High Speed USB 2.0 (480Mbps)DPDT Analog Switch

General Description

The SL7227 is a DPDT (double-pole/double-throw)analog switch. It operates from a 1.8V to 4.3V single power supply. Each switch of the SL7227 is bidirectional, which can ensure that the high speed signals have little or no attenuation at the outputs. The SL7227 features high speed, low power and wide bandwidth. The high performances make it very suitable for multiple applications, such as cellular phones and computer peripherals, etc.

The SL7227 has a power-off protection. It can prevent accidental signal leakage and ensure system reliability under power-down and over-voltage conditions. In addition, the device is capable of withstanding a V_{BUS} short to D+ or D- when the device is either powered on or powered off because of the special circuitry on the D+/D- pins.

The SL7227 is available in Green UTQFN-1.8×1.4-10L and MSOP-10 packages. It operates over an ambient temperature range of -40℃ to +85℃.

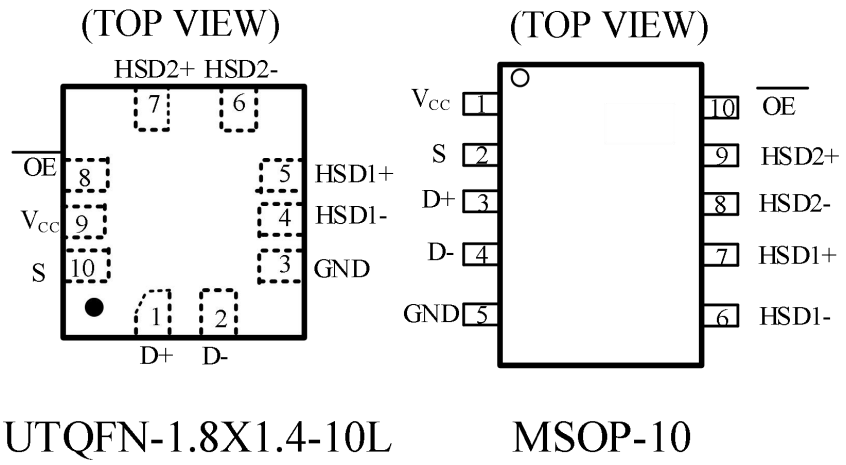
Features

- Supply Voltage Range: 1.8V to 4.3V
- On-Resistance: 5Ω (TYP) at 3.0V
- Off-Isolation: -51dB (R_L = 50Ω, f = 250MHz)
- Crosstalk: -26dB (R_L = 50Ω, f = 250MHz)
- Fast Switching Times at V_{CC} = 3.3V:
  - t_{ON} = 20ns (TYP)
  - t_{OFF} = 18ns (TYP)
- Break-Before-Make Switching
- Rail-to-Rail Input and Output Operation
- Power-Off and Power-On Protections
- -40 ℃ to +85 ℃ Operating Temperature Range
- Available in Green UTQFN-1.8×1.4-10L and MSOP-10 Packages

Applications

- Cellular Phones
- Digital Cameras
- Portable Equipment
- Computer Peripherals
- Battery-Powered Systems
- Routes Signals for USB 2.0 Full-Speed

Pin Configurations



UTQFN-1.8X1.4-10L MSOP-10

Figure 1 Pin Configurations

Pin Description

UTQFN1.8X1.4-10L	MSOP-10	Symbol	Description
Pin Number			
1,2	3,4	D+,D-	Data ports
4,5	6,7	HSD1+,HSD1-	
6,7	8,9	HSD2+,HSD2-	
3	5	GND	Ground
8	10	$\overline{OE}$	Output Enable Control Pin
9	1	V_{CC}	Positive Power Supply Pin
10	2	S	Select Input Pin.

