MAXIM

0.8Ω, Low-Voltage, Single-Supply Dual SPST Analog Switches

General Description

The MAX4741/MAX4742/MAX4743 are low on-resistance, low-voltage, dual single-pole/single-throw (SPST) analog switches that operate from a single +1.6V to +3.6V supply. These devices have fast switching speeds (t$_{ON}$ = 24ns, t$_{OFF}$ = 16ns max), handle Rail-to-Rail® analog signals, and consume less than 1µW of quiescent power. The MAX4743 has break-before-make switching.

When powered from a +3V supply, the MAX4741/MAX4742/MAX4743 feature low 0.8Ω (max) on-resistance (R$_{ON}$), with 0.08Ω (max) R$_{ON}$ matching and 0.18Ω R$_{ON}$ flatness. The digital logic input is 1.8V CMOS compatible when using a single +3V supply.

The MAX4741 has two normally open (NO) switches, the MAX4742 has two normally closed (NC) switches, and the MAX4743 has one NO switch and one NC switch. The MAX4741/MAX4742/MAX4743 are available in 8-pin SOT23 and 8-pin µMAX packages.

Applications

Power Routing

Battery Powered Systems

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 SOT23 and µMAX Packages**

♦ **High-Current Handling Capacity (150mA continuous)**

♦ **1.8V CMOS Logic Compatible (+3V Supply)**

♦ **Fast Switching: t$_{ON}$ = 24ns, t$_{OFF}$ = 16ns**

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE	TOP MARK
MAX4741EKA	-40°C to +85°C	8 SOT23-8	AAIY
MAX4741EUA	-40°C to +85°C	8 µMAX	—
MAX4742EKA	-40°C to +85°C	8 SOT23-8	AAIZ
MAX4742EUA	-40°C to +85°C	8 µMAX	—
MAX4743EKA	-40°C to +85°C	8 SOT23-8	AAJA
MAX4743EUA	-40°C to +85°C	8 µMAX	—

Pin Configurations

TOP VIEW

SOT23-8 Pin Configurations continued at end of data sheet.
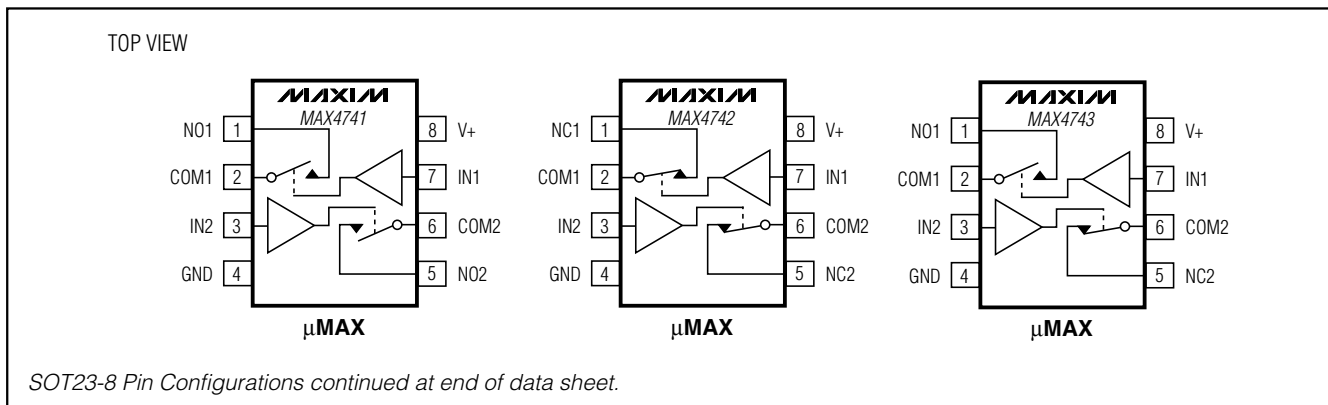
Rail-to-Rail is a registered trademark of Nippon Motorola, Inc.

MAXIM

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.

0.8Ω, Low-Voltage, Single-Supply Dual SPST Analog Switches

ABSOLUTE MAXIMUM RATINGS

Voltages Referenced to GND
V+, IN_...-0.3V to +4V
COM_, NO_, NC_ (Note 1) ....-0.3V to (V+ + 0.3V)
Continuous Current COM_ , NO_, NC_ ....±150mA
Peak Current COM_, NO_, NC_
  (pulsed at 1ms 10% duty cycle)..................................±300mA
Continuous Power Dissipation (T$_A$ = +70°C)
  8-Pin SOT23 (derate 7.52mW/°C above +70°C)...........602mW
  8-Pin µMAX (derate 4.5mW/°C above +70°C) 362mW

