



0.8Ω, Low-Voltage, Single-Supply SPDT Analog Switch in SC70

MAX4714

General Description

The MAX4714 is a low on-resistance, low-voltage single-pole/double-throw (SPDT) analog switch that operates from a single +1.6V to +3.6V supply. The MAX4714 has break-before-make switching. This device also has fast switching speeds ($t_{ON} = 18\text{ns}$, max, $t_{OFF} = 12\text{ns}$, max).

When powered from a +3V supply, the MAX4714 features 0.8Ω (max) on-resistance (R_{ON}), with 0.18Ω (max) R_{ON} matching and flatness. The digital logic input is 1.8V CMOS compatible when using a single +3V supply.

The MAX4714 is pin compatible with the MAX4599 and is available in a 6-pin SC70 or μDFN package.

Applications

- Power Routing
- Battery-Operated Equipment
- Audio and Video Signal Routing
- Low-Voltage Data-Acquisition Systems
- Communications Circuits
- PCMCIA Cards
- Cellular Phones
- Modems
- Hard Drives

Features

- ◆ **Low R_{ON}**
0.8Ω (max) (+3V Supply)
2.5Ω (max) (+1.8V Supply)
- ◆ **0.18Ω max R_{ON} Flatness (+3V Supply)**
- ◆ **+1.6V to +3.6V Single-Supply Operation**
- ◆ **Available in 6-Pin μDFN (1.5mm x 1mm) and SC70 Packages**
- ◆ **Fast Switching: $t_{ON} = 18\text{ns}$ (max), $t_{OFF} = 12\text{ns}$ (max)**
- ◆ **1.8V CMOS Logic Compatible (+3V Supply)**
- ◆ **Pin Compatible with MAX4599**
- ◆ **Guaranteed Break-Before-Make**

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX4714EXT-T	-40°C to +85°C	6 SC70-6	AAY
MAX4714ELT-T	-40°C to +85°C	6 μDFN-6	AJ

Pin Configurations/Functional Diagrams/Truth Table

TOP VIEW

μDFN

SC70-6

LOGIC	NC	NO
0	ON	OFF
1	OFF	ON

SWITCHES SHOWN FOR LOGIC 0 INPUT

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ABSOLUTE MAXIMUM RATINGS

Voltages Referenced to GND	6-Pin SC70 (derate 3.1mW/°C above +70°C).....	247mW
V+, IN	6-Pin μDFN-6 (derate 2.1mW/°C above +70°C)	167mW
COM, NC, NO (Note 1).....	Operating Temperature Range	
Continuous Current NO, NC to COM.....	MAX4714EXT	-40°C to +85°C
Peak Current NO, NC to COM	Junction Temperature	+150°C
(pulsed at 1ms, 10% duty cycle max)	Storage Temperature Range	-65°C to +150°C
Continuous Power Dissipation	Lead Temperature (soldering, 10s)	+300°C

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

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 +3V Supply

(V+ = +2.7V to +3.6V, V_{IH} = +1.4V, V_{IL} = +0.5V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V+ = +3.0V and T_A = +25°C.) (Notes 2, 3)

