

Low Voltage Bidirectional SPDT Analog Switch

Description

The PSMUX1247 is a general purpose SPDT CMOS Analog Switch. It can be used as an analog switch or as a low-delay bus switch. Specified over a wide operating power supply voltage, 1.08V to 5.5V.

Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

The device supports bidirectional analog and digital signals on the source (Sx) and drain (D) pins ranging from GND to V_{DD} . A low supply current of 4 nA enables use in portable applications.

All logic inputs have 1.8V logic compatible thresholds, ensuring both TTL and CMOS logic compatibility when operating in the valid supply voltage range.

Application(s)

- PC Motherboards
- Notebooks
- Servers
- Smartphones
- Remote Radio Units
- Active Antenna System mMIMO (AAS)
- Barcode Scanners
- Motor Drives
- Building Automation
- Video Surveillance
- Electronic Point of Sales
- Appliances
- Consumer Audio

Features

- Wide V_{DD} Range: 1.08V to 5.5V
- Low Supply Current: 4nA
- Low On-Resistance 3Ω
- 1.8 V Logic Compatible
- Voltages on the control pins to be applied before the supply pin
- Signal Passing Bandwidth, 500MHz
- Transition Time: 14 ns
- Break-before-make switching
- Rail-to-Rail Signal Range
- High Off Isolation: -65dB @ 1MHz
- Crosstalk Rejection Reduces Signal Distortion: -65dB @ 1MHz
- Extended Industrial Temperature Range: -40°C to 125°C
- ESD Protection : 2kV(HBM)
- 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-Q100/101/104/200, 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):
 - 6-pin SC-70 (C)

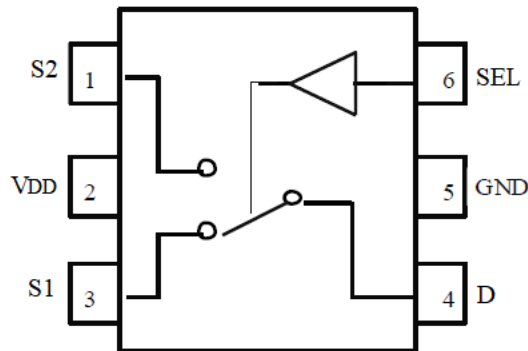
Function Table

SEL	Source (Sx) Connected To D Pin
0	S1
1	S2

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.

Pin Configuration



Pin Description

Pin#	Pin Name	Type	Description
1	S2	I/O	Data port 2
2	V _{DD}	Power	Positive Power Supply
3	S1	I/O	Data Port 1
4	D	I/O	Common Data pin.
5	GND	GND	Ground
6	SEL	I	Selection Pin

Maximum Ratings

Storage Temperature.....	-65°C to +150°C
Ambient Temperature with Power Applied.....	-40°C to +125°C
Supply Voltage V_{DD}	-0.5V to +6V
Control Input Voltage SEL.....	-0.5V to +6V
DC Input Voltage V_{INPUT}	-0.5V to +6V
Continuous Current S1/S2/D.....	±50mA
ESD (HBM)	2kV
ESD (CDM)	1kV

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. The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed. Control input must be held HIGH or LOW; it must not float.

Recommended Operating Conditions

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Operating Voltage		1.08		5.5	V
V_S or V_D	Control Input Voltage		0		V_{DD}	V
V_{SEL}	Select Input Voltage		0		5.5	V
T_A	Operating Temperature		-40	25	125	°C

DC Electrical Characteristics

+5V Supply ($V_{DD} = 5V \pm 10\%$)

Symbol	Parameter	Test Conditions	T_A	Min.	Typ.	Max.	Units
ANALOG SWITCH							
V_S, V_D	Analog Signal Range			0		V_{DD}	V
R_{ON}	On-Resistance	$I_{SD} = 10mA, V_S = 0$ to V_{DD} , <i>Test Circuit 1</i>	25°C -40°C to 85°C -40°C to 125°C		3 5 6		Ω
ΔR_{ON}	On-resistance matching between channels	$I_{SD} = 10mA, V_S = 0$ to V_{DD} , <i>Test Circuit 1</i>	25°C -40°C to 85°C -40°C to 125°C		0.15 1 1		Ω
R_{ONF}	On-Resistance Flatness	$I_{SD} = 10mA, V_S = 0$ to V_{DD} , <i>Test Circuit 1</i>	25°C -40°C to 85°C -40°C to 125°C		1.5 2 3		Ω
$I_{S(OFF)}$	S Off Leakage Current	$V_D = 4.5V/1.5V$ $V_S = 1.5V/4.5V$, Switch OFF	25°C -40°C to 85°C -40°C to 125°C		±75 -150 -175	150 175	nA
$I_{S(ON)}$ or $I_{D(ON)}$	S/D ON Leakage Current	$V_D = V_S = 4.5V/1V$ Switch ON	25°C -40°C to 85°C -40°C to 125°C		±200 -500 -750	500 750	nA

SELECT INPUTS (SEL)

