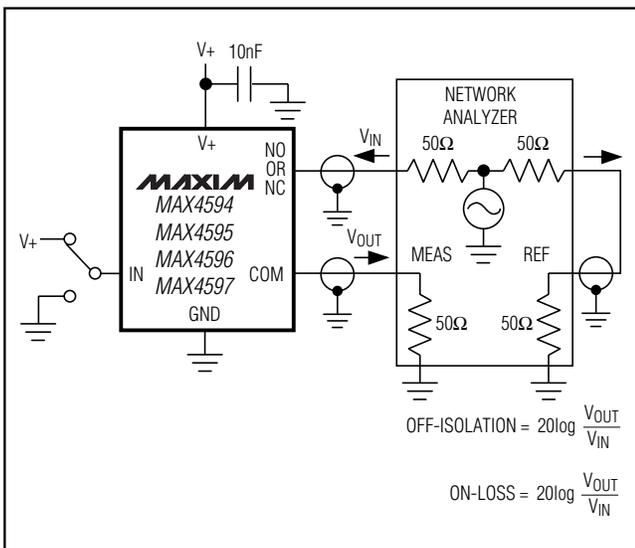


Figure 4. Off-Isolation and On-Channel Bandwidth

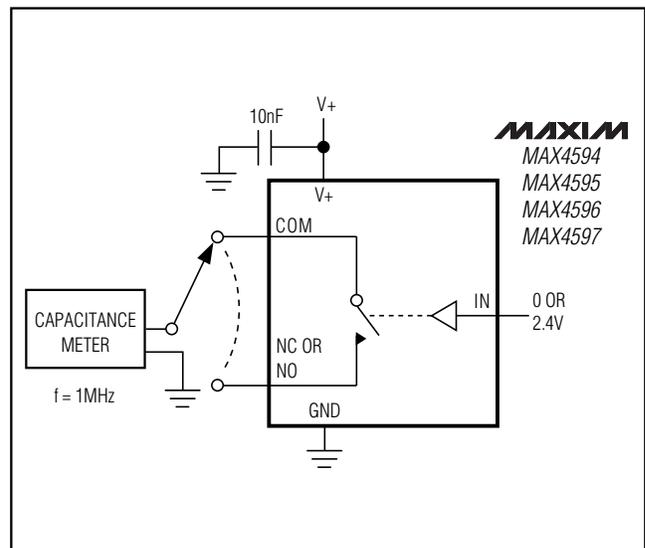
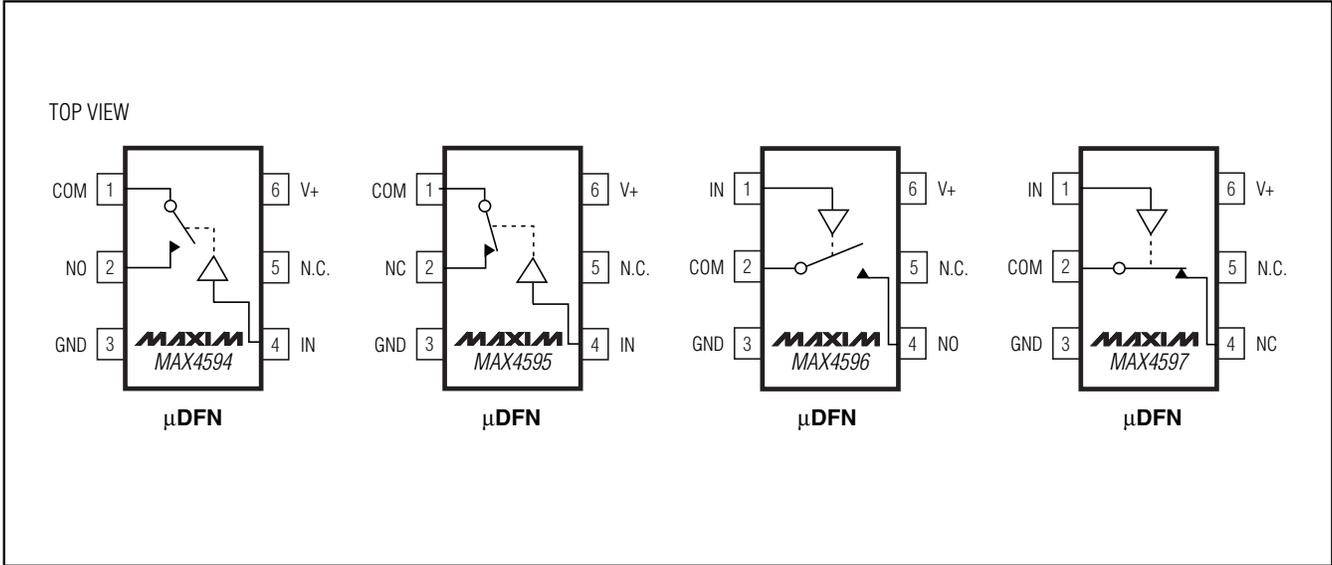