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 4)	R _{ON}	V+ = 2.7V, I _{COM} = 100mA, V _{NO} or V _{NC} = 1.5V	+25°C		0.6	0.8	Ω
			T _{MIN} to T _{MAX}			0.9	
On-Resistance Match Between Channels (Note 5)	ΔR _{ON}	V+ = 2.7V, I _{COM} = 100mA, V _{NO} or V _{NC} = 1.5V	+25°C		0.03	0.06	Ω
			T _{MIN} to T _{MAX}			0.08	
On-Resistance Flatness (Note 6)	R _{FLAT(ON)}	V+ = 2.7V, I _{COM} = 100mA, V _{NO} or V _{NC} = 0.6V, 1.5V, 2.1V	+25°C		0.1	0.18	Ω
			T _{MIN} to T _{MAX}			0.2	
NO or NC Off-Leakage Current	I _{NO(OFF)} , I _{NC(OFF)}	V+ = 3.3V, V _{COM} = 0.3V, 3V, V _{NO} or V _{NC} = 3V, 0.3V	+25°C	-1		+1	nA
			T _{MIN} to T _{MAX}		-5		
COM On-Leakage Current	I _{COM(ON)}	V+ = 3.3V, V _{COM} = 0.3V, 3V, V _{NO} or V _{NC} = 0.3V, 3V or floating	+25°C	-2		+2	nA
			T _{MIN} to T _{MAX}		-10		
DYNAMIC							
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 1	+25°C		13	18	ns
			T _{MIN} to T _{MAX}			20	
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 1	+25°C		6	12	ns
			T _{MIN} to T _{MAX}			15	
Break-Before-Make Delay (Note 7)	t _{BBM}	V _{NO} or V _{NC} = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 2	+25°C	1	9		ns
			T _{MIN} to T _{MAX}	1			
Charge Injection	Q	V _{GEN} , R _{GEN} , C _L = 1.0nF, Figure 3	+25°C		22		pC
Off-Isolation (Note 8)	V _{ISO}	f = 1MHz, V _{COM} = 1V _{RMS} , R _L = 50Ω, C _L = 5pF, Figure 4	+25°C		-54		dB
Crosstalk (Note 9)		f = 1MHz, V _{COM} = 1V _{RMS} , R _L = 50Ω, C _L = 5pF, Figure 4	+25°C		-54		dB
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, V _{COM} = 2V _{P-P} , R _L = 32Ω	+25°C		0.01		%

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ELECTRICAL CHARACTERISTICS—Single +3V Supply (continued)

(V+ = +2.7V to +3.6V, V_{IH} = +1.4V, V_{IL} = +0.5V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V+ = +3.0V and T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	T _A	MIN	TYP	MAX	UNITS
NC or NO Off-Capacitance	C _{NO(OFF)} , C _{NC(OFF)}	f = 1MHz, Figure 5	+25°C		30		pF
COM On-Capacitance	C _{COM(ON)}	f = 1MHz, Figure 5	+25°C		65		pF
LOGIC INPUT							
Input Voltage Low	V _{IL}					0.5	V
Input Voltage High	V _{IH}			1.4			V
Input Leakage Current	I _{IN}	V _{IN} = 0V or V+		-1		+1	μA
SUPPLY							
Power-Supply Range	V+			1.6		3.6	V
Positive Supply Current	I+	V+ = +3.6V, V _{IN} = 0V or V+	+25°C		0.04	0.2	μA
			T _{MIN} to T _{MAX}			2	

ELECTRICAL CHARACTERISTICS—Single +1.8V Supply

(V+ = +1.8V, V_{IH} = +1V, V_{IL} = +0.4V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Notes 2, 3)

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	R _{ON}	I _{COM} = 10mA, V _{NO} or V _{NC} = +0.9V	+25°C		1.2	2.5	Ω
			T _{MIN} to T _{MAX}			5	
NO or NC Off-Leakage Current	I _{NO(OFF)} , I _{NC(OFF)}	V _{COM} = 0.3V, 1.5V, V _{NO} or V _{NC} = 1.5V, 0.3V	+25°C	-1	0.01	+1	nA
			T _{MIN} to T _{MAX}		-5		
COM On-Leakage Current	I _{COM(ON)}	V _{COM} = 0.3V, 1.5V, V _{NO} or V _{NC} = 0.3V, 1.5V or floating	+25°C		-2	+2	nA
			T _{MIN} to T _{MAX}		-10	+10	
DYNAMIC							
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 1	+25°C		18	25	ns
			T _{MIN} to T _{MAX}			30	
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 1	+25°C		9	15	ns
			T _{MIN} to T _{MAX}			18	
Break-Before-Make Delay (Note 7)	t _{BBM}	V _{NO} or V _{NC} = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 2	+25°C		2		ns
			T _{MIN} to T _{MAX}		2		
Charge Injection	Q	V _{GEN} = 0V, R _{GEN} = 0, C _L = 1nF, Figure 3	+25°C		12		pC