V_{IH}	Input Logic High		-40°C to 125°C	1.42		5.5	V
V_{IL}	Input Logic Low		-40°C to 125°C	0		0.75	V
I_{IH} I_{IL}	Input Leakage Current		+25°C -40°C to 125°C		±5 ±50		nA
C_{IN}	Digital input capacitance	$f = 1MHz$	+25°C -40°C to 125°C		1 2		pF

DYNAMIC CHARACTERISTICS

t_{TRAN}	Switching time	$V_S = 3V, R_L = 200\Omega, C_L =$	25°C		12		ns
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Symbol	Parameter	Test Conditions	T _A	Min.	Typ.	Max.	Units
	between channels	15pF	-40°C to 85°C			18	
			-40°C to 125°C			19	
t _{BBM}	Break-Before-Make Delay	V _S = 3V, R _L = 200Ω, C _L = 15pF	25°C		8		ns
			-40°C to 85°C	1			
			-40°C to 125°C	1			
Q _C	Charge injection	V _S = V _{DD} /2; R _S = 0Ω, C _L = 1nF	+25°C		-10		pC
O _{ISO}	Off Isolations	R _L = 50Ω, C _L = 5pF, f = 1MHz	+25°C		-65		dB
		R _L = 50Ω, C _L = 5pF, f = 10MHz	+25°C		-45		
X _{TALKD}	Channel-to-Channel Crosstalk	R _L = 50Ω, C _L = 5pF, f = 1MHz	+25°C		-65		dB
		R _L = 50Ω, C _L = 5pF, f = 10MHz	+25°C		-45		
f _{3dB}	3dB Bandwidth	R _L = 50Ω, C _L = 5pF	+25°C		500		MHz
C _{S (OFF)}	S Channels Off Capacitance	V _{SX} = V _{DD} or GND, Switch OFF. f = 1MHz	25°C		7		pF
C _{S (ON)}	S Channels On Capacitance	V _{SX} = V _{DD} or GND, Switch ON. f = 1MHz	25°C		23		pF
C _{D (ON)}	D Channel On Capacitance	V _{SX} = V _{DD} or GND, Switch ON. f = 1MHz	25°C		23		pF
SUPPLY							
I _{DD}	Power Supply Current	V _{SEL} = GND or 5.5V, Switch ON or OFF	+25°C		0.007		μA
			-40°C to 125°C			1.5	

+3.3V Supply (V_{DD} = 3.3V ±10%)

Symbol	Parameter	Test Conditions	T _A	Min.	Typ.	Max.	Units
ANALOG SWITCH							
V _S , V _D	Analog Signal Range			0	-	V _{DD}	V
R _{ON}	On-Resistance	I _{SD} = 10mA, V _S = 0 to V _{DD} , <i>Test Circuit 1</i>	25 °C		4.5		Ω
			-40°C to 85°C			12.5	
			-40°C to 125°C			13	
Δ R _{ON}	On-resistance matching between channels	I _{SD} = 10mA, V _S = 0 to V _{DD} , <i>Test Circuit 1</i>	25 °C		0.15		Ω
			-40°C to 85°C			1	
			-40°C to 125°C			1	
R _{ONF}	On-Resistance Flatness	I _{SD} = 10mA, V _S = 0 to V _{DD} , <i>Test Circuit 1</i>	25 °C		3.5		Ω
			-40°C to 85°C			4	
			-40°C to 125°C			5	
I _{S (OFF)}	S Off Leakage Current	V _D = 3V/ 1V V _S = 1V/ 3V, Switch OFF	25 °C		±75		nA
			-40°C to 85°C	-150		150	
			-40°C to 125°C	-175		175	
I _{S (ON)} or I _{D (ON)}	S/D ON Leakage Current	V _D = V _S = 3V/ 1V Switch ON	25 °C		±200		nA
			-40°C to 85°C	-500		500	
			-40°C to 125°C	-750		750	
SELECT INPUTS (SEL)							
V _{IH}	Input Logic High		-40°C to 125°C	1.35		5.5	V
V _{IL}	Input Logic Low		-40°C to 125°C	0		0.65	V
I _{IH}	Input Leakage		+25°C		±5		nA

