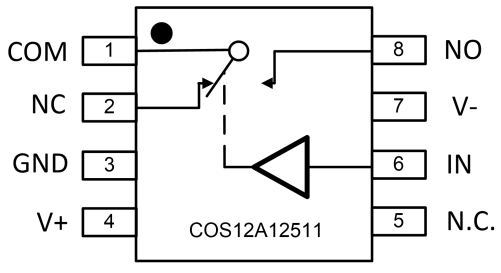
High Voltage, Single and Dual Supply SPDT Analog Switch

Features

- Single and Dual Supply Operation
  - ±3V to ±8V (COS12A12511)
  - +3V to +16V (COS12A12511S)
- Low ON-State Resistance:
  - 2.8Ω with 16V Supply
  - 3.6Ω with 12V Supply
  - 11Ω with 5V Supply
- Low Leakage Currents
  - 1 nA Off-Leakage at 25°C
  - 1 nA On-Leakage at 25°C
- Fast Switching Speed
  t_{ON}=70ns, t_{OFF}=50ns (12V Supply)
- Break-Before-Make Operation
- Rail-to-Rail Operation
- TTL/CMOS Logic Compatible
- Packaging: MSOP8 and SOP8



Pin Diagram

General Description

The COS12A12511 is a high voltage single channel, bidirectional, single-pole double-throw (SPDT) CMOS analog switch. The device can pass signals with swings of 0 to 16 V or -8V to +8V. This switch conducts equally well in both directions when it is on.

The COS12A12511 can operate continuously with a single supply between 3V and 16V (COS12A12511S) or dual supply between ±3V to ±8V (COS12A12511). It can handle rail-to-rail analog signals. The OFF/ON leakage current maximum is only 1nA at 25°C or 10nA at 85°C. The digital inputs have 0.8V to 2.4V logic thresholds, ensuring TTL/CMOS logic compatibility when using a +5V supply.

Applications

- Power routing applications
- Audio and video signal switching
- Precision automatic test equipment
- Relay replacement
- Automotive applications
- Sample and hold systems
- Telecom signal switching
- Battery power systems

Rev1.4

1 Pin Configuration and Functions

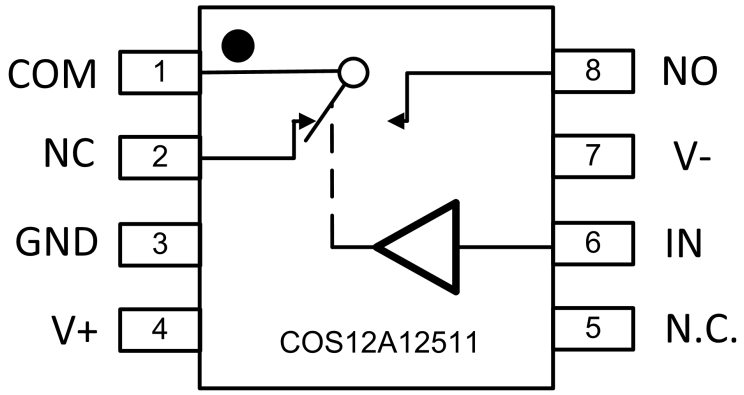


Figure 1 Pin Diagram

Truth Table

IN Logic	NC to COM, COM to NC	NO to COM, COM to NO
L	On	Off
H	Off	On

Pin Description

PIN			FUNCTION
NO.	NAME	I/O	
1	COM	I/O	Common terminal. Can be an input or output
2	NC	I/O	Normally closed terminal. Can be an input or output
3	GND	-	Ground. 0V reference
4	V+	I	Most positive power supply
5	N.C.	-	No connect. Not internally connected
6	IN	I	Logic control input
7	V-	I	Most negative power supply. This pin is only used in dual-supply applications and should be tied to ground in single-supply applications.
8	NO	I/O	Normally open terminal. Can be an input or output

2 Package and Ordering Information

Supply Mode	Order Number	Package	Package Option	Marking Information
Dual Supply	COS12A12511	MSOP8	Tape and Reel, 3000	COS12A12511
Single Supply	COS12A12511S	MSOP8	Tape and Reel, 3000	COS12A12511S