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ELECTRICAL CHARACTERISTICS—Single +1.8V Supply (continued)

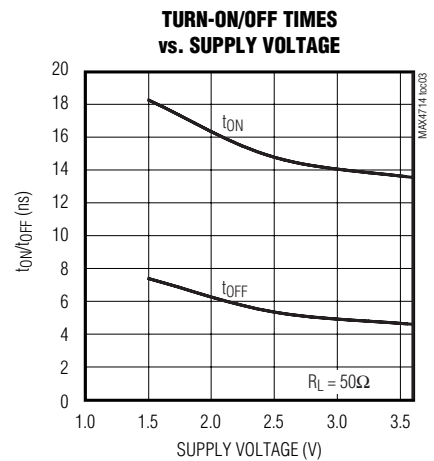
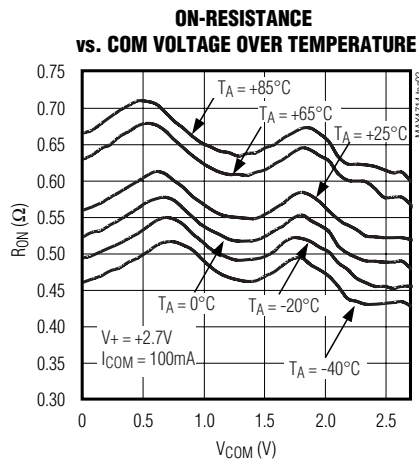
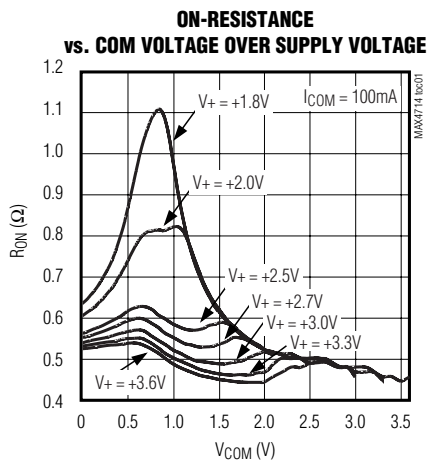
($V_+ = +1.8V$, $V_{IH} = +1V$, $V_{IL} = +0.4V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A = +25^\circ C$.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
LOGIC INPUT							
Input Voltage Low	V_{IL}					0.4	V
Input Voltage High	V_{IH}			1			V
Input Leakage Current	I_{IN}	$V_{IN} = 0V$ or V_+				1	μA
SUPPLY							
Positive Supply Current	I_+	$V_{IN} = 0V$ or V_+	+25°C		0.04	0.2	μA
			T_{MIN} to T_{MAX}			2	

- Note 2:** The algebraic convention, where the most negative value is a minimum and the most positive value is a maximum, is used in this data sheet.
- Note 3:** Parts are 100% tested at +25°C. Limits across the full temperature range are guaranteed by design and correlation.
- Note 4:** Guaranteed by design for μDFN package.
- Note 5:** $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$.
- Note 6:** Flatness is defined as the difference between the maximum and minimum values of on-resistance as measured over the specified analog signal range.
- Note 7:** Guaranteed by design.
- Note 8:** Off-Isolation = $20 \log_{10} [V_{COM} / (V_{NC} \text{ or } V_{NO})]$, V_{COM} = output, V_{NC} or V_{NO} = input to off switch.
- Note 9:** Between the two switches.