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Symbol	Parameter	Test Conditions	T _A	Min.	Typ.	Max.	Units
I _{IL}	Current		-40°C to 125°C			±50	
C _{IN}	Digital input capacitance	f = 1MHz	+25°C		1		pF
			-40°C to 125°C			2	
DYNAMIC CHARACTERISTICS							
t _{TRAN}	Switching time between channels	V _S = 2V, R _L = 200Ω, C _L = 15pF	25°C		14		ns
			-40°C to 85°C			20	
			-40°C to 125°C			22	
t _{BBM}	Break-Before-Make Delay	V _S = 2V, R _L = 200Ω, C _L = 15pF	25°C		8		ns
			-40°C to 85°C	1			
			-40°C to 125°C	1			
Q _C	Charge injection	V _S = V _{DD} /2; R _S = 0Ω, C _L = 1nF	+25°C		-6		pC
O _{ISO}	Off Isolations	R _L = 50Ω, C _L = 5pF, f = 1MHz	+25°C		-65		dB
		R _L = 50Ω, C _L = 5pF, f = 10MHz	+25°C		-45		
X _{TALKD}	Channel-to-Channel Crosstalk	R _L = 50Ω, C _L = 5pF, f = 1MHz	+25°C		-65		dB
		R _L = 50Ω, C _L = 5pF, f = 10MHz	+25°C		-45		
f _{3dB}	3dB Bandwidth	R _L = 50Ω, C _L = 5pF	+25°C		500		MHz
C _{S (OFF)}	S Channels Off Capacitance	V _{Sx} = V _{DD} or GND, Switch OFF. f = 1MHz	25°C		7		pF
C _{S (ON)}	S Channels On Capacitance	V _{Sx} = V _{DD} or GND, Switch ON. f = 1MHz	25°C		23		pF
C _{D (ON)}	D Channel On Capacitance	V _{Sx} = V _{DD} or GND, Switch ON. f = 1MHz	25°C		23		pF
SUPPLY							
I _{DD}	Power Supply Current	V _{SEL} = GND or 5.5V, Switch ON or OFF	+25°C	-	0.004		μA
			-40°C to 125°C	-	-	0.8	

+1.8V Supply (V_{DD} = 1.8V ±10%)

Symbol	Parameter	Test Conditions	T _A	Min.	Typ.	Max.	Units
ANALOG SWITCH							
V _S , V _D	Analog Signal Range			0		V _{DD}	V
R _{ON}	On-Resistance	I _{SD} = 10mA, V _S = 0 to V _{DD} , <i>Test Circuit 1</i>	25°C		40		Ω
			-40°C to 85°C			80	
			-40°C to 125°C			80	
Δ R _{ON}	On-resistance matching between channels	I _{SD} = 10mA, V _S = 0 to V _{DD} , <i>Test Circuit 1</i>	25°C		0.4		Ω
			-40°C to 85°C			1.5	
			-40°C to 125°C			1.5	
I _{S (OFF)}	S Off Leakage Current	V _D = 1.8V/ 1V V _S = 1V/ 1.8V, Switch OFF	25°C		±75		nA
			-40°C to 85°C	-150		150	
			-40°C to 125°C	-175		175	
I _{S (ON)} or I _{D (ON)}	S/D ON Leakage Current	V _D = V _S = 1.8V/ 1V Switch ON	25°C		±200		nA
			-40°C to 85°C	-500		500	
			-40°C to 125°C	-750		750	
SELECT INPUTS (SEL)							
V _{IH}	Input Logic High		-40°C to 125°C	1.07		5.5	V

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Symbol	Parameter	Test Conditions	T _A	Min.	Typ.	Max.	Units
V _{IL}	Input Logic Low		-40°C to 125°C	0		0.55	V
I _{IH} I _{IL}	Input Leakage Current		+25°C		±5		nA
			-40°C to 125°C			±50	
C _{IN}	Digital input capacitance	f = 1MHz	+25°C		1		pF
			-40°C to 125°C			2	

DYNAMIC CHARACTERISTICS

t _{TRAN}	Switching time between channels	V _S = 1V, R _L = 200Ω, C _L = 15pF	25°C		24		ns
			-40°C to 85°C			44	
			-40°C to 125°C			45	
t _{BBM}	Break-Before-Make Delay	V _S = 1V, R _L = 200Ω, C _L = 15pF	25°C		16		ns
			-40°C to 85°C	1			
			-40°C to 125°C	1			
Q _c	Charge injection	V _S = V _{DD} /2; R _S = 0Ω, C _L = 1nF	+25°C		-3		pC
O _{ISO}	Off Isolations	R _L = 50Ω, C _L = 5pF, f = 1MHz	+25°C		-65		dB
		R _L = 50Ω, C _L = 5pF, f = 10MHz	+25°C		-45		
X _{TALKD}	Channel-to-Channel Crosstalk	R _L = 50Ω, C _L = 5pF, f = 1MHz	+25°C		-65		dB
		R _L = 50Ω, C _L = 5pF, f = 10MHz	+25°C		-45		
f _{3dB}	3dB Bandwidth	R _L = 50Ω, C _L = 5pF	+25°C		500		MHz
C _{S(OFF)}	S Channels Off Capacitance	V _{SX} = V _{DD} or GND, Switch OFF. f = 1MHz	25°C		7		pF
C _{S(ON)}	S Channels On Capacitance	V _{SX} = V _{DD} or GND, Switch ON. f = 1MHz	25°C		23		pF
C _{D(ON)}	D Channel On Capacitance	V _{SX} = V _{DD} or GND, Switch ON. f = 1MHz	25°C		23		pF

SUPPLY

I _{DD}	Power Supply Current	V _{SEL} = GND or 5.5V, Switch ON or OFF	+25°C		0.002		μA
			-40°C to 125°C			0.52	

+1.2V Supply (V_{DD} = 1.2V ±10%)