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 COM_, NO_, or NC_ exceeding V+ or GND are clamped by internal diodes. Limit forward 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—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 specified. Typical values are at V+ = +3.0V, 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$_{ON}$	V+ = 2.7V, I$_{COM\_}$ = 100mA, V$_{NO\_}$ or V$_{NC\_}$ = 1.5V	+25°C		0.5	0.8	Ω
			T$_{MIN}$ to T$_{MAX}$			0.9	
On-Resistance Match Between Channels (Note 4)	ΔR$_{ON}$	V+ = 2.7V, I$_{COM\_}$ = 100mA, V$_{NO\_}$ or V$_{NC\_}$ = 1.5V	+25°C		0.05	0.08	Ω
			T$_{MIN}$ to T$_{MAX}$			0.09	
On-Resistance Flatness (Note 5)	R$_{FLAT(ON)}$	V+ = 2.7V, I$_{COM\_}$ = 100mA, V$_{NO\_}$ or V$_{NC\_}$ = 1V, 1.5V, 2V	+25°C		0.05	0.18	Ω
			T$_{MIN}$ to T$_{MAX}$			0.20	
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		5	
COM_ Off-Leakage Current	I$_{COM\_(OFF)}$	V+ = 3.3V, V$_{COM\_}$ = 0.3V, 3V V$_{NO\_}$ or V$_{NC\_}$ = 3V, 0.3V or floating	+25°C	-1		1	nA
			T$_{MIN}$ to T$_{MAX}$	-5		5	
COM_ On-Leakage Current	I$_{COM\_(ON)}$	V+ = 3.3V, V$_{COM\_}$ = 3V, 0.3V; V$_{NO\_}$ or V$_{NC\_}$ = 3V, 0.3V or floating	+25°C	-2		2	nA
			T$_{MIN}$ to T$_{MAX}$	-10		10	

МAXIM

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 specified. Typical values are at V+ = +3.0V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
SWITCH DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	$V_{NO\_}$, $V_{NC\_}$ = 1.5V, R_L = 50Ω, C_L = 35pF, Figure 1	+25°C		18	24	ns
			T_{MIN} to T_{MAX}			28	
Turn-Off Time	t_{OFF}	$V_{NO\_}$, $V_{NC\_}$ = 1.5V, R_L = 50Ω, C_L = 35pF, Figure 1	+25°C		12	16	ns
			T_{MIN} to T_{MAX}			18	
Break-Before-Make (Note 6)	t_{BBM}	$V_{NO\_}$, $V_{NC\_}$ = 1.5V, R_L = 50Ω, C_L = 35pF, Figure 1 (MAX4743)	+25°C		6		ns
			T_{MIN} to T_{MAX}	1			
Charge Injection	Q	V_{GEN} = 0, R_{GEN} = 0, C_L = 1.0nF, Figure 3	+25°C		28		pC
NO_ or NC_ Off-Capacitance	C_{OFF}	f = 1MHz, Figure 4	+25°C		32		pF
COM_ Off-Capacitance	$C_{COM\_(OFF)}$	f = 1MHz, Figure 4	+25°C		32		pF
COM_ On-Capacitance	$C_{COM\_(ON)}$	f = 1MHz, Figure 4	+25°C		44		pF
-3dB On-Channel Bandwidth	BW	Signal = 0, R_{IN} = R_{OUT} = 50Ω, C_L = 5pF, Figure 2			100		MHz
Off-Isolation (Note 7)	V_{ISO}	f = 1MHz, $V_{COM\_}$ = 1V_{RMS}, R_L = 50Ω, C_L = 5pF, Figure 2	+25°C		-55		dB
Crosstalk (Note 8)		f = 1MHz, $V_{COM\_}$ = 1V_{RMS}, R_L = 50Ω, C_L = 5pF, Figure 2	+25°C		-110		dB
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, $V_{COM\_}$ = 2Vp-p, R_L = 32Ω	+25°C		0.02		%
LOGIC INPUT							
Input Logic High	V_{IH}			1.4			V
Input Logic Low	V_{IL}					0.5	V
Input Leakage Current	I_{IN}	$V_{IN\_}$ = 0 or V+		-1	0.005	1	µA
POWER SUPPLY							
Power-Supply Range	V+			1.6		3.6	V
Positive Supply Current	I+	V+ = 3.6V, $V_{IN\_}$ = 0 or V+, all channels on or off	+25°C			0.2	µA

0.8Ω, Low-Voltage, Single-Supply Dual SPST Analog Switches

MAX4741/MAX4742/MAX4743

ELECTRICAL CHARACTERISTICS—Single +1.8V Supply

(V+ = +1.8V, V_{IH} = +1.0V, V_{IL} = 0.4V, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. 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		1.3	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		1	nA
			T_{MIN} to T_{MAX}	-5		5	
COM_ Off-Leakage Current	$I_{COM\_(OFF)}$	$V_{COM\_}$ = 0.3V, 1.5V; $V_{NO\_}$ or $V_{NC\_}$ = 1.5V, 0.3V	+25°C	-1		1	nA
			T_{MIN} to T_{MAX}	-5		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	
SWITCH DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	$V_{NO\_}$, $V_{NC\_}$ = 1.5V, R_L = 50Ω, C_L = 35pF, Figure 1	+25°C		25	35	ns
			T_{MIN} to T_{MAX}			40	
Turn-Off Time	t_{OFF}	$V_{NO\_}$, $V_{NC\_}$ = 1.5V, R_L = 50Ω, C_L = 35pF, Figure 1	+25°C		16	25	ns
			T_{MIN} to T_{MAX}			30	
Break-Before-Make (Note 6)	t_{BBM}	$V_{NO\_}$, $V_{NC\_}$ = 1.5V, R_L = 50Ω, C_L = 35pF, Figure 1 (MAX4743)	+25°C		10		ns
			T_{MIN} to T_{MAX}	1			
Charge Injection	Q	V_{GEN} = 0, R_{GEN} = 0, C_L = 1nF, Figure 2	+25°C		16		pC
Off-Isolation (Note 7)	V_{ISO}	f = 1MHz, $V_{NO\_}$ = $V_{NC\_}$ = 1V_{RMS}, R_L = 50Ω, C_L = 5pF, Figure 2	+25°C		-50		dB
Crosstalk (Note 8)		f = 1MHz, $V_{COM\_}$ = 1V_{RMS}, R_L = 50Ω, C_L = 5pF, Figure 2	+25°C		-110		dB