Typical Operating Characteristics

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



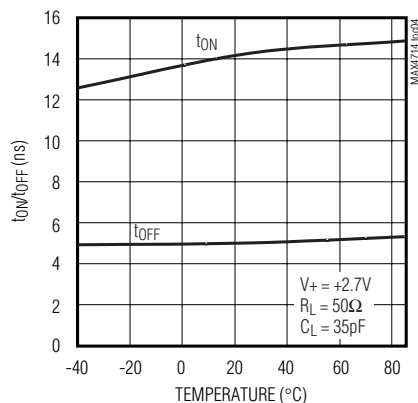
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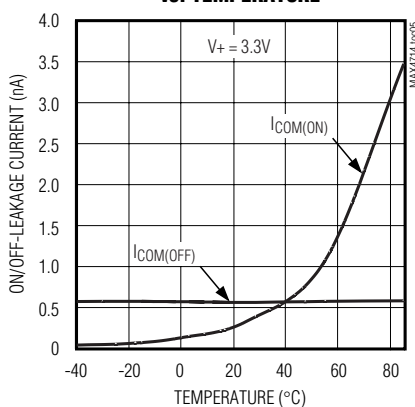
Typical Operating Characteristics (continued)

($T_A = +25^\circ\text{C}$, unless otherwise noted.)

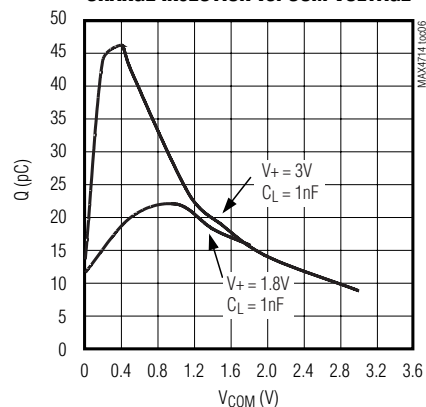
TURN-ON/OFF TIMES vs. TEMPERATURE



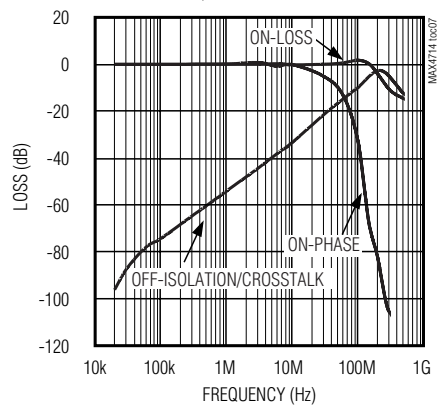
ON/OFF-LEAKAGE CURRENT vs. TEMPERATURE



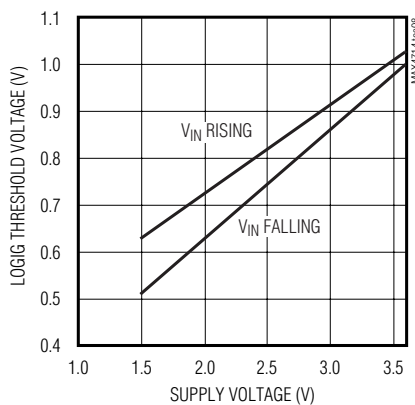
CHARGE INJECTION vs. COM VOLTAGE



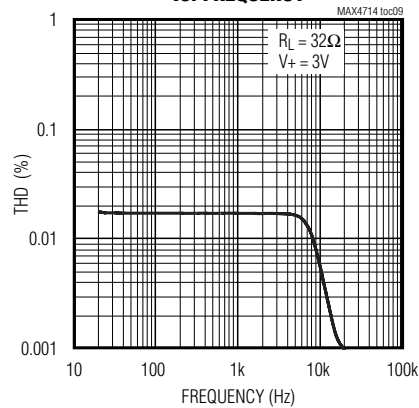
FREQUENCY RESPONSE



LOGIC THRESHOLD VOLTAGE vs. SUPPLY VOLTAGE



TOTAL HARMONIC DISTORTION vs. FREQUENCY



Pin Description

PIN	NAME	FUNCTION
1	IN	Digital Control Input
2	V+	Positive Supply Voltage Input
3	GND	Ground
4	NC	Analog Switch—Normally Closed
5	COM	Analog Switch—Common
6	NO	Analog Switch—Normally Open

0.8Ω, Low-Voltage, Single-Supply SPDT Analog Switch in SC70

Detailed Description

The MAX4714 is a low-on-resistance (R_{ON}), low-voltage, single-pole/double-throw (SPDT) analog switch that operates from a +1.6V to +3.6V supply. The MAX4714 has break-before-make switching. This device also has fast switching speeds ($t_{ON} = 18\text{ns}$, max, $t_{OFF} = 12\text{ns}$, max).