Symbol	Parameter	Test Conditions	T _A	Min.	Typ.	Max.	Units
V _S , V _D	Analog Signal Range			0		V _{DD}	V
R _{ON}	On-Resistance	I _{SD} = 10mA, V _S = 0 to V _{DD} , Test Circuit 1	25 °C		70		Ω
			-40°C to 85°C			105	
			-40°C to 125°C			105	
Δ R _{ON}	On-resistance matching between channels	I _{SD} = 10mA, V _S = 0 to V _{DD} , Test Circuit 1	25 °C		0.4		Ω
			-40°C to 85°C			1.5	
			-40°C to 125°C			1.5	
I _{S(OFF)}	S Off Leakage Current	V _D = 1.2V/ 1V V _S = 1V/ 1.2V, Switch OFF	25 °C		±75		nA
			-40°C to 85°C	-150		150	
			-40°C to 125°C	-175		175	
I _{S(ON)} or I _{D(ON)}	S/D ON Leakage Current	V _D = V _S = 1.2V/ 1V Switch ON	25 °C		±200		nA
			-40°C to 85°C	-500		500	
			-40°C to 125°C	-750		750	

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Symbol	Parameter	Test Conditions	T _A	Min.	Typ.	Max.	Units
SELECT INPUTS (SEL)							
V _{IH}	Input Logic High		-40°C to 125°C	0.96			V
V _{IL}	Input Logic Low		-40°C to 125°C			0.36	V
I _{IH} I _{IL}	Input Leakage Current		+25°C		±5		nA
			-40°C to 125°C			±100	
C _{IN}	Digital input capacitance	f = 1MHz	+25°C		1		pF
			-40°C to 125°C			2	
DYNAMIC CHARACTERISTICS							
t _{TRAN}	Switching time between channels	V _S = 1V, R _L = 200Ω, C _L = 15pF	25°C		40		ns
			-40°C to 85°C			175	
			-40°C to 125°C			175	
t _{BDM}	Break-Before-Make Delay	V _S = 1V, R _L = 200Ω, C _L = 15pF	25°C		27		ns
			-40°C to 85°C	1			
			-40°C to 125°C	1			
Q _C	Charge injection	V _S = V _{DD} /2; R _S = 0, C _L = 1nF	+25°C		±5		pC
O _{ISO}	Off Isolations	R _L = 50Ω, C _L = 5pF, f = 1MHz	+25°C		-64		dB
		R _L = 50Ω, C _L = 5pF, f = 10MHz	+25°C		-44		
X _{TALKD}	Channel-to-Channel Crosstalk	R _L = 50Ω, C _L = 5pF, f = 1MHz	+25°C		-64		dB
		R _L = 50Ω, C _L = 5pF, f = 10MHz	+25°C		-44		
f _{3dB}	3dB Bandwidth	R _L = 50Ω, C _L = 5pF	+25°C		500		MHz
C _{S(OFF)}	S Channels Off Capacitance	V _{SX} = V _{DD} or GND, Switch OFF. f = 1MHz	25°C		7		pF
C _{S(ON)}	S Channels On Capacitance	V _{SX} = V _{DD} or GND, Switch OFF. f = 1MHz	25°C		23		pF
C _{D(ON)}	D Channel On Capacitance	V _{SX} = V _{DD} or GND, Switch ON. f = 1MHz	25°C		23		pF
SUPPLY							
I _{DD}	Power Supply Current	V _{SEL} = GND or 5.5V, Switch ON or OFF	+25°C		0.0015		uA
			-40°C to 85°C			0.45	