MAXIM

ELECTRICAL CHARACTERISTICS—Single +1.8V Supply (continued)

(V+ = +1.8V, V_{IH} = +1.0V, V_{IL} = 0.4V, T_A = T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are at T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
LOGIC INPUT							
Input Logic High	V_{IH}			1			V
Input Logic Low	V_{IL}					0.4	V
Input Leakage Current	I_{IN}	$V_{IN\_}$ = 0 or V+		-1		1	μA

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: SOT23 packaged parts are 100% tested at +25°C. Limits across the full temperature range are guaranteed by design and correlation. μMAX packaged parts -40°C specifications are guaranteed by design.

Note 4: ΔR_{ON} = $R_{ON(MAX)}$ - $R_{ON(MIN)}$.

Note 5: Flatness is defined as the difference between the maximum and the minimum value of on-resistance as measured over the specified analog signal ranges.
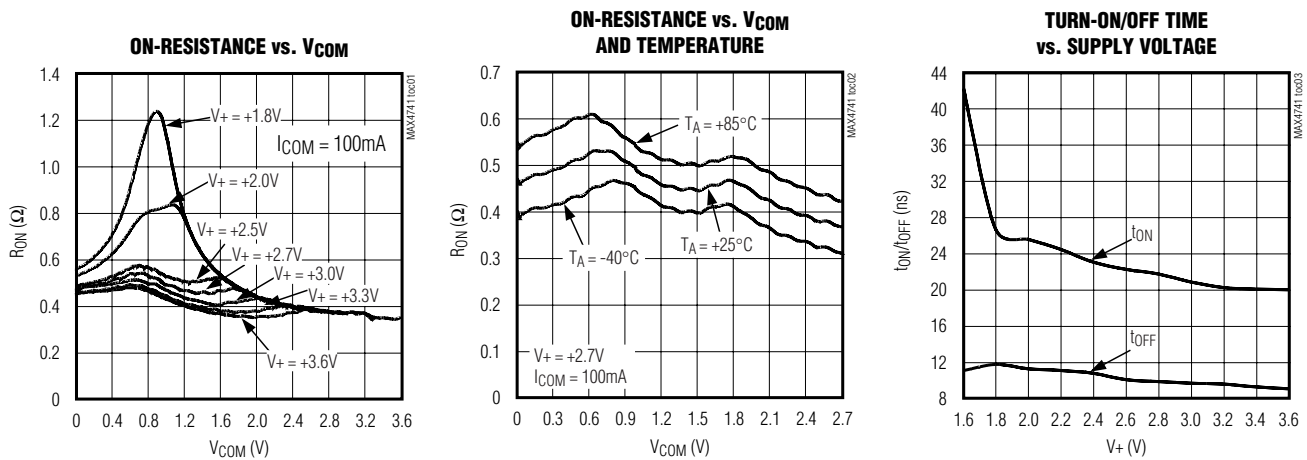
Note 6: Guaranteed by design.

Note 7: Off-Isolation = $20\log_{10}(V_{COM\_}/V_{NO\_})$, $V_{COM\_}$ = output, $V_{NO\_}$ = input to off switch.

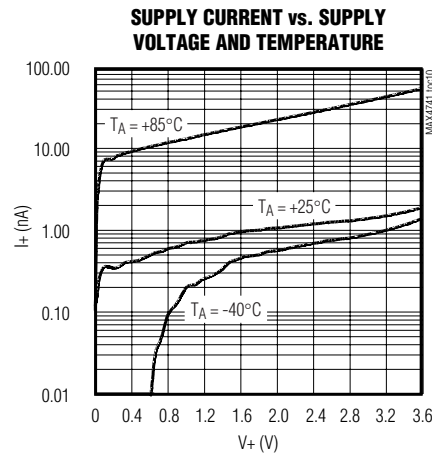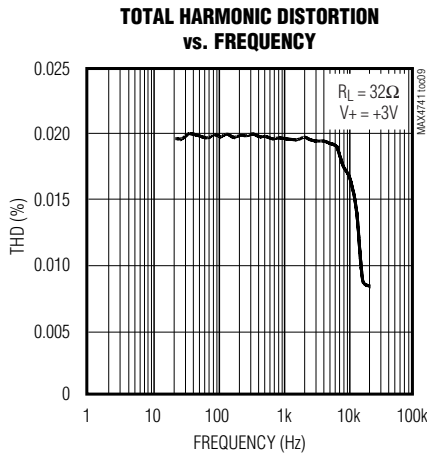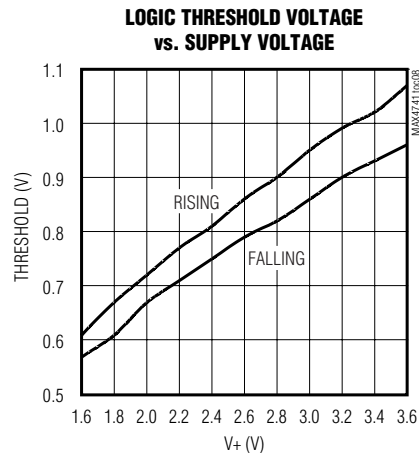**Note 8:** Between two switches.
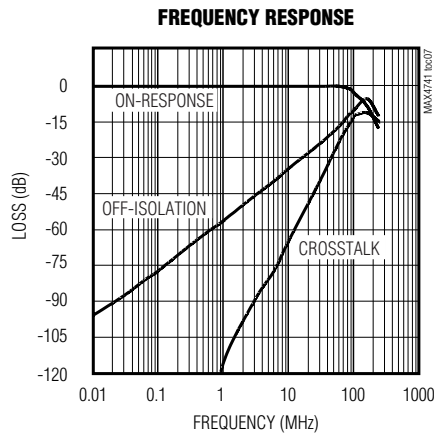
Typical Operating Characteristics

