



Precision 8-Channels, Differential 4-Channels, 36V Analog Multiplexers

Features

- → Low On-Capacitance
 - PS508: 30pF
 - PS509: 20pF
- → Low Input Leakage: 30pA
- → Low Charge Injection: 0.9pC
- → Rail-to-Rail Operation
- → Wide Supply Range: ±5V to ±18V, 10V to 36V
- → Low On-Resistance: 125Ω
- → Transition Time: 171ns
- → Break-Before-Make Switching Action
- → EN Pin Connectable to VDD
- → Logic Levels: 2V to VDD
- → Low Supply Current: 135µA
- → ESD Protection HBM: 2000V
- → Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- → Halogen and Antimony Free. "Green" Device (Note 3)
- → For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.

https://www.diodes.com/quality/product-definitions/

- → Packaging (Pb-free & Green):
 - □ 16-pin TSSOP (L)
 - 16-pin QSOP (Q)
 - 16-pin SOIC (W)

Truth Tables

P\$509						
EN	A1	A0	STATE			
0	X*	X*	All channels are off			
1	0	0	Channels 1A and 1B on			
1	0	1	Channels 2A and 2B on			
1	1	0	Channels 3A and 3B on			
1	1	1	Channels 4A and 4B on			

Description

The PS508 and PS509 are modern, complementary metal-oxide semiconductor (CMOS), analog multiplexers (muxes). The PS508 offers 8:1 single-ended channels, whereas the PS509 offers differential 4:1 or dual 4:1 single-ended channels. The PS508 and PS509 work equally well with either dual supplies ($\pm 5V$ to $\pm 18V$) or a single supply (10 V to 36 V). They also perform well with symmetric supplies (such as VDD = 12V, VSS = -12V), and unsymmetric supplies (such as VDD = 12V, VSS = -5V). All digital inputs have TTL-logic compatible thresholds, ensuring both TTL and CMOS logic compatibility when operating in the valid supply voltage range.

The PS508 and PS509 have very low on and off leakage currents, allowing these multiplexers to switch signals from high input impedance sources with minimal error. A low supply current of 135 µA allows for use in portable applications.

Applications

- → Factory Automation and Industrial Process Controls
- → Programmable Logic Controllers (PLC)
- → Analog Input Modules
- → ATE Test Equipment
- ➔ Digital Multimeters
- → Battery Monitoring Systems

Truth Tables

PS508						
EN	A2	A1	A0	STATE		
0	X*	X*	X*	All channels are off		
1	0	0	0	Channel 1 on		
1	0	0	1	Channel 2 on		
1	0	1	0	Channel 3 on		
1	0	1	1	Channel 4 on		
1	1	0	0	Channel 5 on		
1	1	0	1	Channel 6 on		
1	1	1	0	Channel 7 on		
1	1	1	1	Channel 8 on		

* X denotes don't care.

Notes:

* X denotes don't care.

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.

2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free. 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

June 2020





Pin Configuration PS508



Pin Description

Pin#	Pin Name	Туре	Description
1	A0	Ι	Address line 0.
16	A1	Ι	Address line 1.
15	A2	Ι	Address line 2.
8	D	I/O	Drain pin.
2	EN	Ι	Active high digital input. When this pin is low, all switches are turned off. When this pin is high, the A[2:0] logic inputs determine which switch is turned on.
14	GND	Power	Ground.
4	S1	I/O	Source pin 1.
5	S2	I/O	Source pin 2.
6	S3	I/O	Source pin 3.
7	S4	I/O	Source pin 4.
12	S5	I/O	Source pin 5.
11	S6	I/O	Source pin 6.
10	S7	I/O	Source pin 7.
9	S8	I/O	Source pin 8.
13	VDD	Power	Positive power supply. This pin is the most positive power-supply potential. For reliable opera- tion, connect a decoupling capacitor ranging from 0.1μ F to 10μ F between VDD and GND.
3	VSS	Power	Negative power supply. This pin is the most negative power-supply potential. In single-supply applications, this pin can be connected to ground. For reliable operation, connect a decoupling capacitor ranging from 0.1μ F to 10μ F between VSS and GND.

