

# High Voltage, Single and Dual Supply SPDT Analog Switch

### Features

- Single and Dual Supply Operation
  - ±1.5V to ±8V
  - +3V to +16V
- Low ON-State Resistance:
  - 2.8Ω with 16V Supply
  - 3.6 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<sub>ON</sub>=70ns, t<sub>OFF</sub>=50ns (12V Supply)
- Break-Before-Make Operation
- Rail-to-Rail Operation
- TTL/CMOS Logic Compatible
- Packaging: MSOP8 and SOP8



#### Pin Diagram

#### Rev1.1

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#### **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 or dual supply between  $\pm 1.5V$  to  $\pm 8V$ . 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



# 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				
Н	Off	On				

Pin Descriptio	n
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	PIN		EUNCTION	
NO.	NAME	I/O	TUNCTION	
1	СОМ	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. Ordering Information

Order Number	Package	Package Option	Marking Information
COS12A12511	MSOP8	Tape and Reel, 3000	COS12A12511
COS12A12511SR	SOP8	Tape and Reel, 4000	COS12A12511SR



## 3. Product Specification

#### 3.1 Absolute Maximum Ratings<sup>(1)</sup>

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 <sub>NC</sub> , V <sub>NO</sub> , V <sub>COM</sub> )	V0.5	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+	0V ~ 16	V
V-	-8 ~ 0	V
Vi/o	V- to V+	V
Vin	0 ~ V+	V



## 3.4 Electrical Characteristics for $\pm 8V$ Dual Supply

(Typical values are tested at T<sub>A</sub>=25 °C, V+=8V $\pm$ 10%, V-=-8V $\pm$ 10%, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit		
Analog Switch	Analog Switch							
Analog signal range	V <sub>COM</sub> , V <sub>NO</sub> , V <sub>NC</sub> ,		V-		V+	V		
On-state resistance	Ron	$V_{NC}$ or $V_{NO}$ = -4.5V to +4.5V, $I_{COM}$ = -10mA		3.2	6	Ω		
On-state resistance flatness	Ron	$V_{NC}$ or $V_{NO}$ = -3.3V to +3.3V, $I_{COM}$ = -10mA		1.0	3	Ω		
OFF leakage current (NO, NC)	INO(OFF), I <sub>NC(OFF)</sub>	$V_{NC}$ or $V_{NO}$ = -4.5V to +4.5V, $V_{COM}$ = -4.5V to +4.5V			50	nA		
ON leakage current (NO, NC)	Ino(on), I <sub>nc(on)</sub>	$V_{NC}$ or $V_{NO}$ = -4.5V to +4.5V, $V_{COM}$ = open			50	nA		
Digital Control Input (IN)								
Input logic high	VIH		5		V+	V		
Input logic low	VIL		0		0.8	V		
Input leakage current	IıH, Iı∟	V <sub>IN</sub> = 0 or V+			0.05	μA		
Switch Dynamic Characteri	stics							
Turn-on time	t <sub>ON</sub>	$V_{NO}$ or $V_{NC}$ =3.3V, R <sub>L</sub> =300 $\Omega$ , C <sub>L</sub> = 35pF, Figure 1		70	130	ns		
Turn-off time	t <sub>OFF</sub>	$V_{NO}$ or $V_{NC}$ =3.3V, R <sub>L</sub> =300 $\Omega$ , C <sub>L</sub> = 35pF, Figure 1		50	75	ns		
Break-Before-Make Delay (COS4561 only)	t <sub>ввм</sub>	$V_{NO}$ or $V_{NC}$ =3.3V, R <sub>L</sub> =300 $\Omega$ , C <sub>L</sub> = 35pF, Figure 2	5	40		ns		
Charge Injection	Q	$V_{NO}=V_{NC}=0V$ , $R_{GEN}=0$ , $C_{L} = 1.0nF$ , Figure 3		-110		рС		
NO or NC off capacitance	COFF	$V_{NC}=V_{NO}=0,$ f = 1MHz,		15		pF		
COM off-capacitance (COS4514/COS4515 only)	Ссом	$V_{COM} = 0,$ f = 1MHz,		65		pF		
COM On-Capacitance	Ссом	$V_{COM} = V_{NO}, V_{NC} = 0,$ f = 1MHz,		65		pF		
Off-Isolation	V <sub>ISO</sub>	$    R_L = 50\Omega, C_L = 15 p F, \\ V_{NC} = 1 V_{RMS}, f = 100 k Hz $		-85		dB		
Bandwidth	BW	$\label{eq:RL} \begin{split} R_L &= 50\Omega, \ C_L = 15 \text{pF}, \\ V_{\text{NC}} &= 1 V_{\text{RMS}}, \ \text{f} = 100 \text{kHz} \end{split}$		100		MHz		
Power Supply								
V+ supply current	I+	V <sub>IN</sub> = 0 or V+			0.1	μA		