Test Circuits and Timing Diagrams

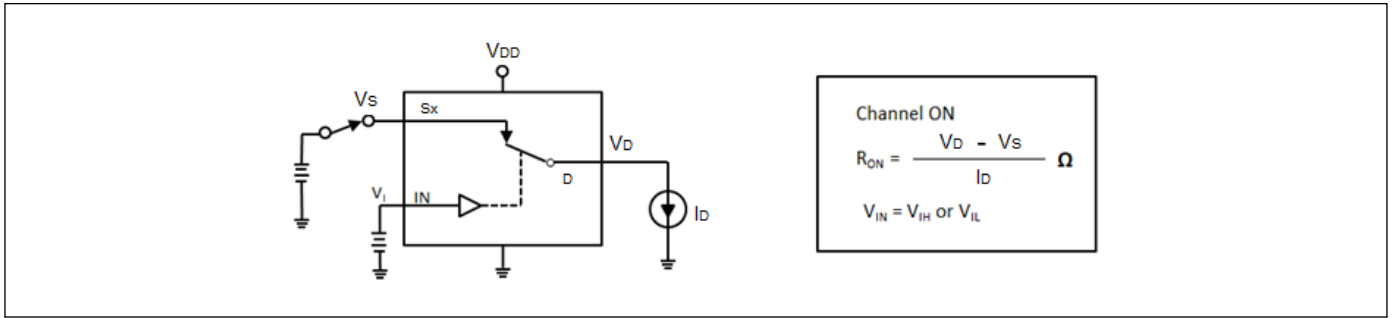


Figure 1. On Resistance

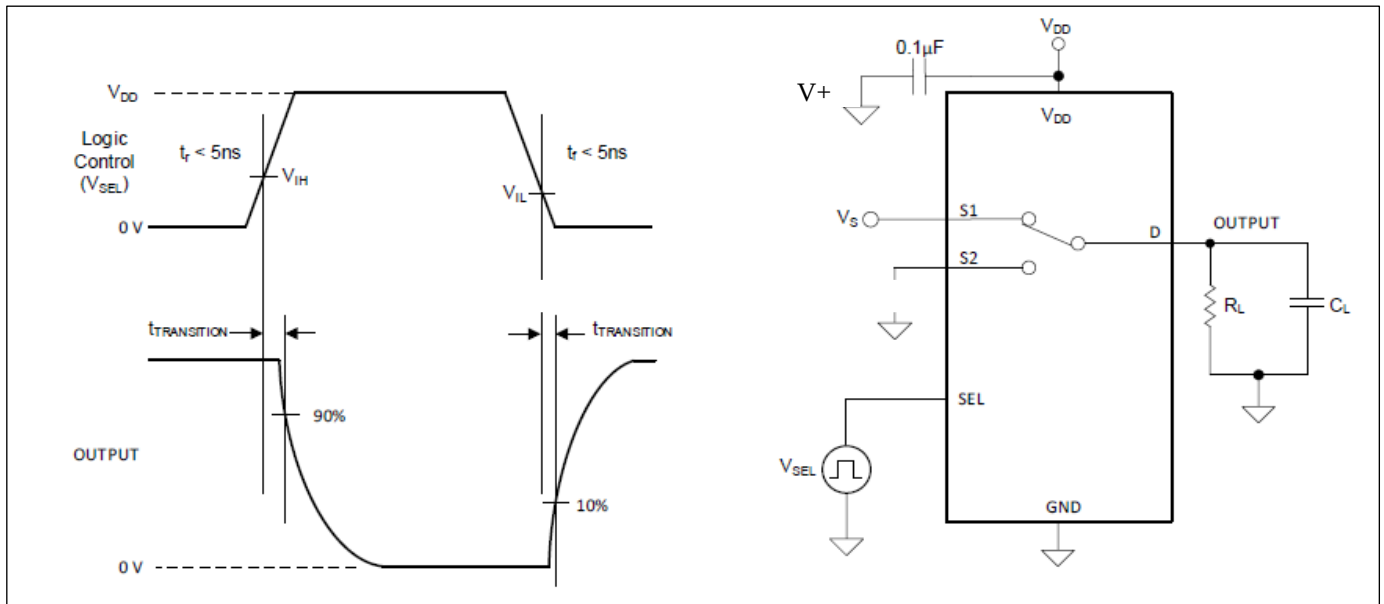


Figure 2. Transition Time