Note: I = Input, O = Output and I/O = Input/Output





Pin Configuration PS509



Pin Description

Pin#	Pin Name	Туре	Description
1	A0	Ι	Address line 0.
16	A1	Ι	Address line 1.
8	DA	I/O	Drain pin A. Can be an input or output.
9	DB	I/O	Drain pin B. Can be an input or output.
2	EN	Ι	Active high digital input. When this pin is low, all switches are turned off. When this pin is high, the A[1:0] logic inputs determine which pair of switches is turned on.
15	GND	Pwr	Ground (0 V) reference
4	S1A	I/O	Source pin 1A. Can be an input or output.
5	S2A	I/O	Source pin 2A. Can be an input or output.
6	S3A	I/O	Source pin 3A. Can be an input or output.
7	S4A	I/O	Source pin 4A. Can be an input or output.
13	S1B	I/O	Source pin 1B. Can be an input or output.
12	S2B	I/O	Source pin 2B. Can be an input or output.
11	S3B	I/O	Source pin 3B. Can be an input or output.
10	S4B	I/O	Source pin 4B. Can be an input or output.
14	VDD	Pwr	Positive power supply. This pin is the most positive power supply potential. For reliable opera- tion, connect a decoupling capacitor ranging from 0.1 μ F to 10 μ F between VDD and GND.
3	VSS	Pwr	Negative power supply. This pin is the most negative power supply potential. In single supply applications, this pin can be connected to ground. For reliable operation, connect a decoupling capacitor ranging from 0.1 μ F to 10 μ F between VSS and GND.

Note: I = Input, O = Output and I/O = Input/Output





Maximum Ratings

(Above which useful life may be impaired. For user guidelines, not tested.)

Storage Temperature65°C to +150°C
Junction Temperature
Operating Temperature40°C to +125°C
Supply Voltage to Ground Potential, V_{DD} 0.3V to +40V
Supply Voltage to Ground Potential, V_{SS} 40 to +0.3V
Supply Voltage, $V_{\text{DD}} {-} V_{\text{SS}}$ +40V
Digital Input Voltage (EN A0, A1, A2 pins)V_{SS} –0.3 to V_{dd} +0.3V
Digital Input Current (EN A0, A1, A2 pins)30 to +30 mA
Analog Input Voltage (Sx, SxA, SxB pins)V_{SS} –2 to V_{dd} +2V
Analog Input Current (Sx, SxA, SxB pins)30 to +30 mA
Analog Output Voltage (D, DA, DB pins)V _{SS} –2 to V_{dd} +2V
Analog Output Current (D, DA, DB pins)30 to +30 mA

Note:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

ESD Ratings

Symbol	Parameters	Conditions	Value	Units
V _(ESD) Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS- 001 ⁽¹⁾		V	
	Electrostatic discharge	Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	500	V

Note:

1. JEDEC document JEP155 states that 500-V HBM allow safe manufacturing with a standard ESD control process.

2. JEDEC document JEP157 states that 250-V HBM allow safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

Symbol	Parameters		Min.	Тур.	Max.	Units
XT (1)	Desitive power supply voltage	Dual supply	5		18	V
V DD	Positive power-supply voltage	Single supply	10		36	v
$V_{ss}^{(2)}$	Negative power-supply voltage (dual supply)				-18	V
V _{DD} - V _{SS}	Supply voltage				36	V
VS	Source pins voltage ⁽³⁾				V _{DD}	V
VD	Drain pins voltage				V _{DD}	V
$V_{_{\rm EN}}$	Enable pin voltage				V _{DD}	V
VA	Address pins voltage				V _{DD}	V
I _{CH}	Channel current (TA = 25°C)				25	mA
ТА	Operating temperature				125	°C

Note:

1. When VSS = 0 V, VDD can range from 10 V to 36 V.

2. VDD and VSS can be any value as long as 10 V \leq (VDD – VSS) \leq 36 V, and VDD \geq 5 V.

3. VS is the voltage on all the S pins.

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Electrical Characteristics: Dual Supply At $T_A = 25^{\circ}$ C, $V_{DD} = 15$ V, and $V_{SS} = -15$ V (unless otherwise noted)

Symbol	Parameters	Conditions		Min.	Тур.	Max.	Units
Analog Switc	h						
	Analog signal range	$T_A = -40^{\circ}C \text{ to } +125^{\circ}C$		V _{ss}		V _{DD}	V
		$V_{s} = 0V, I_{CH} = 1mA$			125	170	Ω
D	On resistance				145	200	Ω
κ _{ON}	Oll-Tesistance	$V_{s} = \pm 10V, I_{CH} = 1mA$	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			230	Ω
			$T_A = -40^{\circ}C \text{ to } +125^{\circ}C$			250	Ω
	On-resistance mis-				2.4	6	Ω
$\Delta R_{_{ON}}$	match between chan-	$V_{s} = \pm 10V, I_{CH} = 1mA$	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			9	Ω
	nels		$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			11	Ω
					22	45	Ω
R _{flat}	On-resistance flatness	V _s = 10V, 0V, -10V	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			53	Ω
			$T_A = -40^{\circ}C \text{ to } +125^{\circ}C$			58	Ω
	On-resistance drift	$V_s = 0V$			0.52		%/°C
		Switch state is off, $V_s = \pm 10V$, $V_D = \pm 10V^{(1)}$		-1	0.03	1	nA
I _{S(OFF)}	Input leakage current		$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	-10		10	nA
			$T_A = -40^{\circ}C \text{ to } +125^{\circ}C$	-25		25	nA
		Switch state is off, $V_s = \pm 10V$, $V_D = \pm 10V^{(1)}$		-1	0.22	1	nA
I _{D(OFF)}	Output off leakage		$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	-10		10	nA
			$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$	-50		50	nA
				-1	0.25	1	nA
I _{D(ON)}	current	Switch state is on, $V_D = +10V V = floating$	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	-10		10	nA
		8	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$	-50		50	nA
Logic Input							
V _{IH}	High-level input voltage			2.0			V
V _{IL}	Low-level input voltage					0.8	V
ID	Input current					0.15	μA
Switch Dynar	nics ⁽²⁾						
					126	210	ns
t _{on}	Enable turn-on time	$V_s = \pm 10V, R_L = 300\Omega,$ C = 35pF	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			210	ns
			$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			210	ns
					125	191	ns
t _{OFF}	Enable turn-off time	$V_{s} = \pm 10V, R_{L} = 300\Omega,$ C = 35pF	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			191	ns
			$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			191	ns





Electrical Characteristics: Dual Supply Cont.

Symbol	Parameters	Conditions		Min.	Тур.	Max.	Units
					171	310	ns
t	Transition time	$V_{\rm s} = 10V, R_{\rm L} = 300\Omega,$	$T_{A} = -40^{\circ}C \text{ to } +85^{\circ}C$			310	ns
		$C_{L} = 35 \text{pr},$	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			310	ns
t _{BBM}	Break-before-make time delay	$V_{s} = 10V, R_{L} = 300\Omega, C_{I}$ +125°C	$= 35 \text{pF}, T_{A} = -40^{\circ}\text{C} \text{ to}$	30	75		ns
	Charge injection	C = 1 p E P = 00	$V_s = 0V$		0.9		pC
Q _j	Charge injection	$C_L = IIIF, K_S = 0.22$	$V_{s} = -15V \text{ to } +15V$		±2		pC
	Off inslation	$R_{I} = 50\Omega, V_{S} = 1V_{RMS},$	Nonadjacent channel to D, DA, DB		-96		dB
	Off-isolation	f = 1MHz	Adjacent channel to D, DA, DB		-85		dB
	Channel-to-channel	$R_{L} = 50\Omega, V_{S} = 1V_{RMS},$ f = 1MHz	Nonadjacent channels		-96		dB
	crosstalk		Adjacent channels		-88		dB
C _{S(OFF)}	Input off-capacitance	$f = 1MHz, V_s = 0V$			5	7	pF
C		$f = 1MHz, V_s = 0V$	PS508		24	30	pF
C _{D(OFF)}	Output on-capacitance		PS509		15	20	pF
C	Input/Output on-ca-	$f = 1MH_7 V = 0V$	PS508		30	36	pF
C _{D(ON)}	pacitance	$1 - 1101112, v_{s} - 00$	PS509		20	25	pF
Power Supply	,						
					135	200	μΑ
	V _{DD} supply current	All $V_A = 0V$ or 3.3V, $V_A = 0V$ $V_A = 2.2V$	$T_{A} = -40^{\circ}C \text{ to } +85^{\circ}C$			200	μΑ
		$v_{\rm s} = 0V, v_{\rm EN} = 3.3V$	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			200	μΑ
					135	200	μA
	V _{ss} supply current	All $v_A = 0V$ or 3.3V, V = 0V $V = 3.3V$	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			200	μA
	$v_{\rm S} = 0v, v_{\rm EN} = 3.3v,$	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			200	μΑ	