When powered from a +3V supply, the 0.8Ω (max) R_{ON} allows high continuous currents to be switched in a variety of applications.

Applications Information

Logic Inputs

The MAX4714 logic input can be driven up to +3.6V regardless of the supply voltage. For example, with a

+3.3V supply, IN may be driven low to GND and high to +3.6V. Driving IN rail-to-rail minimizes power consumption.

Analog Signal Levels

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

Chip Information

TRANSISTOR COUNT: 135

PROCESS: CMOS

Test Circuits/Timing Diagrams

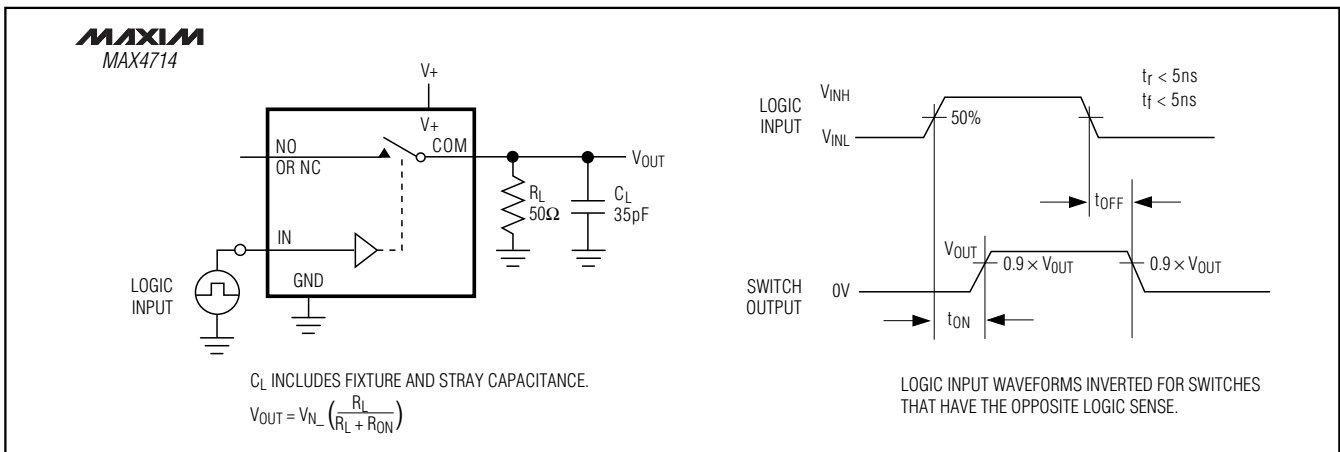


Figure 1. Switching Time

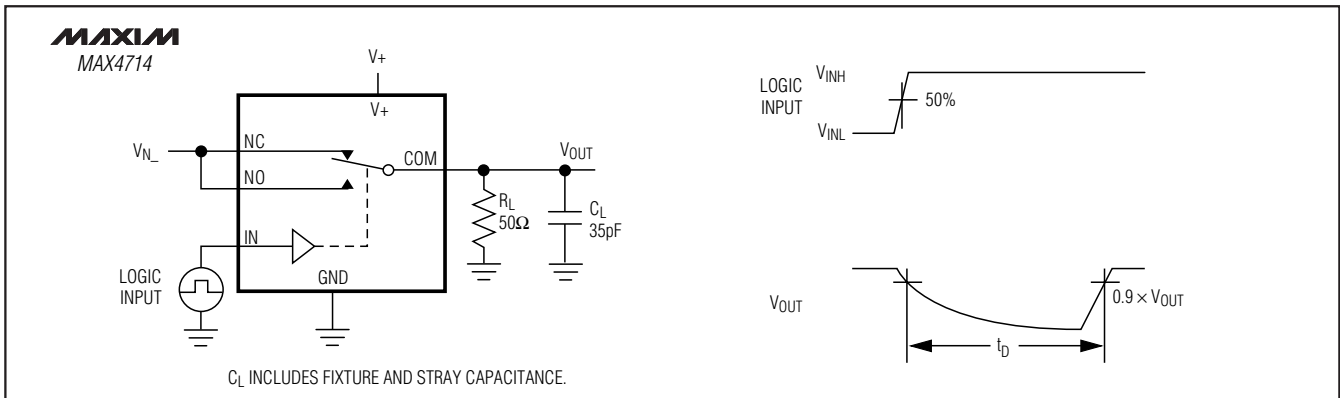


Figure 2. Break-Before-Make Interval

0.8Ω, Low-Voltage, Single-Supply SPDT Analog Switch in SC70

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Test Circuits/Timing Diagrams (continued)

