Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

ABSOLUTE MAXIMUM RATINGS

(Voltages Referenced to GND)	
V+	0.3V to +13V
V	13V to +0.3V
V+ to V	0.3V to +13V
EN, IN, COM, NC, NO (Note 1)	(V0.3V) to $(V++0.3V)$
Continuous Current (any terminal)	±20mA
Peak Current, COM, NC, NO	
(pulsed at 1ms, 10% duty cycle)	±30mA
ESD per Method 3015.7	

Continuous Power Dissipation ($T_A = -$	+70°C)
SOT23 (derate 5.6mW/°C above +	-70°C)444.4mW
μMAX (derate 4.5mW/°C above +	70°C)362mW
Operating Temperature Range	
MAX4564E_A	40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	
Lead Temperature (soldering, 10s)	
Soldering Temperature (reflow)	+260°C

Note 1: Signals on NO, NC, COM, IN, or EN exceeding V+ or V- 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

 $(V+ = +4.5V \text{ to } +6V, V- = -4.5V \text{ to } -6V, V_{IH} = +2.4V, V_{IL} = +0.8V, GND = 0, T_A = T_{MIN} \text{ to } T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Notes 2, 3)$

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}			V-		V+	V
On-Resistance	V+ = +4.5V, V- = -4.5V, +	+25°C		40	60	Ω	
On-Resistance	Ron	$I_{COM} = 1$ mA; V_{NO} , $V_{NC} = \pm 3.5$ V	Е			100	52
On-Resistance Match Between	ΔRon	V+ = +4.5V, V- = -4.5V,	+25°C		0.75	3	Ω
Channels (Note 4)	ΔhON	$I_{COM} = 1mA; V_{NO}, V_{NC} = \pm 3.5V$	Е			4	32
On-Resistance Flatness	DEL ATIONS	V+ = +4.5V, V- = -4.5V, I _{COM} =	+25°C		6.5	10	Ω
(Note 5)	R _{FLAT} (ON)) 1mA; V_{NO} , $V_{NC} = -3.5V$, 0, +3.5V	Е			13	
NO or NC Off-Leakage Current	I _{NC(OFF)} or	V+ = +5.5V, V- = -5.5V; V _{COM} = +4.5V, -4.5V;	+25°C	-1	0.05	1	nA
NO of NC Off-Leakage Current	INO(OFF)	V_{NO} , $V_{NC} = -4.5$, $+4.5$ V	Е	-5		5	117 (
COM Off-Leakage Current	loowers)	V+ = +5.5V, V- = -5.5V; V _{COM} = +4.5V, -4.5V;	+25°C	-1	0.05	1	nA
COM On-Leakage Current	ICOM(OFF)	$V_{COM} = +4.5V, -4.5V,$ $V_{NO}, V_{NC} = -4.5, +4.5V$	Е	-5		5	117.
COM On-Leakage Current	loon won	V+ = +5.5V, V- = -5.5V, V _{COM} = +4.5V, -4.5V; V _{NO} , V _{NC} = +4.5V,	+25°C	-2	0.05	2	nA
	ICOM(ON)	$-4.5V$, $-4.5V$, V_{NO} , $V_{NC} = +4.5V$, $-4.5V$, or unconnected	Е	-10		10	11/1

Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

ELECTRICAL CHARACTERISTICS—±5V Supply (continued)

 $(V+ = +4.5V \text{ to } +6V, V- = -4.5V \text{ to } -6V, V_{IH} = +2.4V, V_{IL} = +0.8V, GND = 0, T_A = T_{MIN} \text{ to } T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Notes 2, 3)$