Note:

1. When VS is positive, VD is negative, and vice versa.

2. Specified by design, not production tested.





Electrical Characteristics: Single Supply at $T_A = 25^{\circ}$ C, $V_{DD} = 12$ V, and $V_{SS} = 0$ V (unless otherwise noted)

Symbol	Parameters	Conditions		Min.	Тур.	Max.	Units
Analog Switch	•						
	Analog signal range	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$		V _{ss}		V _{DD}	V
					235	340	Ω
R _{ON}	On-resistance	$V_{s} = +10V, I_{CH} = 1mA$	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			390	Ω
			$T_A = -40^{\circ}C \text{ to } +125^{\circ}C$			430	Ω
	On-resistance				3.1	12	Ω
ΔR_{ON}	mismatch between	$V_{s} = +10V, I_{CH} = 1mA$	$T_{A} = -40^{\circ}C \text{ to } +85^{\circ}C$			19	Ω
	channels		$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			23	Ω
	On-resistance drift	$V_s = 10V$			0.47		%/°C
		Switch state is off. $V =$		-1	0.03	1	nA
I _{s(off)}	Input leakage current	$1V \text{ and } V_D = 10V, \text{ or } V_S$	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	-10		10	nA
		= 10V and $V_D = 1V^{(1)}$	$T_A = -40^{\circ}C \text{ to } +125^{\circ}C$	-25		25	nA
		Switch state is off V -		-1	0.22	1	nA
I _{D(OFF)} Output off leakage	1 V and $V_D = 10$ V, or V_S	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	-10		10	nA	
		= 10V and $V_{\rm D} = 1V^{(1)}$	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$	-50		50	nA
		Switch state is on, V_D = 1V and 10V, V_S =		-1	0.25	1	nA
I _{D(ON)}	Output on leakage		$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$	-10		10	nA
		floating	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$	-50		50	nA
Logic Input							
V _{IH}	High-level input voltage			2.0			V
V _{IL}	Low-level input volt- age					0.8	V
ID	Input current					0.15	μΑ
Switch Dynam	ics ⁽²⁾	I		1		1	
					115	220	ns
t _{on}	Enable turn-on time	$V_{s} = 8V, R_{L} = 300\Omega,$	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			220	ns
			$T_A = -40^{\circ}C \text{ to } +125^{\circ}C$			220	ns
					118	200	ns
t _{off}	Enable turn-off time	$V_{s} = 8V, R_{L} = 300\Omega,$	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$			200	ns
Urr		$C_L = 35 \text{ pr}$ $T_A = -40^{\circ}\text{C to } +125^{\circ}\text{C}$				200	ns