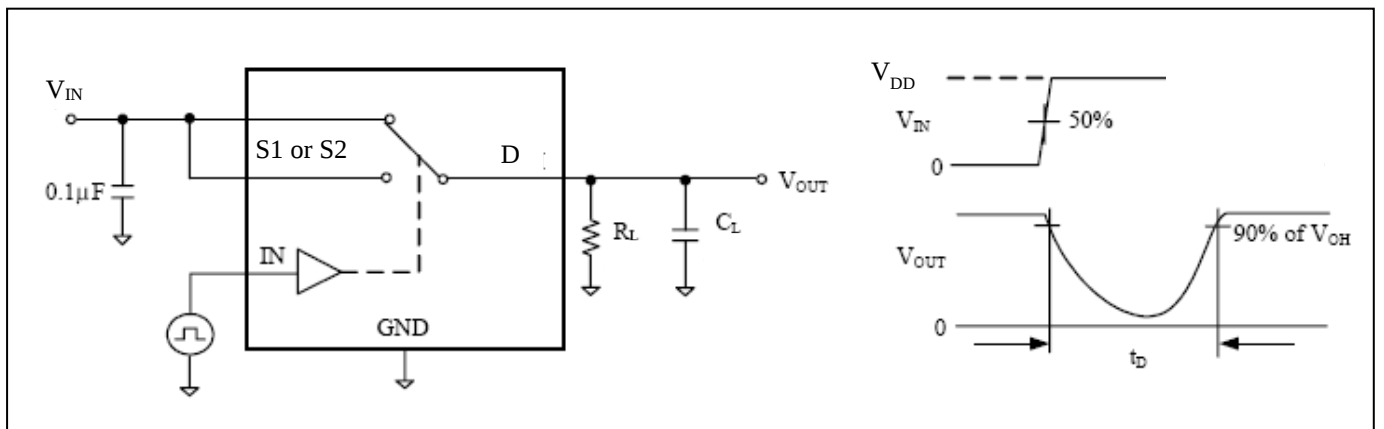


Figure 3. Break Before Make Interval Timing

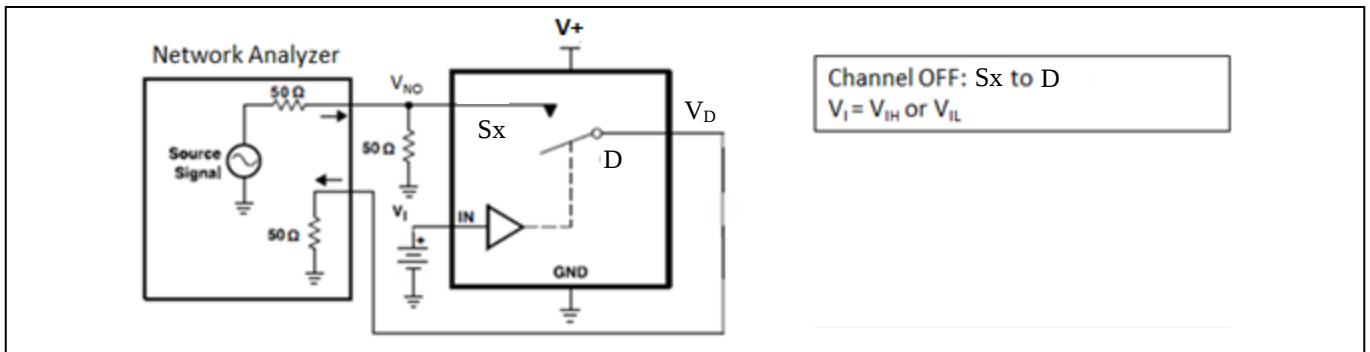


Figure 4. OFF Isolation (O_{iso})