3 Product Specification

3.1 Absolute Maximum Ratings (1)

Parameter	Min	Max	Unit
V+ to V-	0	17	V
V+ to GND	-0.3	17	V
V- to GND	-8.5	0.3	V
Analog voltage range (V_{NC}, V_{NO}, V_{COM})	V- -0.5	V+ + 0.5	V
Continuous current into any terminal		±20	mA
Peak current into any terminal		±50	mA
Continuous power dissipation		560	mW
Operating junction temperature	-40	+125	°C
Storage temperature	-55	+150	°C

(1) Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

3.2 Thermal Data

Parameter	Rating	Unit
Package Thermal Resistance	206 (MSOP8) 155 (SOP8)	°C/W

3.3 Recommended Operating Conditions

Parameter	Rating	Unit
V+	3 ~ 16	V
V-	-8 ~ 0	V
$V_{I/O}$	V- to V+	V
V_{IN}	0 ~ V+	V

3.4 Electrical Characteristics for ±8V Dual Supply

(Typical values are tested at T_A=25 ºC, V+=8V±10%, V-=-8V±10%, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Analog Switch						
Analog signal range	V_{COM}, V_{NO}, V_{NC},		V-		V+	V
On-state resistance	R_{ON}	V_{NC} or V_{NO} = -4.5V to +4.5V, I_{COM}= -10mA		3.2	6	Ω
On-state resistance flatness	R_{ON}	V_{NC} or V_{NO} = -3.3V to +3.3V, I_{COM}= -10mA		1.0	3	Ω
OFF leakage current (NO, NC)	$I_{NO(OFF)}$, $I_{NC(OFF)}$	V_{NC} or V_{NO} = -4.5V to +4.5V, V_{COM} = -4.5V to +4.5V			50	nA
ON leakage current (NO, NC)	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{NC} or V_{NO} = -4.5V to +4.5V, V_{COM} = open			50	nA
Digital Control Input (IN)						
Input logic high	V_{IH}		5		V+	V
Input logic low	V_{IL}		0		0.8	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 0 or V+			0.05	μA
Switch Dynamic Characteristics						
Turn-on time	t_{ON}	V_{NO} or V_{NC}=3.3V, R_L=300Ω, C_L = 35pF, Figure 1		70	130	ns
Turn-off time	t_{OFF}	V_{NO} or V_{NC}=3.3V, R_L=300Ω, C_L = 35pF, Figure 1		50	75	ns
Break-Before-Make Delay (COS4561 only)	t_{BBM}	V_{NO} or V_{NC}=3.3V, R_L=300Ω, C_L = 35pF, Figure 2	5	40		ns
Charge Injection	Q	V_{NO}=V_{NC}=0V, R_{GEN}=0, C_L = 1.0nF, Figure 3		-110		pC
NO or NC off capacitance	C_{OFF}	V_{NC}=V_{NO} = 0, f = 1MHz,		15		pF
COM off-capacitance (COS4514/COS4515 only)	C_{COM}	V_{COM} = 0, f = 1MHz,		65		pF
COM On-Capacitance	C_{COM}	V_{COM} = V_{NO}, V_{NC} = 0, f = 1MHz,		65		pF
Off-Isolation	V_{ISO}	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 100kHz		-85		dB
Bandwidth	BW	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 100kHz		100		MHz
Power Supply						
V+ supply current	I_+	V_{IN} = 0 or V+			0.1	μA