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

ON-RESISTANCE vs. V_{COM}

ON-RESISTANCE vs. V_{COM} AND TEMPERATURE

TURN-ON/OFF TIME vs. SUPPLY VOLTAGE

MAX4741/MAX4742/MAX4743

Typical Operating Characteristics (continued)

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

TURN-ON/OFF TIME vs. TEMPERATURE

LEAKAGE CURRENT vs. TEMPERATURE

CHARGE INJECTION vs. OUTPUT VOLTAGE

FREQUENCY RESPONSE

LOGIC THRESHOLD VOLTAGE vs. SUPPLY VOLTAGE

TOTAL HARMONIC DISTORTION vs. FREQUENCY

SUPPLY CURRENT vs. SUPPLY VOLTAGE AND TEMPERATURE
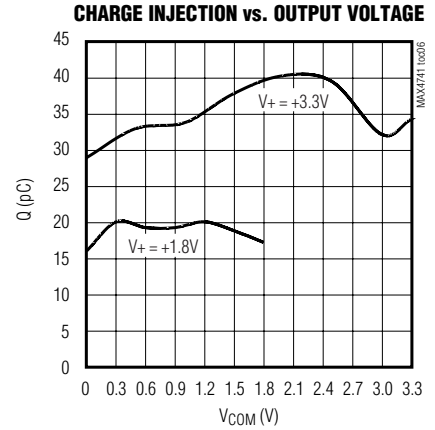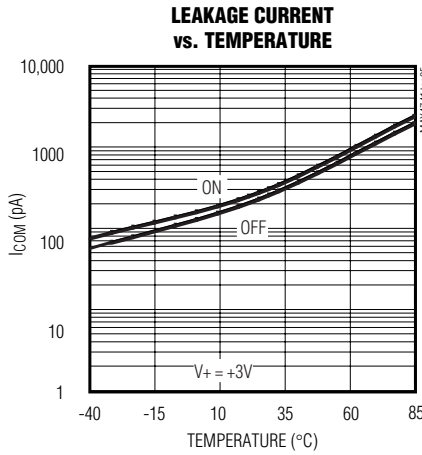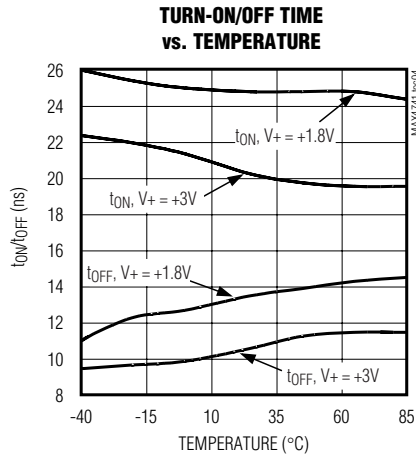
Pin Description

PIN						NAME	FUNCTION
MAX4741		MAX4742		MAX4743			
μMAX	SOT23-8	μMAX	SOT23-8	μMAX	SOT23-8		
1	8	—	—	1	8	NO1	Analog Switch 1 Normally Open
—	—	1	8	—	—	NC1	Analog Switch 1 Normally Closed
2	7	2	7	2	7	COM1	Analog Switch 1 Common
3	6	3	6	3	6	IN2	Logic Control Input Switch 2
4	5	4	5	4	5	GND	Ground
5	3	—	—	—	—	NO2	Analog Switch 2 Normally Open
—	—	5	3	5	3	NC2	Analog Switch 2 Normally Closed
6	4	6	4	6	4	COM2	Analog Switch 2 Common
7	1	7	1	7	1	IN1	Logic Control Input Switch 1
8	2	8	2	8	2	V+	Positive Supply Voltage

Detailed Description

The MAX4741/MAX4742/MAX4743 are low 0.8Ω max (at V+ = +3V) on-resistance, low-voltage, dual analog switches that operate from a +1.6V to +3.6V single supply. CMOS switch construction allows switching analog signals that are within the supply voltage range (GND to V+).