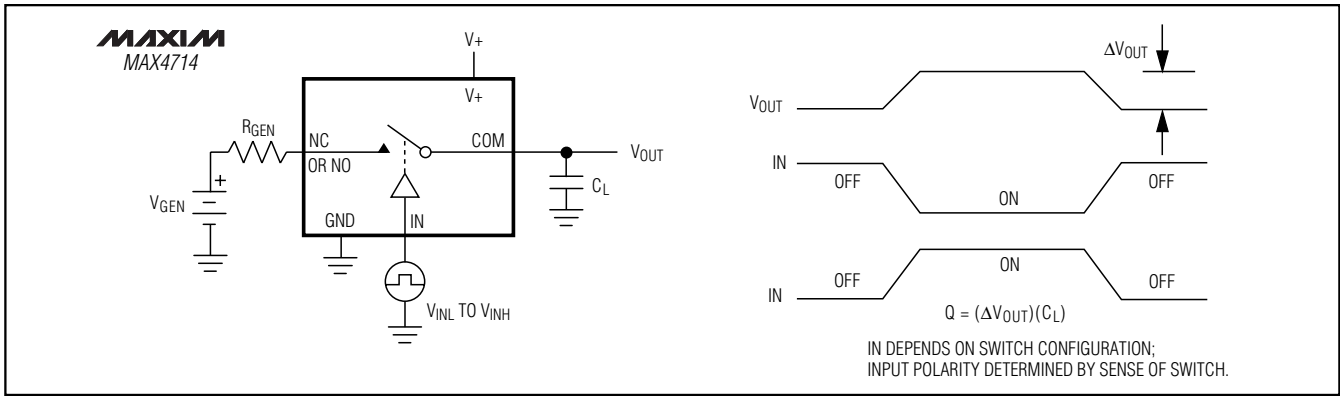


Figure 3. Charge Injection

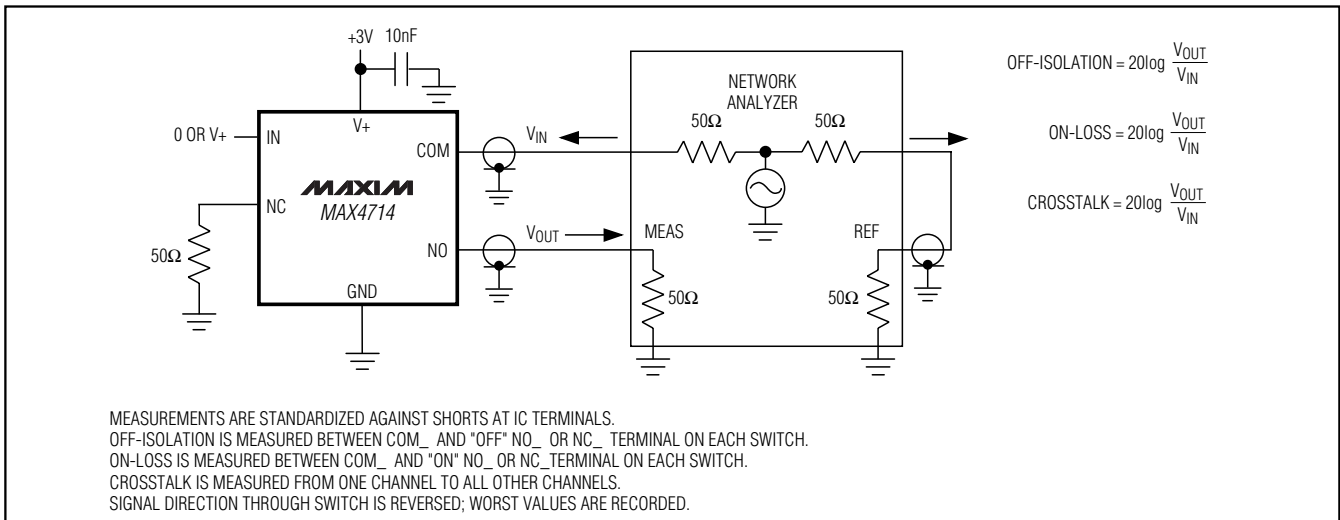


Figure 4. On-Loss, Off-Isolation, and Crosstalk

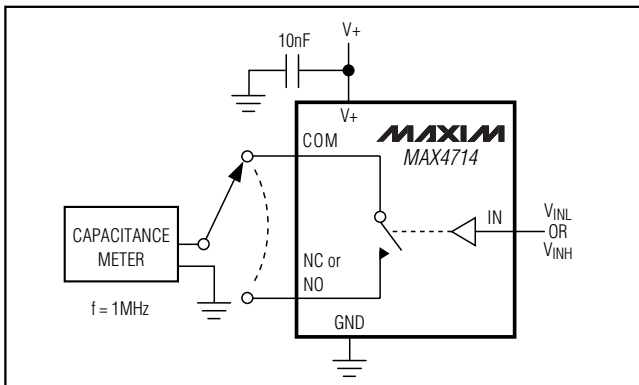
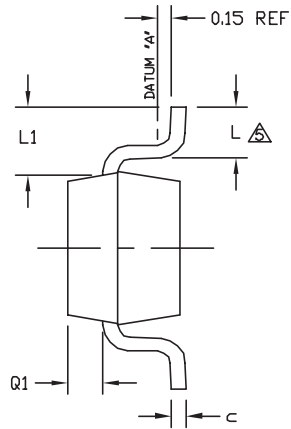
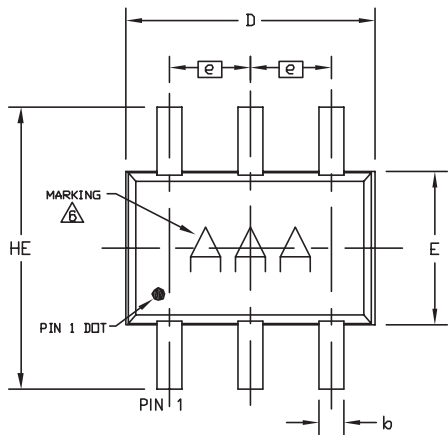


Figure 5. Channel Off/On-Capacitance

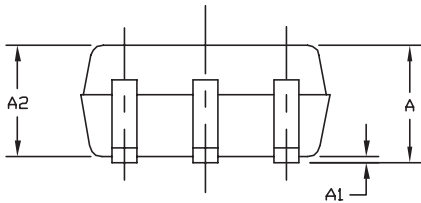
0.8Ω, Low-Voltage, Single-Supply SPDT Analog Switch in SC70

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.