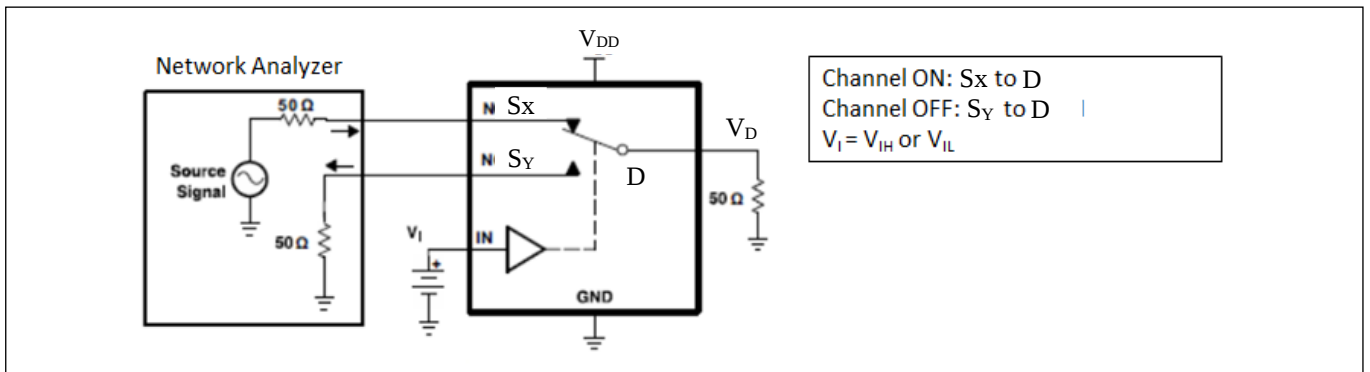


Figure 5. Crosstalk

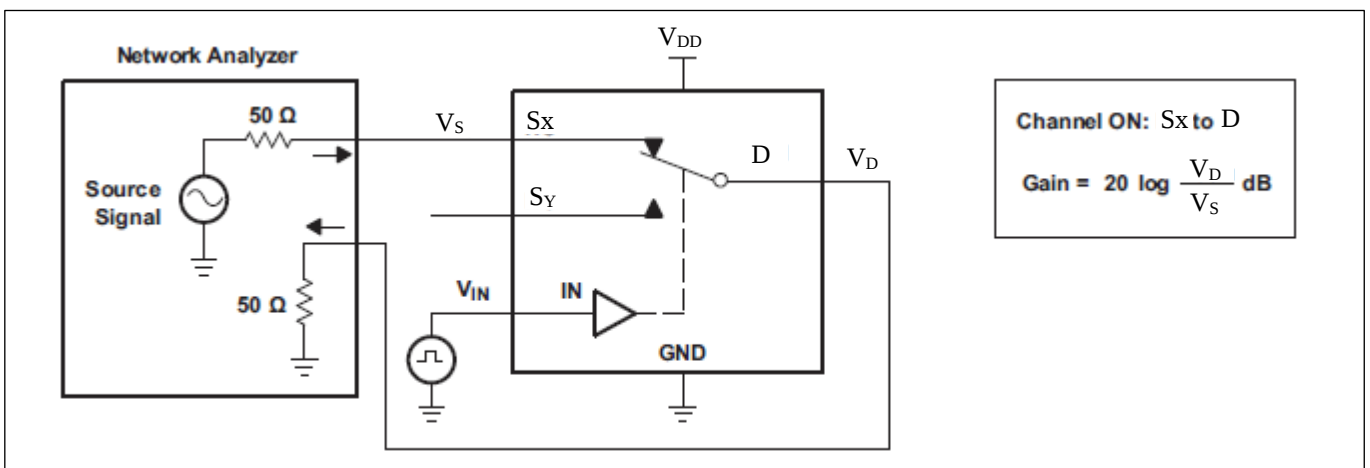


Figure 6. Bandwidth

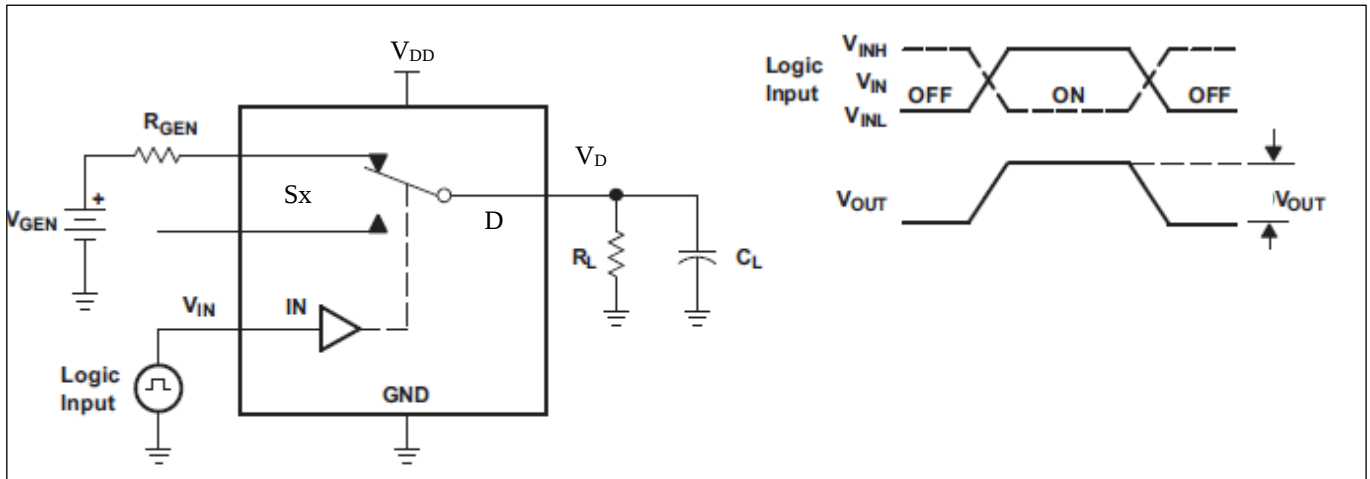


Figure 7. Charge Injection (Qc)