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

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings can cause permanent damage to the devices. Always sequence V+ on first, followed by NO_, NC_, or COM_.

Although it is not required, power-supply bypassing improves noise margin and prevents switching noise propagation from the V+ supply to other components. A 0.1μF capacitor, connected from V+ to GND, is adequate for most applications.

Logic Inputs

The MAX4741/MAX4742/MAX4743 logic inputs can be driven up to +3.6V regardless of the supply voltage. For example, with a +1.8V 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.

Layout

High-speed switches require proper layout and design procedures for optimum performance. Reduce stray inductance and capacitance by keeping traces short and wide. Ensure that bypass capacitors are as close to the device as possible. Use large ground planes where possible.

MAXIM _____ 7

MAX4741/MAX4742/MAX4743
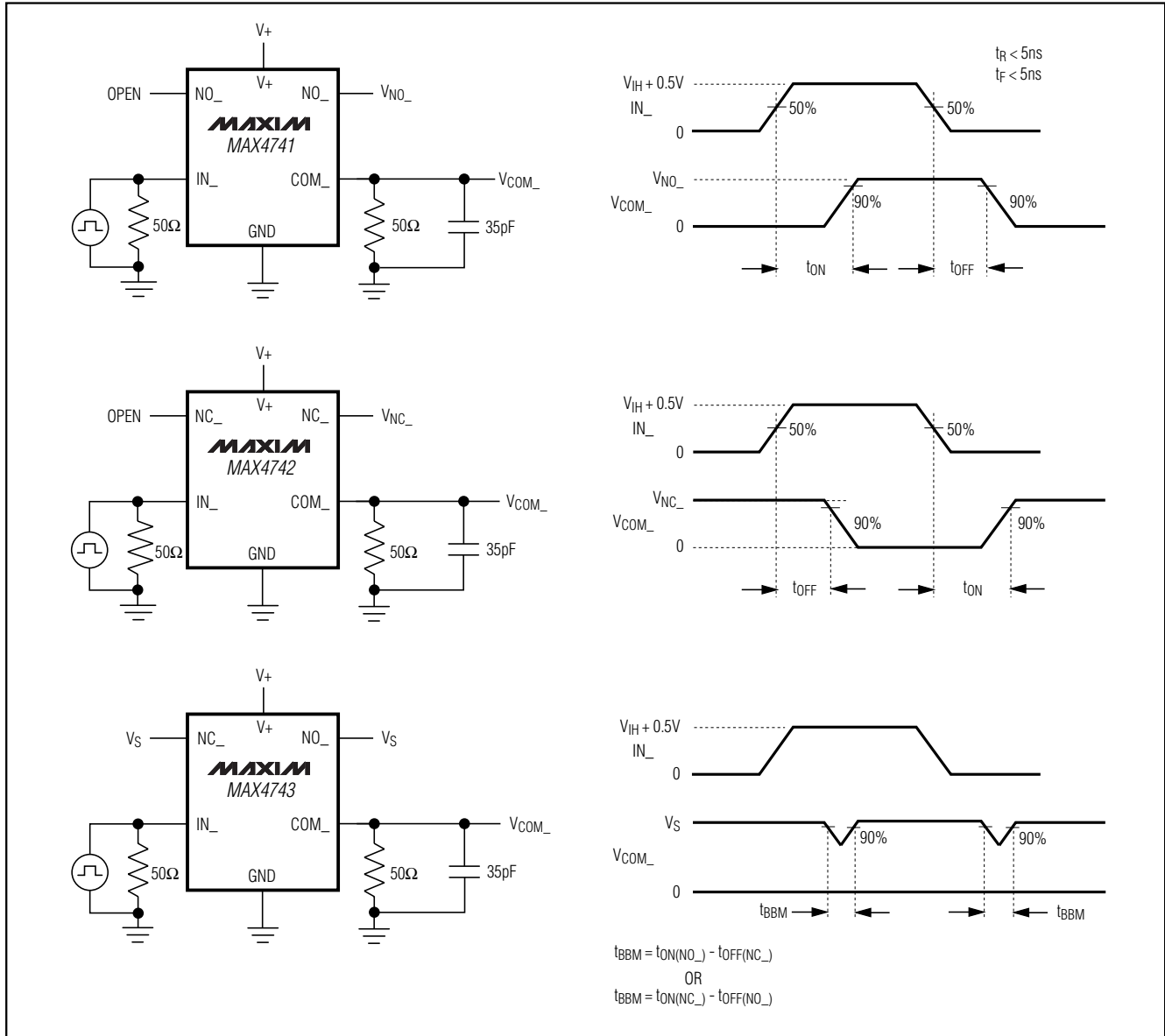
Figure 1. Switching Times

MAXIM

MAX4741/MAX4742/MAX4743

MEASUREMENTS ARE STANDARDIZED AGAINST SHORT AT SOCKET TERMINALS. OFF-ISOLATION IS MEASURED BETWEEN COM AND "OFF" TERMINAL ON EACH SWITCH. ON-LOSS IS MEASURED BETWEEN COM AND "ON" TERMINAL ON EACH SWITCH. SIGNAL DIRECTION THROUGH SWITCH IS REVERSED; WORST VALUES ARE RECORDED.