-DRAWING NOT TO SCALE-

TITLE		
PACKAGE OUTLINE, 6L SC70		
APPROVAL	DOCUMENT CONTROL NO.	REV.
	21-0077	C 1/1

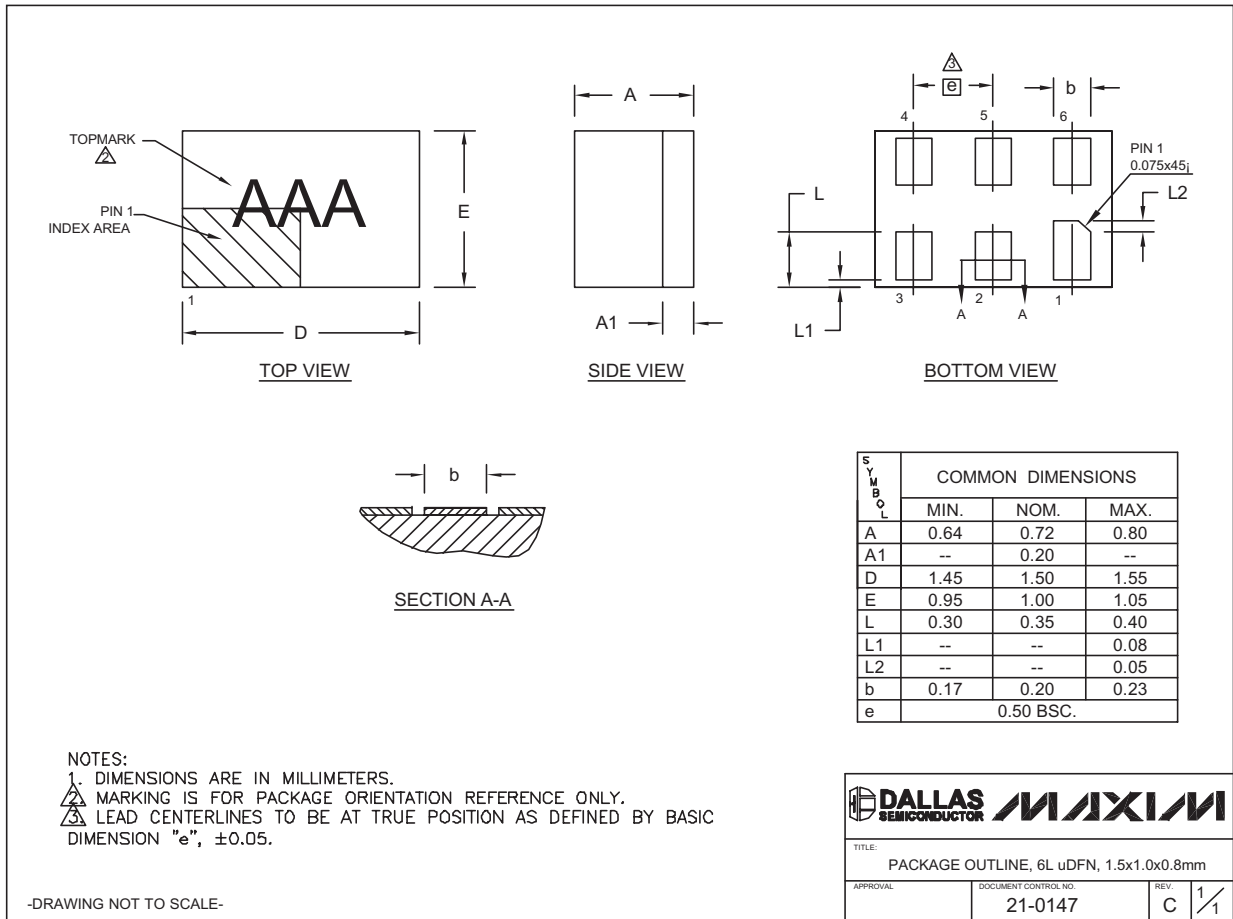
SC70, 6LEPS

0.8Ω, Low-Voltage, Single-Supply SPDT Analog Switch in SC70

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.)

MAX4714



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