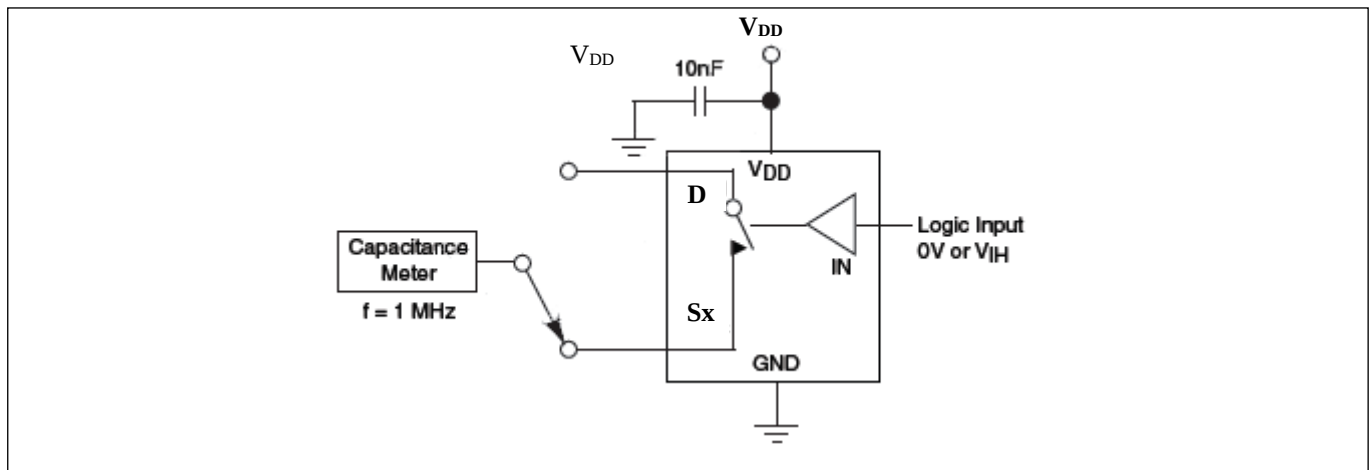


Figure 8. Channel Off Capacitance

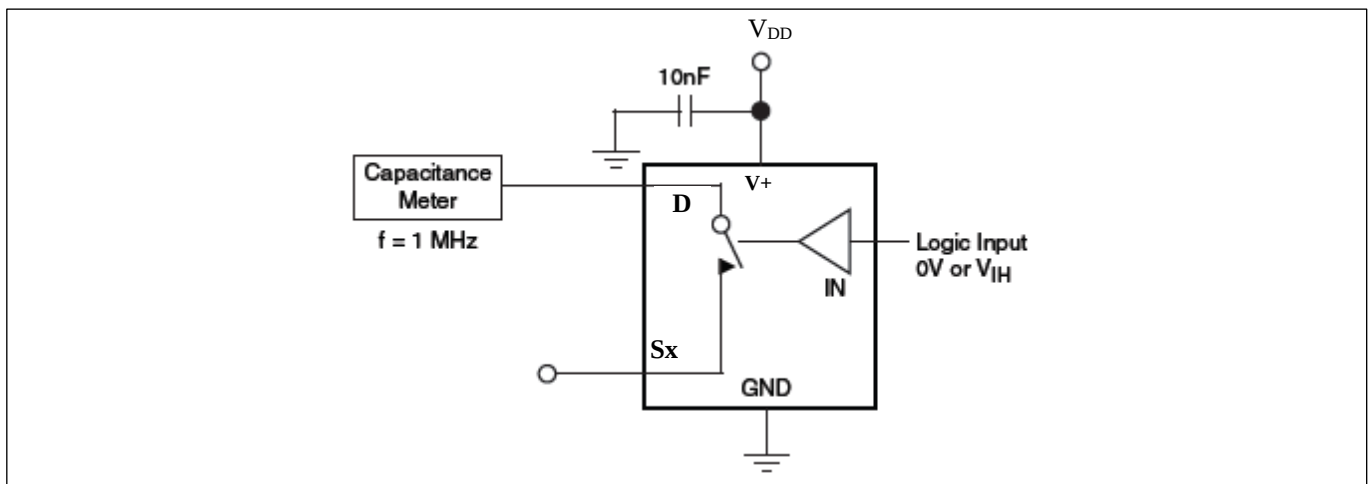


Figure 9. Channel On Capacitance

Part Marking

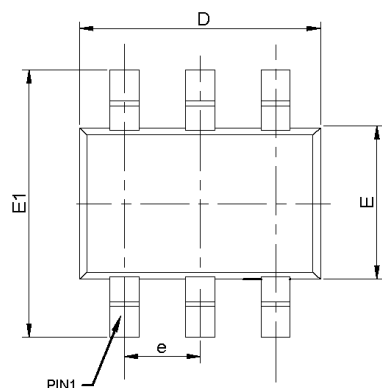
Top Mark: $\overline{yDYW}$

Pin 1

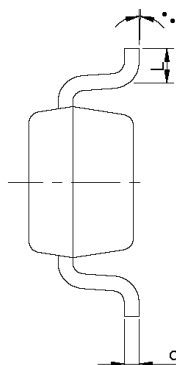
Y: Date Code (Year)
W: Date Code (Workweek)
Bar above "W" means Cu wire

Packaging Mechanical

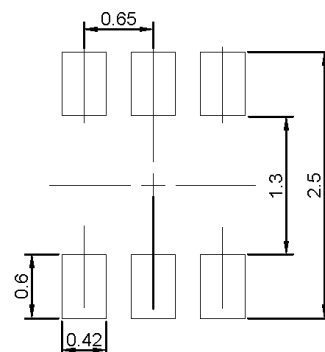
6-SOT363 (C)



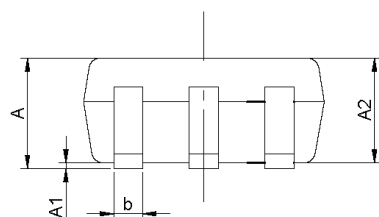
TOP VIEW



BOTTOM VIEW



RECOMMENDED LAND PATTERN (unit:mm)



SIDE VIEW

PKG. DIMENSIONS(MM)		
SYMBOL	Min	Max
A	-	1.10
A1	0.00	0.10
A2	0.70	1.00
b	0.15	0.40
c	0.08	0.22
D	1.80	2.20
E	1.10	1.40
E1	1.80	2.40
e	0.65 BSC	
L	0.26	0.46
θ	0°	8°

Notes:

1. Comply with MO-203C/AB, except b Max, D Min and D Max.
2. PACKAGE OUTLINE DIMENSIONS DO NOT INCLUDE MOLD FLASH AND METAL BURR
3. LAND PATTERN REFERENCE DIODES SOT363 PACKAGE INFORMATION.



DATE: 11/18/19

DESCRIPTION: 6-Pin, SOT363 (SC70)

PACKAGE CODE: C (C6)

DOCUMENT CONTROL#: PD-1902

REVISION: C

19-1160

For latest package info.

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

Ordering Information

Part Number	Packaging Code	Package Description
PSMUX1247CEX	C	6-Pin, SOT363 (SC70)

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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