Figure 5. Channel On-/Off-Capacitance

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Pin Configurations/Functional Diagrams/Truth Table (continued)



Chip Information

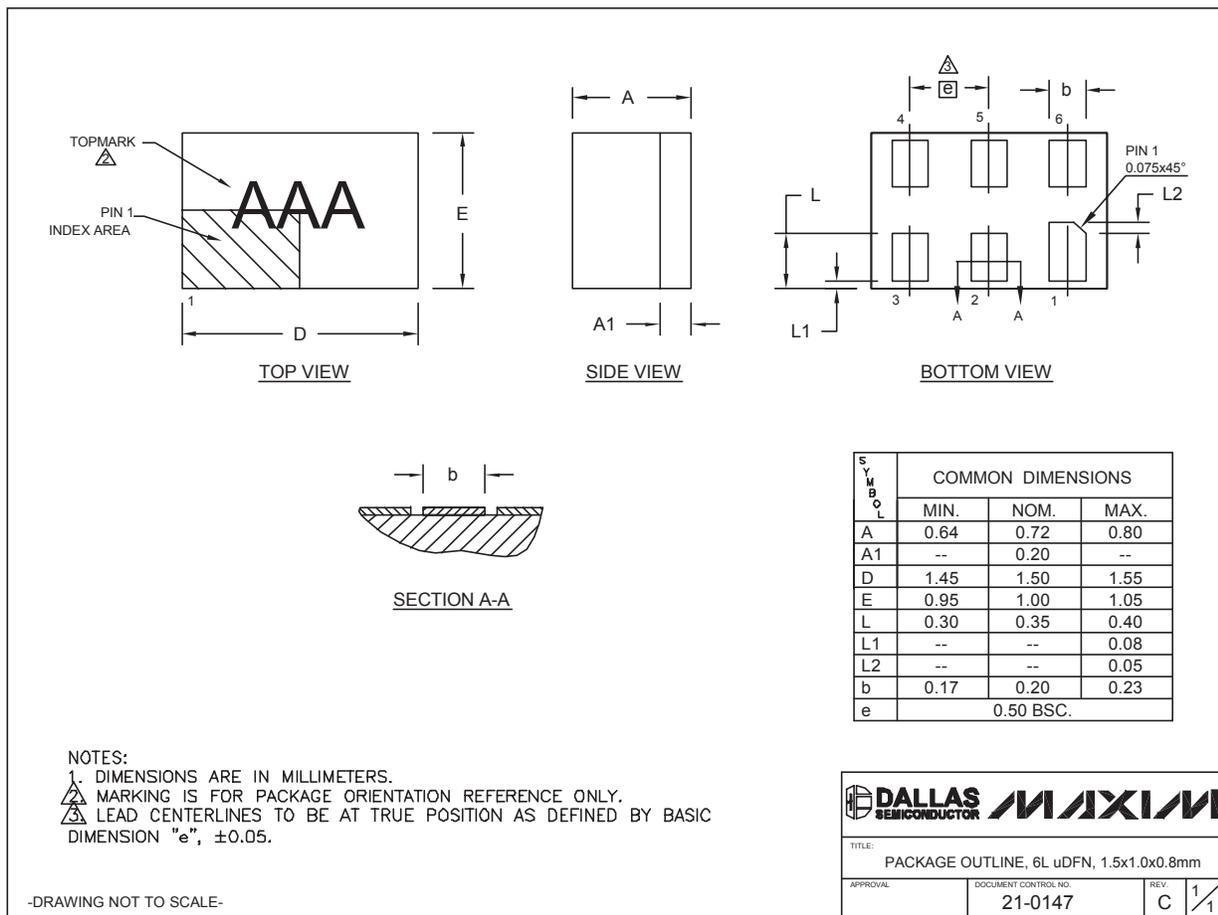
TRANSISTOR COUNT: 50

Low-Voltage, Single-Supply, 10Ω SPST 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.)

MAX4594-MAX4597



Low-Voltage, Single-Supply, 10Ω SPST CMOS Analog Switches

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.)

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	0.40
L1	0.425 TYP.	
Q1	0.10	0.40

NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE INCLUSIVE OF PLATING.
- DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH & METAL BURR.
- COMPLY TO EIAJ SC70 EXCEPT FOR PIN COUNT AND DIMENSION "b".
- COPLANARITY 4 MILS. MAX.
- FOOT LENGTH MEASURED AT INTERCEPT POINT BETWEEN DATUM "A" AND LEAD SURFACE.
- MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
- LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ±0.05.

SC70, 5LEPS

DALLAS SEMICONDUCTOR MAXIM

TITLE: PACKAGE OUTLINE, 5L SC70

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-DRAWING NOT TO SCALE-

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