$$\text{OFF-ISOLATION} = 20\log \frac{V_{OUT}}{V_{IN}}$$

$$\text{ON-LOSS} = 20\log \frac{V_{OUT}}{V_{IN}}$$

* ADD 50Ω TERMINATION FOR OFF-ISOLATION
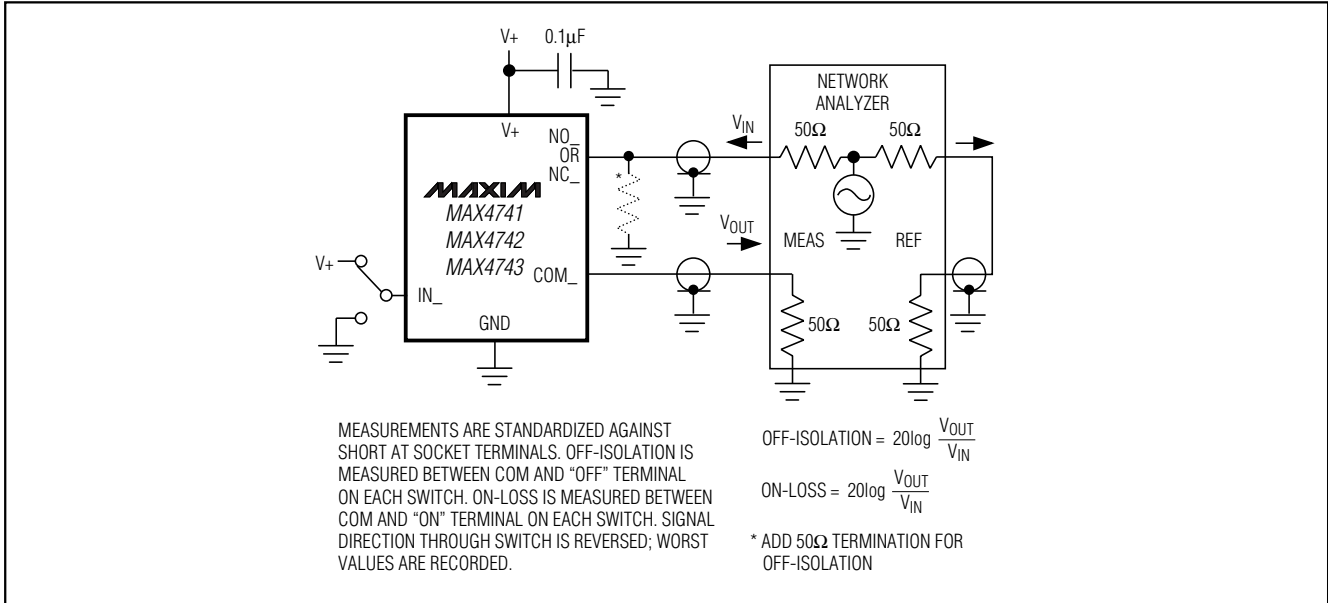
Figure 2. Off-Isolation, On-Loss, and Crosstalk

ΔV_{OUT} IS THE MEASURED VOLTAGE DUE TO CHARGE TRANSFER ERROR Q WHEN THE CHANNEL TURNS OFF.

$$Q = \Delta V_{OUT} \times C_L$$
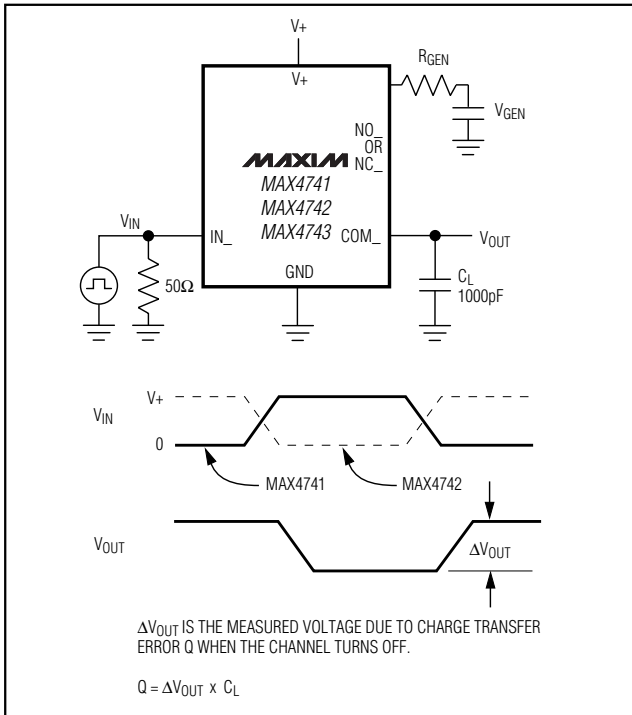
Figure 3. Charge Injection
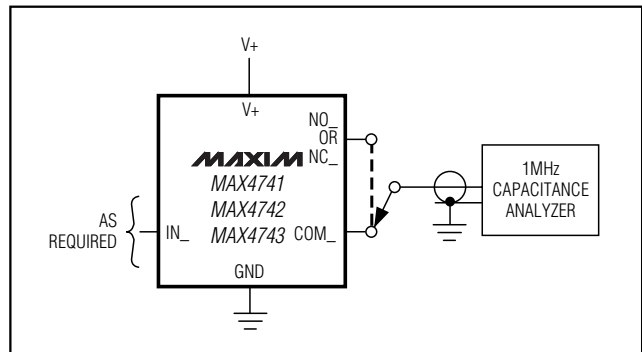
Figure 4. NO_, NC_, and COM_ Capacitance