3.5 Electrical Characteristics for 12V Single Supply

(Typical values are tested at T_A=25 ºC, V+=11.4V to 12.6V, V_{INH}=5V, V_{INL}=0.8, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Analog Switch						
Analog signal range	V_{COM}, V_{NO}, V_{NC},		0		V+	V
On-state resistance	R_{ON}	V_{NC} or V_{NO} = 0V to 10.8V, I_{COM}= -10mA		4.0	7.4	Ω
On-state resistance flatness	R_{ON}	V_{NC} or V_{NO} = 3.3V to +7V, I_{COM}= -10mA		1.5	3	Ω
OFF leakage current (NO, NC)	$I_{NO(OFF)}$, $I_{NC(OFF)}$	V_{NC} or V_{NO} =0V to 10.8V, V_{COM} = 0V to 10.8V			50	nA
ON leakage current (NO, NC)	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{NC} or V_{NO} = 0V to 10.8V, V_{COM} = open			50	nA
Digital Control Input (IN)						
Input logic high	V_{IH}		2.4		V+	V
Input logic low	V_{IL}		0		0.8	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 0 or V+			0.01	μA
Switch Dynamic Characteristics						
Turn-on time	t_{ON}	V_{NO} or V_{NC}=10V, R_L=300Ω, C_L = 35pF, Figure 1		70	130	ns
Turn-off time	t_{OFF}	V_{NO} or V_{NC}=10V, R_L=300Ω, C_L = 35pF, Figure 1		50	75	ns
Break-Before-Make Delay (COS4561 only)	t_{BBM}	V_{NO} or V_{NC}=10V, R_L=300Ω, C_L = 35pF, Figure 2	5	40		ns
Charge Injection	Q	V_{GEN} =5V, R_{GEN}=0, C_L = 1.0nF, Figure 3		-110		pC
NO or NC off capacitance	C_{OFF}	V_{NC}=V_{NO} = 0, f = 1MHz,		15		pF
COM off-capacitance (COS4514/COS4515 only)	C_{COM}	V_{COM} = 0, f = 1MHz,		65		pF
COM On-Capacitance	C_{COM}	V_{COM} = V_{NO}, V_{NC} = 0, f = 1MHz,		65		pF
Off-Isolation	V_{ISO}	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 100kHz		-85		dB
Bandwidth	BW	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 100kHz		90		MHz
Power Supply						
V+ supply current	I_+	V_{IN} = 0 or V+			0.1	μA

3.6 Electrical Characteristics for 5V Single Supply

(Typical values are tested at T_A=25 ºC, V_+=4.5V to 5.5V, V_{INH}=2.4V, V_{INL}=0.8, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Analog Switch						
Analog signal range	V_{COM}, V_{NO}, V_{NC},		0		V+	V
On-state resistance	R_{ON}	V_{NC} or V_{NO} = 0V to 4.5V, I_{COM}= -10mA		11	32	Ω
OFF leakage current (NO, NC)	$I_{NO(OFF)}$, $I_{NC(OFF)}$	V_{COM}=0V to 4.5V, V_{NO} or V_{NC}=0V to 4.5V			50	nA
ON leakage current (NO, NC)	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{COM}=open, V_{NO} or V_{NC}=0V to 4.5V			50	nA
Digital Control Input (IN)						
Input logic high	V_{IH}		2.4		V+	V
Input logic low	V_{IL}		0		0.8	V
Input leakage current	I_{IH}, I_{IL}	V_{IN} = 0 or V+			0.01	μA
Switch Dynamic Characteristics						
Turn-on time	t_{ON}	V_{NO} or V_{NC}=3V, R_L=300Ω, C_L = 35pF, Figure 1		75	130	ns
Turn-off time	t_{OFF}	V_{NO} or V_{NC}=3V, R_L=300Ω, C_L = 35pF, Figure 1		45	70	ns
Break-Before-Make Delay (COS4561 only)	t_{BBM}	V_{NO} or V_{NC}=3V, R_L=300Ω, C_L = 35pF, Figure 2	5	40		ns
Charge Injection	Q	V_{GEN} =2V, R_{GEN}=0, C_L = 1.0nF, Figure 3		-40		pC
NO or NC Off Capacitance	C_{OFF}	V_{NC}=V_{NO} = 0, f = 1MHz,		15		pF
COM Off-Capacitance (COS4514/COS4515 only)	C_{COM}	V_{COM} = 0, f = 1MHz,		65		pF
COM On-Capacitance	C_{COM}	V_{COM} = V_{NO}, V_{NC} = 0, f = 1MHz,		65		pF
Off-Isolation	V_{ISO}	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 100kHz		-85		dB
Bandwidth	BW	R_L = 50Ω, C_L = 15pF, V_{NC} = 1V_{RMS}, f = 100kHz		60		MHz
Power Supply						
V+ supply current	I_+	V_{IN} = 0 or V+			0.1	μA