SWITCH DYNAMIC CHARACTERISTICS Turn-On Time ton VNO, VNC = +3V, -3V, RL = 1KΩ, CL = 35pF ±25°C 40 60 75 Turn-Off Time toFF VNO, VNC = +3V, -3V, RL = 35pF ±25°C 28 40 60 8 Transition Time trRANS VNO, VNC = +3V, VNO = -3V, VNO = -3V, NNO = +3V, NNO =	PARAMETER	SYMBOL	CONDITIONS	TA	MIN	TYP	MAX	UNITS
Turn-On Time Ion RL = IRΩ, CL = 35pF E 75 Turn-Off Time toFF No., VNC = +3V, -3V, -8L = 1RΩ, CL = 35pF E 50 Transition Time toFF VNC, VNC = +3V, -3V, -8L = 300Ω, -8L = 1RΩ, -8L = 300Ω, -8L = 1RQ, -8L = 300Ω, -8	SWITCH DYNAMIC CHARACTE	ERISTICS		L				1
Turn-Off Time	- 0 -		VNO. VNC = +3V3V.	+25°C		40	60	
Turn-Off Time toFF RL = 1kΩ, CL = 35pF E 50 Transition Time tTRANS VNC = +3V, VNO = -3V, VND = +3V, VNC = +3V, V	Turn-On Time	tON		Е			75	ns
H _L = 1KΩ, C _L = 35pF E 50 70	Turn Off Time	+0.55	$V_{NO}, V_{NC} = +3V, -3V,$	+25°C		28	40	200
Transition Time	Turn-Oil Time	IOFF	$R_L = 1k\Omega$, $C_L = 35pF$	Е			50	ns
R _L = 1kΩ, C _L = 35pF E 85			$V_{NC} = +3V, V_{NO} = -3V,$	+25°C		50	70	
Charge Injection Q	Transition Time	ttrans		Е			85	ns
C _L = 100pF		t _{BBM}		+25°C	5	15		ns
Toda Foda 1 MHz	Charge Injection	Q		+25°C		3		рС
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	-3dB Bandwidth	f _{-3dB}	· ·	+25°C		450		MHz
Signal Output V- = -4.5V, f _{IN} = 1MHz, V _{EN} = V _{IH} V- = -4.5°C Os Crosstalk (Between Switches) V _{CT} R _L = 50Ω, C _L = 10pF, f _{IN} = 1MHz +25°C -72 Total Harmonic Distortion THD R _L = 600kΩ, C _L = 50pF, f _{IN} = 20kHz +25°C 0.15 Control Input Capacitance C _{IN} 3	Off-Isolation (Note 7)	VISO		+25°C		-77		dB
Total Harmonic Distortion THD RL = 600κΩ, CL = 50pF, fliN = 20kHz +25°C 0.15			· ·	+25°C		68		mV
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Crosstalk (Between Switches)	VCT	· · · · · · · · · · · · · · · · · · ·	+25°C		-72		dB
NO or NC Off-Capacitance	Total Harmonic Distortion	THD	· ·	+25°C		0.15		%
COM Off-Capacitance C _{COM(OFF)} f _{IN} = 1MHz +25°C 8 COM On-Capacitance C _{COM(ON)} f _{IN} = 1MHz +25°C 14 LOGIC INPUT Input Voltage Low V _{IL} 0.8 Input Voltage High V _{IH} 2.4 Input Leakage Current I _L V+ = +5.5V, V- = -5.5V, V- = -5.5V, V- = -5.5V +25°C -1 0.0001 1 POWER SUPPLY V+	Control Input Capacitance	C _{IN}				3		рF
COM On-Capacitance CCOM(ON) fIN = 1MHz +25°C 14 LOGIC INPUT Input Voltage Low VIL 0.8 Input Voltage High VIH 2.4 Input Leakage Current IL V+ = +5.5V, V- = -5.5V, V = -5.5V, V = -5.5V +25°C -1 0.0001 1 POWER SUPPLY V+ E -10 10 Power-Supply Range V+ V+ -2 -6 Positive Supply Current I+ V+ = +5.5V, V- = -5.5V,	NO or NC Off-Capacitance	C _{OFF}	$f_{IN} = 1MHz$	+25°C		6		рF
Input Voltage Low Vil	COM Off-Capacitance	C _C OM(OFF)	f _{IN} = 1MHz	+25°C		8		рF
Input Voltage Low VIL	COM On-Capacitance	C _{COM} (ON)	f _{IN} = 1MHz	+25°C		14		рF
Input Voltage High	LOGIC INPUT							
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Input Voltage Low	V _{IL}					0.8	V
Input Leakage Current IL	Input Voltage High	VIH			2.4			V
POWER SUPPLY Power-Supply Range V+ Vin = V EN = 0 or +5.5V E -10 10 2 6 V- Positive Supply Current I+ V+ = +5.5V, V- = -5.5V, V- = -5.5V, V- = -5.5V Negative Supply Current V+ = +5.5V, V- = -5.5V,	Input Leakage Current		1 · · · · · · · · · · · · · · · · · · ·	+25°C	-1	0.0001	1	μA
V+ 2 6		<u>"</u>	$V_{IN} = V \overline{EN} = 0 \text{ or } +5.5V$	E	-10		10	μ, τ
Power-Supply Range V- Positive Supply Current I+ V+ = +5.5V, V- = -5.5V, V = -5.5V, V = -10.0001 V N = V \overline{EN} = 0 \text{ or } +5.5V	POWER SUPPLY	1		T				1
Positive Supply Current V	Power-Supply Range							V
Positive Supply Current $V_{IN} = V_{\overline{EN}} = 0 \text{ or } +5.5V$ E -10 10 Negative Supply Current $V_{IN} = V_{\overline{EN}} = 0 \text{ or } +5.5V$, $V_{IN} = V_{\overline{EN}} = 0 \text{ or } +5.5V$, $V_{IN} = V_{\overline{EN}} = 0 \text{ or } +5.5V$, $V_{IN} = V_{\overline{EN}} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = V_{IN} = 0 \text{ or } +5.5V$, $V_{IN} = 0$		V-						
VIN = V EN = U OF +5.5V E -10 10 V+ = +5.5V, V- = -5.5V, +25°C -1 0.0001 1	Positive Supply Current	l+				0.0001		μΑ
Negative Supply Current				+		0.0001		
VIN - VEN - 0 01 75.5V E -10 10	Negative Supply Current	I-				0.0001		μΑ
			VIIN - V EIN - U UI +0.5V	E	-10		10	

Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

ELECTRICAL CHARACTERISTICS—Single +5V Supply

 $(V+ = +4.5V \text{ to } +6V, V- = 0, V_{IH} = +2.4V, V_{IL} = +0.8V, GND = 0, T_A = T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted.}$ Typical values are at $T_A = +25^{\circ}\text{C.}$) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}			0		V+	V
On-Resistance	Ron	V+ = +4.5V, V- = 0,	+25°C		72	100	Ω
On-nesistance	HON	$I_{COM} = 1$ mA; V_{NO} , $V_{NC} = +3.5$ V	Е			125	
On-Resistance Match Between	ΔRON	V+ = +4.5V, V- = 0,	+25°C		0.75	5	Ω
Channels (Note 4)	ΔιιΟΝ	$I_{COM} = 1 \text{mA}; V_{NO}, V_{NC} = +3.5 \text{ V}$	Е			7	32
SWITCH DYNAMIC CHARACTE	RISTICS						
Turn-On Time	ton	V_{NO} , $V_{NC} = +3V$,	+25°C		62	90	ns
Turr on Time	ιΟΙ ν	$R_L = 1k\Omega$, $C_L = 35pF$	Е			125	113
Turn-Off Time	toff	V_{NO} , $V_{NC} = +3V$,	+25°C		22	60	ns I
	UFF	$R_L = 1k\Omega$, $C_L = 35pF$	Е			75	
Transition Time	ttrans		+25°C		68	100	ns
Transition fillie			Е			130	110
Break-Before-Make Time (Note 6)	tBBM	$V_{NO}, V_{NC} = +3V,$ $R_L = 300\Omega, C_L = 35pF$	Е	10	35		ns
LOGIC INPUT	•						
Input Voltage Low	VIL					0.8	V
Input Voltage High	VIH			2.4			V
Input Lookaga Current	I.	V+ = +5.5V, V- = 0,	+25°C	-1	0.0001	1	
Input Leakage Current	ΙL	$V_{IN} = V \overline{EN} = 0 \text{ or } +5.5V$	Е	-10		10	μA
POWER SUPPLY							
Power-Supply Range	V+			1.8		12	V
Dogitiva Cupply Current	1.	V+ = +5.5V, V- = 0,	+25°C	-1	0.0001	1	
Positive Supply Current	l+	$V_{IN} = V \overline{EN} = 0 \text{ or } +5.5V$	Е	-10		10	μA
Negative Supply Current	l-	V+ = +5.5V, V- = 0,	+25°C	-1	0.0001	1	μA
negative Supply Current	'	$V_{IN} = V \overline{EN} = 0 \text{ or } +5.5V$	E	-10		10	- μA

Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

ELECTRICAL CHARACTERISTICS—Single +3V Supply

 $(V+=+2.7V \text{ to } +3.3V, V-=0, V_{IH}=+2.4V, V_{IL}=+0.8V, GND=0, T_A=T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise noted.}$ Typical values are at $T_A=+25^{\circ}C.$) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	TYP	MAX	UNITS
ANALOG SWITCH	1		•				•
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}			0		V+	V
On-Resistance	Pou	V+ = +2.7V, V- = 0,	+25°C		160	275	Ω
On-nesistance	Ron	$I_{COM} = 1 \text{mA}$; V_{NO} , $V_{NC} = +1.5 \text{V}$	Е			300	\$2
On-Resistance Match Between	A.D	V+ = +2.7V, V- = 0,	+25°C		1.5	10	
Channels (Note 4)	ΔR _{ON}	$I_{COM} = 1$ mA; V_{NO} , $V_{NC} = +1.5$ V	Е			12	Ω
SWITCH DYNAMIC CHARACTE	RISTICS						
Turn-On Time	tou	$V_{NO}, V_{NC} = +1.5V,$	+25°C		120	250	200
Turn-On Time	ton	$_{\text{L}}$ = 2k Ω , CL = 35pF	Е			275	ns
T 0" T		$V_{NO}, V_{NC} = +1.5V,$	+25°C		40	110	
Turn-Off Time	tOFF	$R_L = 2k\Omega$, $C_L = 35pF$	Е			125	ns
Break-Before-Make Time (Note 6)	tBBM	$V_{NO}, V_{NC} = +1.5V,$ $R_L = 2k\Omega, C_L = 35pF$	Е	10			ns
LOGIC INPUT							
Input Voltage Low	VIL					0.8	V
Input Voltage High	VIH		_	2.4			V
Input Lookaga Current	1.	V+ = +3.3V, V- = 0,	+25°C	-1	0.0001	1	
Input Leakage Current	ΙL	$V_{IN} = V_{\overline{EN}} = 0 \text{ or } +3.3V$	Е	-10		10	μΑ

Note 2: The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

Note 3: SOT-packaged products are 100% tested at +25°C and guaranteed by design at the full-rated temperature.