MAX4741/MAX4742/MAX4743

Pin Configurations (continued)

TOP VIEW

```
        MAXIM
        MAX4741
IN1   1           8   NO1
V+    2           7   COM1
NO2   3           6   IN2
COM2  4           5   GND
        SOT23-8
```

```
        MAXIM
        MAX4742
IN1   1           8   NC1
V+    2           7   COM1
NC2   3           6   IN2
COM2  4           5   GND
        SOT23-8
```

```
        MAXIM
        MAX4743
IN1   1           8   NO1
V+    2           7   COM1
NC2   3           6   IN2
COM2  4           5   GND
        SOT23-8
```
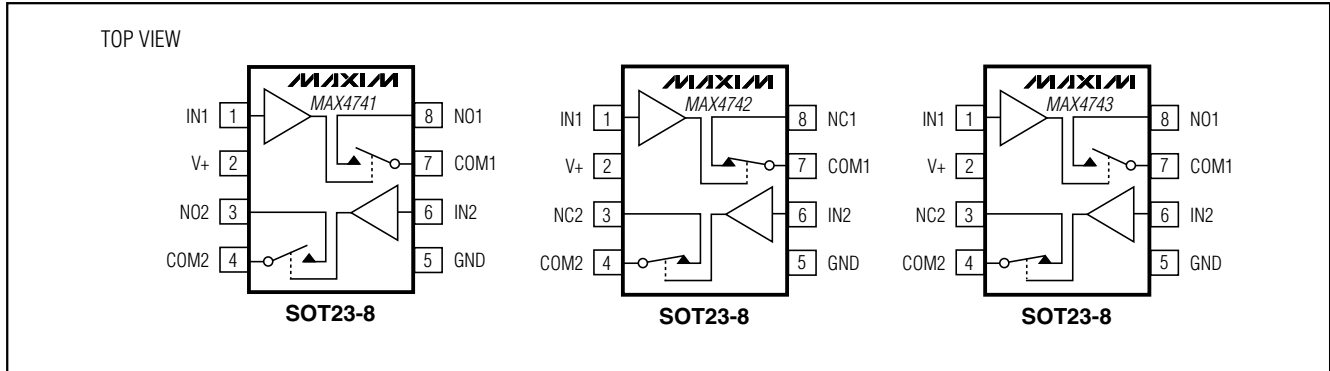
Chip Information

TRANSISTOR COUNT = 121

PROCESS = CMOS

MAXIM

0.8Ω, Low-Voltage, Single-Supply Dual SPST Analog Switches

SOT23, 8L.EPS
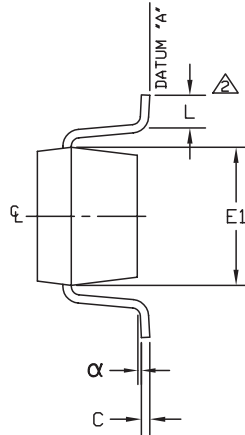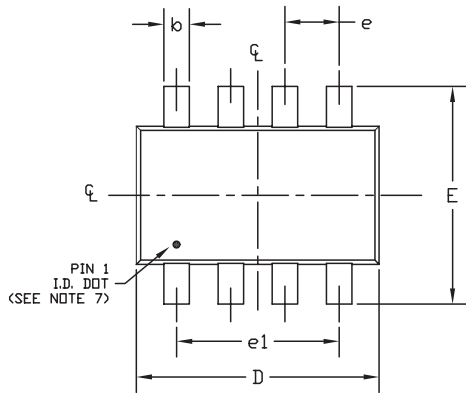
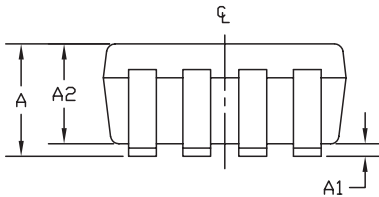| SYMBOL	MIN	MAX
A	0.90	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.28	0.45
c	0.09	0.20
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.75
L	0.10	0.60
e	0.65 ref	
e1	1.95 ref	
α	0⁻	10⁻

NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. FOOT LENGTH MEASURED REFERENCE TO FLAT FOOT
   SURFACE PARALLEL TO DATUM "A".
3. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & METAL BURR.
4. PACKAGE OUTLINE INCLUSIVE OF SOLDER PLATING.
5. EIAJ REF. NUMBER' SC-74 (6 LEAD VERSION)
6. COPLANARITY 4 MILS. MAX.
7. PIN 1 I.D. DOT IS 0.3 MM Ø MIN. LOCATED ABOVE PIN 1.
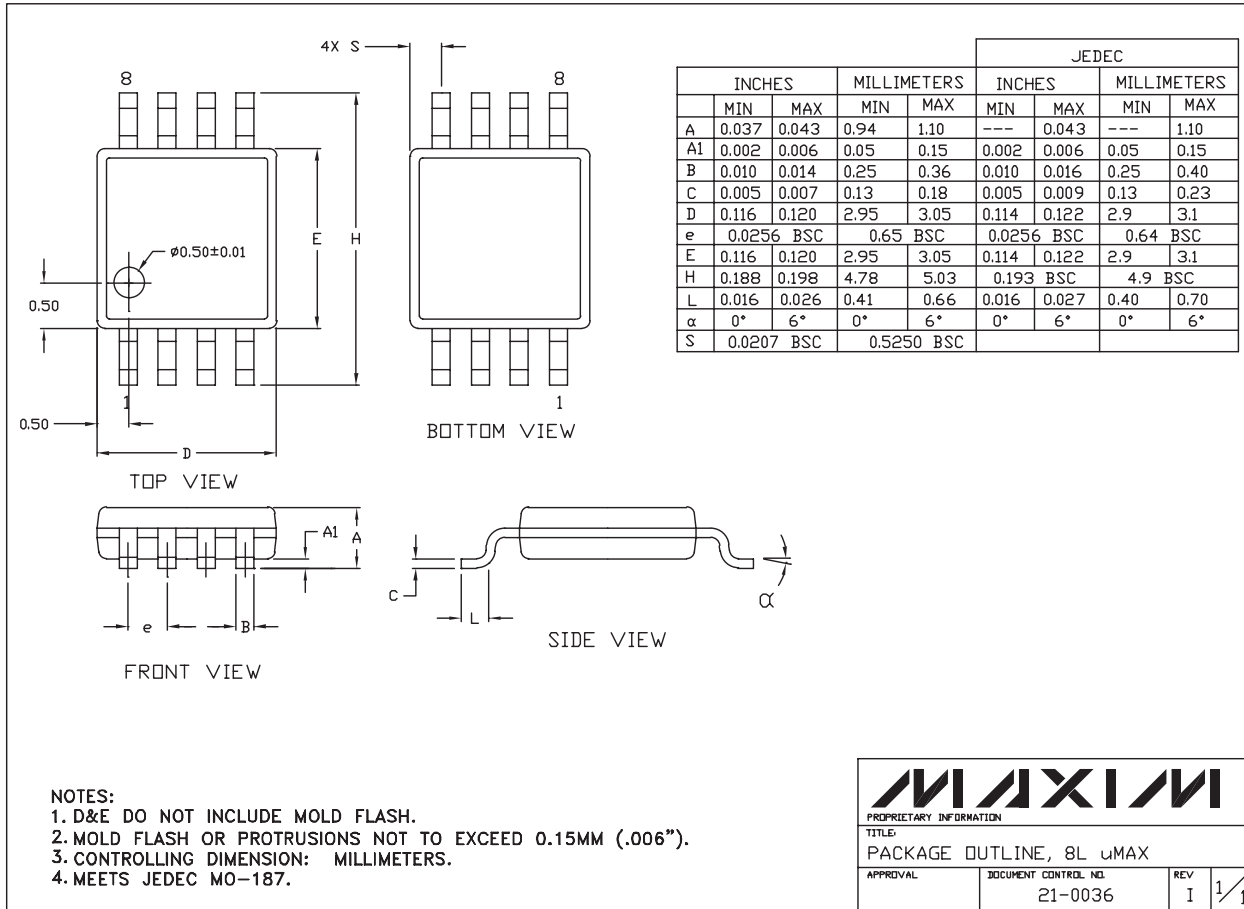8. MEETS JEDEC MO178.

MAXIM
PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, SOT-23, 8L			
APPROVAL	DOCUMENT CONTROL NO. 21-0078	REV C	1/1

MAX4741/MAX4742/MAX4743

MAXIM

0.8Ω, Low-Voltage, Single-Supply Dual SPST Analog Switches

MAX4741/MAX4742/MAX4743

8LUMAXD.EPS

	INCHES		MILLIMETERS		JEDEC			
					INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	0.037	0.043	0.94	1.10	---	0.043	---	1.10
A1	0.002	0.006	0.05	0.15	0.002	0.006	0.05	0.15
B	0.010	0.014	0.25	0.36	0.010	0.016	0.25	0.40
C	0.005	0.007	0.13	0.18	0.005	0.009	0.13	0.23
D	0.116	0.120	2.95	3.05	0.114	0.122	2.9	3.1
e	0.0256 BSC		0.65 BSC		0.0256 BSC		0.64 BSC	
E	0.116	0.120	2.95	3.05	0.114	0.122	2.9	3.1
H	0.188	0.198	4.78	5.03	0.193 BSC		4.9 BSC	
L	0.016	0.026	0.41	0.66	0.016	0.027	0.40	0.70
α	0°	6°	0°	6°	0°	6°	0°	6°
S	0.0207 BSC		0.5250 BSC					

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15MM (.006").
3. CONTROLLING DIMENSION: MILLIMETERS.
4. MEETS JEDEC MO−187.

/N/I /I X I /N/I
PROPRIETARY INFORMATION

TITLE:
PACKAGE OUTLINE, 8L uMAX

APPROVAL	DOCUMENT CONTROL NO.	REV	
	21-0036	I	1/1