4 Test Circuits and Timing Diagrams

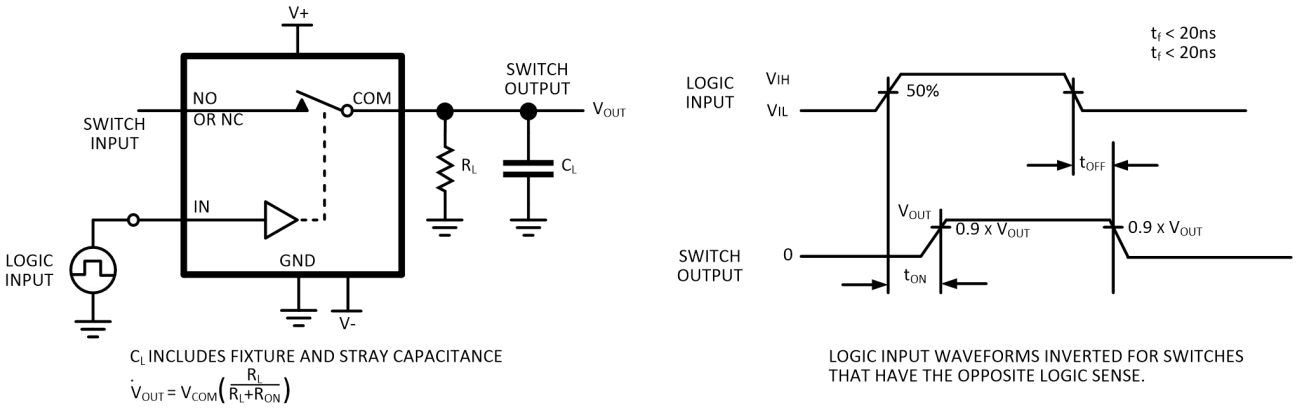


Figure 1. Switching Time

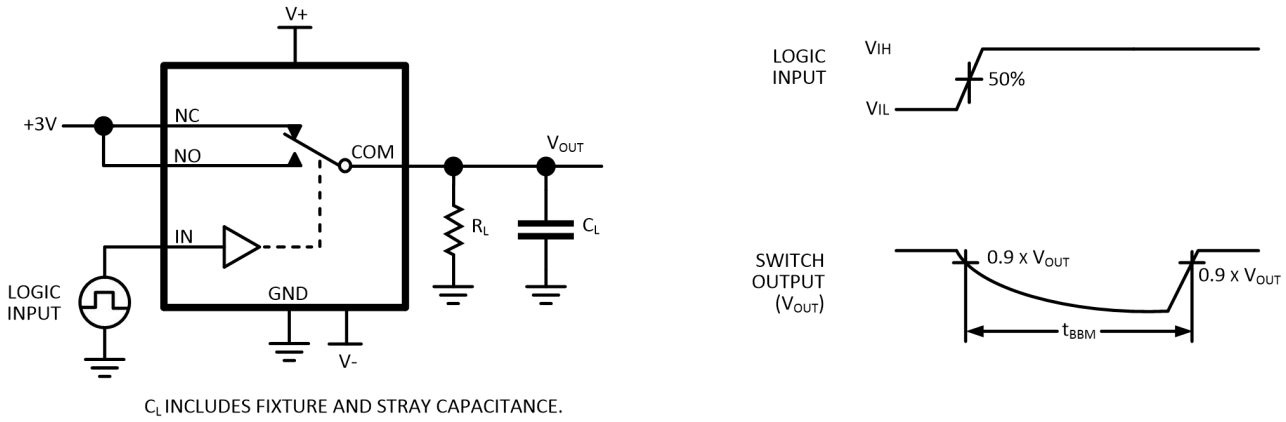


Figure 2. Break-Before-Make Interval

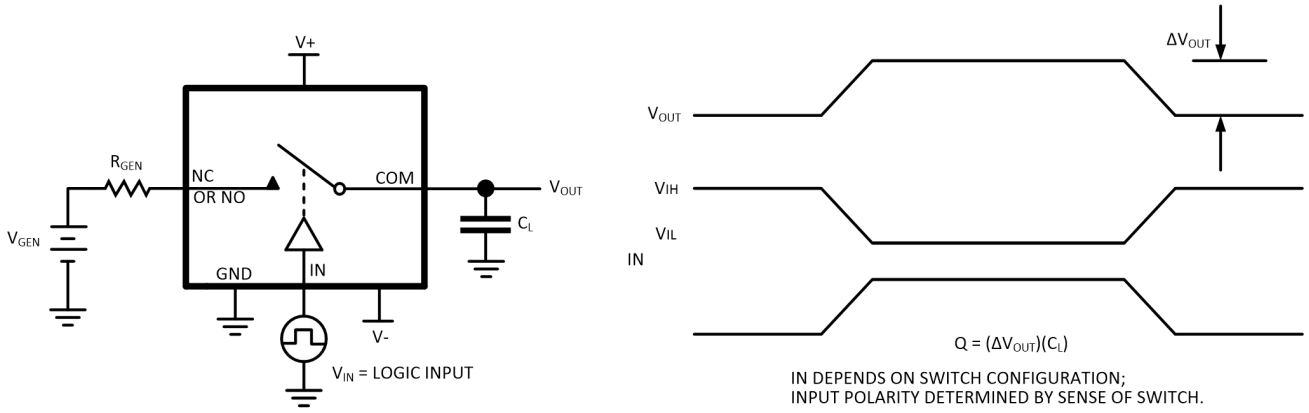
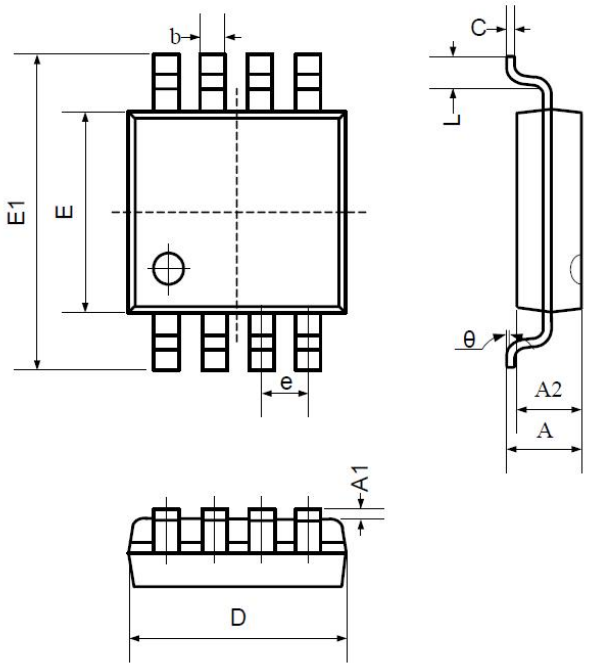


Figure 3. Charge Injection

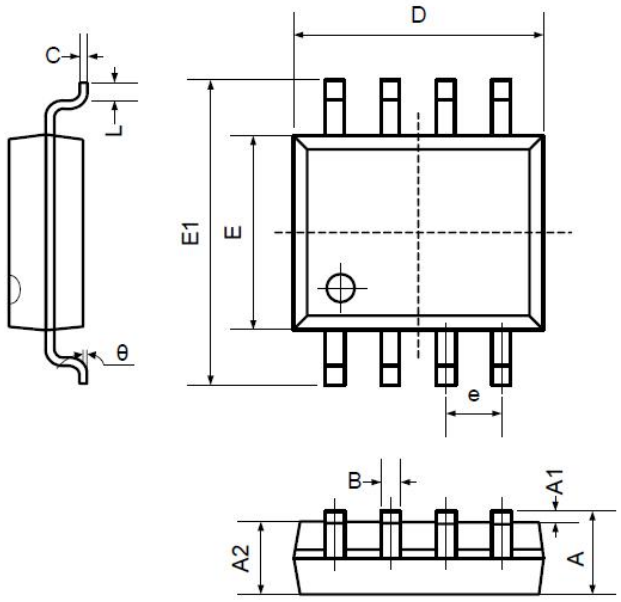
5 Package Information

5.1 MSOP8 (Package Outline Dimensions)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
c	0.15 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.65 TYP		0.026 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

5.2 SOP8 (Package Outline Dimensions)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°