Note 4: $\Delta R_{ON} = R_{ON}(MAX) - R_{ON}(MIN)$

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

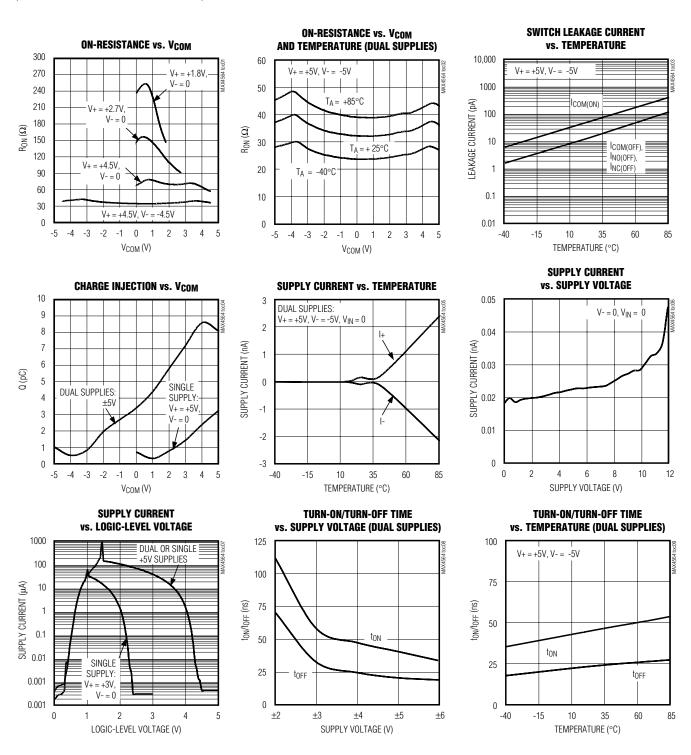
Note 6: Guaranteed by design.

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

Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

Typical Operating Characteristics

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

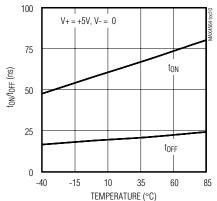


Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

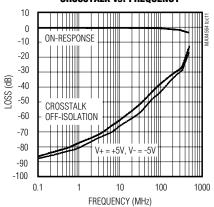
Typical Operating Characteristics (continued)

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

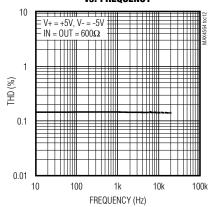
TURN-ON/TURN-OFF TIME vs. Temperature (Single Supply)



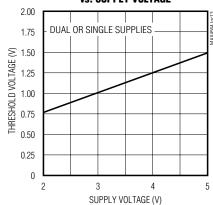
ON-RESPONSE, OFF-ISOLATION, CROSSTALK vs. FREQUENCY



TOTAL HARMONIC DISTORTION vs. FREQUENCY



LOGIC-LEVEL THRESHOLD VOLTAGE vs. SUPPLY VOLTAGE



Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

Pin Description

μ МАХ	SOT23	NAME	FUNCTION
1	8	COM	Analog Switch Common
2	7	ĒN	Device Enable. Drive $\overline{\text{EN}}$ low for normal SPDT switch operation. If $\overline{\text{EN}}$ is high, both NO and NC are disconnected.
3	6	V-	Negative Supply Voltage
4	5	GND	Ground
5	3	IN	Digital Control Input
6	4	NO	Analog Switch Normally Open
7	1	NC	Analog Switch Normally Closed
8	2	V+	Positive Supply Voltage

Detailed Description

The MAX4564 is a dual-supply SPDT CMOS analog switch. The MAX4564 has break-before-make switching. The CMOS switch construction provides Rail-to-Rail® signal handling while consuming virtually no power. Each of the two switches is independently controlled by a TTL/CMOS-level-compatible digital input.

_Applications Information

Overvoltage Protection

Do not exceed the absolute maximum ratings because stresses beyond the listed ratings may cause permanent damage to the device. Proper power-supply sequencing is recommended for all CMOS devices. Always sequence V+ on first, then V-, followed by the logic inputs NO, NC, or COM. If power-supply sequencing is not possible, add two small-signal diodes (D1, D2) in series with supply pins. Adding diodes reduces the analog signal range to one diode drop below V+ and one diode drop above V-, but does not affect the device's low switch resistance and low leakage characteristics.

Test Circuits/ Timing Diagrams

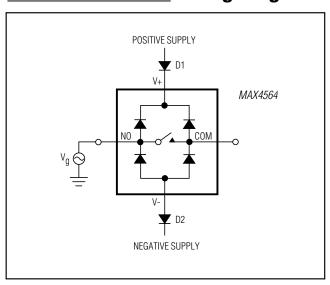


Figure 1. Overvoltage Protection Using Two External Blocking Diodes

Rail-to-Rail is a registered trademark of Nippon Motorola, Ltd.

Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

Test Circuits/Timing Diagrams (continued)

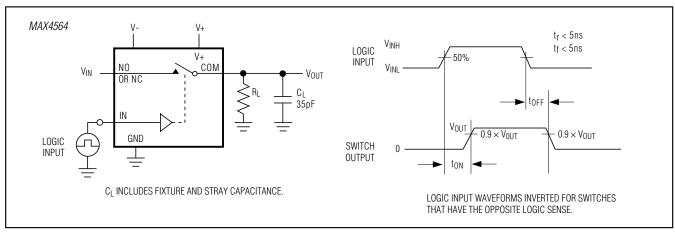


Figure 2. Switching Time

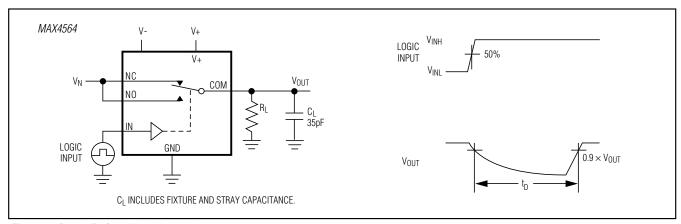


Figure 3. Break-Before-Make Interval

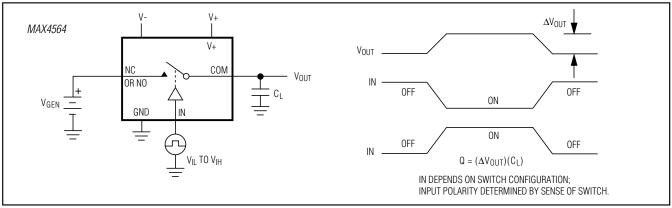


Figure 4. Charge Injection

Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

Test Circuits/Timing Diagrams (continued)

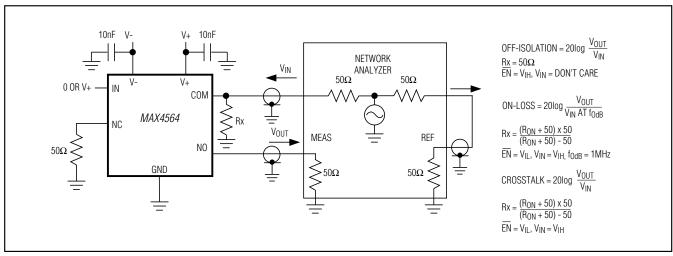


Figure 5. On-Loss, Off-Isolation, and Crosstalk

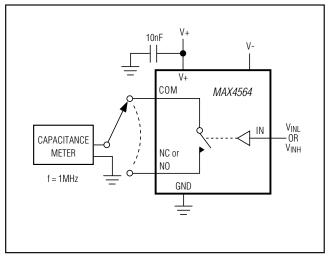


Figure 6. Channel Off/On-Capacitance

_____Chip Information

PROCESS: CMOS

Package Information

For the latest package outline information and land patterns (footprints), go to www.maximintegrated.com/packages. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	OUTLINE NO.	LAND PATTERN NO.
8 SOT23	K8SN+1	<u>21-0078</u>	90-0176
8 SO	U8+1	21-0036	90-0092

Low-Voltage, Dual-Supply, SPDT Analog Switch with Enable

Revision History

REVISION	REVISION	DESCRIPTION	PAGES
NUMBER	DATE		CHANGED
2	10/12	Added lead-free designation to the part numbers in the Ordering Information	1



Maxim Integrated cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim Integrated product. No circuit patent licenses are implied. Maxim Integrated reserves the right to change the circuitry and specifications without notice at any time. The parametric values (min and max limits) shown in the Electrical Characteristics table are guaranteed. Other parametric values quoted in this data sheet are provided for guidance.

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