## COS12A12511

## 3.5 Electrical Characteristics for 12V Single Supply

(Typical values are tested at T<sub>A</sub>=25 °C, V+=11.4V to 12.6V, V<sub>INH</sub>=5V, V<sub>INL</sub>=0.8, unless otherwise noted)

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



## 3.6 Electrical Characteristics for 5V Single Supply

(Typical values are tested at T<sub>A</sub>=25 °C, V<sub>+</sub>=4.5V to 5.5V, V<sub>INH</sub>=2.4V, V<sub>INL</sub>=0.8, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Тур.	Max.	Unit
Analog Switch	1		1	1		
Analog signal range	V <sub>COM</sub> , V <sub>NO</sub> , V <sub>NC</sub> ,		0		V+	V
On-state resistance	Ron	$V_{NC}$ or $V_{NO}$ = 0V to 4.5V, I <sub>COM</sub> = -10mA		11	32	Ω
OFF leakage current (NO, NC)	INO(OFF), I <sub>NC(OFF)</sub>	V <sub>COM</sub> =0V to 4.5V, V <sub>NO</sub> or V <sub>NC</sub> =0V to 4.5V			50	nA
ON leakage current (NO, NC)	INO(ON), Inc(on)	V <sub>COM</sub> =open, V <sub>NO</sub> or V <sub>NC</sub> =0V to 4.5V			50	nA
Digital Control Input (IN)						
Input logic high	VIH		2.4		V+	V
Input logic low	VIL		0		0.8	V
Input leakage current	IıH, Iı∟	V <sub>IN</sub> = 0 or V+			0.01	μA
Switch Dynamic Characteri	stics				•	
Turn-on time	t <sub>ON</sub>	$V_{NO}$ or $V_{NC}$ =3V, R <sub>L</sub> =300 $\Omega$ , C <sub>L</sub> = 35pF, Figure 1		75	130	ns
Turn-off time	t <sub>OFF</sub>	$V_{NO}$ or $V_{NC}$ =3V, R <sub>L</sub> =300 $\Omega$ , C <sub>L</sub> = 35pF, Figure 1		45	70	ns
Break-Before-Make Delay (COS4561 only)	t <sub>ввм</sub>	$V_{NO}$ or $V_{NC}$ =3V, R <sub>L</sub> =300 $\Omega$ , C <sub>L</sub> = 35pF, Figure 2	5	40		ns
Charge Injection	Q	$V_{GEN} = 2V, R_{GEN} = 0,$ $C_L = 1.0nF, Figure 3$		-40		рС
NO or NC Off Capacitance	COFF	$V_{NC}=V_{NO}=0,$ f = 1MHz,		15		pF
COM Off-Capacitance (COS4514/COS4515 only)	Ссом	V <sub>COM</sub> = 0, f = 1MHz,		65		pF
COM On-Capacitance	Ссом	$V_{COM} = V_{NO}, V_{NC} = 0,$ f = 1MHz,		65		pF
Off-Isolation	V <sub>ISO</sub>	$R_L = 50\Omega, C_L = 15pF,$ $V_{NC} = 1V_{RMS}, f = 100kHz$		-85		dB
Bandwidth	BW	$\label{eq:RL} \begin{split} R_L &= 50\Omega, \ C_L = 15 p F, \\ V_{NC} &= 1 V_{RMS}, \ f = 100 k Hz \end{split}$		60		MHz
Power Supply						
V+ supply current	I+	V <sub>IN</sub> = 0 or V+			0.1	μA



## 4. Test Circuits and Timing Diagrams















## 5. Package Information

#### 5.1 MSOP8 (Package Outline Dimensions)



A2 A

Symbol	Dimer In Milli	nsions meters	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		
С	0.15	TYP	0.006 TYP		
D	2.900	3.100	0.114	0.122	
е	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	Dimer In Milli	nsions meters	Dimensions In Inches		
	Min	Max	Min	Max	
А	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	
В	0.330	0.510	0.013	0.020	
С	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	
е	1.270	TYP	0.050	TYP	
L	0.400	1.270	0.016	0.050	
θ	<b>0</b> °	8°	0°	8°	