Symbol	Parameters	Conditions		Min.	Тур.	Max.	Units
		$V_{s} = 8V, R_{L} = 300\Omega, C_{L} =$	= 35pF		212	418	ns
t,	Transition time	$V_{s} = 8V, R_{L} = 300\Omega,$ $C_{L} = 35pF$	$T_{A} = -40^{\circ}C \text{ to } +85^{\circ}C$			418	ns
		$V_{s} = 8V, R_{L} = 300\Omega,$ $C_{L} = 35pF$	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			418	ns
t _{BBM}	Break-before-make time delay	$V_s = 8V, R_L = 300\Omega, C_L = +125^{\circ}C$	= 35pF, $T_A = -40^{\circ}C$ to	30	120		ns
0	Charge injection	$C = 1 \pi E R = 0 O$	$V_s = 6 V$		0.5		pC
Q _j	Charge injection	$C_L = IIIF, K_S = 0.22$	$V_{s} = 0$ V to 12 V,		±1.5		pC
		$R_{L} = 50\Omega, V_{S} = 1V_{RMS},$	Nonadjacent channel to D, DA, DB		-96		dB
	Off-isolation	f = 1MHz	Adjacent channel to D, DA, DB		-85		dB
	Channel-to-channel	$R_{\rm L} = 50\Omega, V_{\rm S} = 1V_{\rm RMS},$	Nonadjacent channels		-96		dB
crosstalk	crosstalk	f = 1MHz	Adjacent channels		-88		dB
C _{S(OFF)}	Input off-capacitance	$f = 1MHz$, $V_s = 6V$			5	7	pF
0	Output off-capaci-		PS508		24	30	pF
C _{D(OFF)}	tance	$f = 1MHz, V_s = 6V$	PS509		15	20	pF
C	Input/Output on-	$f = 1MH_7 V = 6V$	PS508		30	36	pF
C _{D(ON)}	capacitance	$1 - 1101112, v_s - 0v$	PS509		21	25	pF
Power Supply							
					104	160	μΑ
	VDD supply current	All $V_A = 0V$ or 3.3V, V = 0V $V = 3.3V$	$T_{A} = -40^{\circ}C \text{ to } +85^{\circ}C$			160	μΑ
		s s, , , , , , , , , , , , , , , , , ,	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			160	μΑ
					104	160	μΑ
	VSS supply current	All $V_{A} = 0V$ or 3.3V, $V_{A} = 0V$ V $- 3.3V$	$T_{A} = -40^{\circ}C \text{ to } +85^{\circ}C$			160	μA
		• _s = ••, • _{en} = 5.5 •	$T_{A} = -40^{\circ}C \text{ to } +125^{\circ}C$			160	μA

Electrical Characteristics: Single Supply Cont.

Note:

1. When VS is 1 V, VD is 10 V, and vice versa.

2. Specified by design, not production tested.







Figure 1. On-Resistance Measurement Setup



Figure 2. Off-Leakage Measurement Setup







Figure 4. Transition-Time Measurement Setup







Figure 5. Break-Before-Make Delay Measurement Setup



Figure 6. Turn-On and Turn-Off Time Measurement Setup



Figure 7. Charge-Injection Measurement Setup







Figure 8. Off Isolation Measurement Setup



Figure 9. Channel-to-Channel Crosstalk Measurement Setup

Part Marking

Top mark not available at this time. To obtain advance information regarding the top mark, please contact your local sales representative.





Packaging Mechanical: 16-TSSOP (L)



16-0061





Packaging Mechanical: 16-QSOP (Q)



16-0056





Packaging Mechanical: 16-SOIC (W)



For latest package info.

please check: http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/

Ordering Information

Ordering Code	Package Code	Package Description
PS508LEX	L	16-pin, 173mil Wide (TSSOP)
PS508QEX	Q	16-pin, 150mil Wide (QSOP)
PS508WEX	W	16-pin, 150mil Wide (SOIC)
PS509LEX	L	16-pin, 173mil Wide (TSSOP)
PS509QEX	Q	16-pin, 150mil Wide (QSOP)
PS509WEX	W	16-pin, 150mil Wide (SOIC)

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.

2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free. 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm

- antimony compounds.
- 4. E = Pb-free and Green
- 5. X suffix = Tape/Reel





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