Ordering Information

Type Number	Package	Quantity
SL7227XF10	QFN1.8*1.4-10L	3000PCS
SL7227XV10	MSOP-10	3000PCS

Absolute Maximum Ratings (T_A= 25℃)

Symbol	parameter	Rating	UNIT
	V_{CC} to GND	0 to4.6	V
	Analog, Digital Voltage Range	-0.3 to (V_{CC}+0.3)	V
	Continuous Current HSDn or Dn	±50	mA
	Peak Current HSDn or Dn	±100	mA
T_A	Operating Temperature Range	-40 to 85	℃
T_J	Junction Temperature	+150	℃
T_{STG}	Storage Temperature Range .	-65 to 150	℃
T_L	Lead Temperature (Soldering, 10s)	+260	℃
ESD Susceptibility	HBM	4000	V
	MM	400	V

备注：

1.Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

2.This integrated circuit can be damaged if ESD protections are not considered carefully. SLKOR recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

3.SLKOR reserves the right to make any change in circuit design, or specifications without prior notice.

Electrical Characteristics

（V_{CC} = +3.3V, Full = -40℃ to +85℃, typical values are at T_A = +25℃, unless otherwise noted）

Symbol	Parameter	Conditions	Temp	Min.	Typ.	Max.	Units
Analog Switch							
V_{IS}	Analog I/O Voltage (HSD1+, HSD1-, HSD2+, HSD2-)		Full	0		V_{CC}	V
R_{ON}	On-Resistance	V_{CC} = 3.0V, V_{IS} = 0V to 0.4V, I_D = 8mA, Test Circuit 1	+25℃		5	8	Ω
			Full			9	Ω
ΔR_{ON}	On-Resistance Match Between Channels	V_{CC} = 3.0V, V_{IS} = 0V to 0.4V, I_D = 8mA, Test Circuit 1	+25℃		0.3	0.7	Ω
			Full			0.8	Ω
$R_{FLAT(ON)}$	On-Resistance Flatness	V_{CC} = 3.0V, V_{IS} = 0V to 1.0V, I_D = 8mA, Test Circuit 1	+25℃		1	1.8	Ω
			Full			2	Ω
I_{OFF}	Power Off Leakage Current (D+, D-)	V_{CC} = 0V, V_D = 0V to 3.6V, V_S , V_{OE} = 0V or 3.6 V	Full			1	μA
I_{CCT}	Increase in I_{CC} per Control Voltage	V_{CC} = 3.6V, V_S or $V_{\overline{OE}}$ = 2.6V	Full			5	μA
$I_{HSD2(OFF)}$ $I_{HSD1(OFF)}$	Source Off Leakage Current	V_{CC} = 3.6V, V_{IS} = 3.3V/ 0.3V, V_D = 0.3V/ 3.3V	Full			1	μA
$I_{HSD2(ON)}$ $I_{HSD1(ON}$	Channel On Leakage Current	V_{CC} = 3.6V, V_{IS} = 3.3V/0.3V, V_D = 3.3V/0.3V or floating	Full			1	μA
Digital Inputs							
V_{IH}	Input High Voltage		Full	1.6			V
V_{IL}	Input Low Voltage		Full			0.3	V
I_{IN}	Input Leakage Current	V_{CC} = 3.0V, V_S , $V_{\overline{OE}}$ = 0V or V_{CC}	Full			1	μA

Electrical Characteristics

（V_{CC} = +3.3V, Full = -40℃ to +85℃, typical values are at T_A = +25℃, unless otherwise noted）

Symbol	Parameter	Conditions	Temp	Min.	Typ.	Max.	Units
Dynamic Characteristics							
t_{ON}	Turn-On Time	V_{IS} = 0.8V, R_L = 50Ω, C_L = 10pF, Test Circuit 2	+25℃		20		ns
t_{OFF}	Turn-Off Time		+25℃		18		ns
t_D	Break-Before-Make Time Delay	V_{IS} = 0.8V, R_L = 50Ω, C_L = 10pF, Test Circuit 3	+25℃		4		ns
t_{PD}	Propagation Delay	R_L = 50Ω, C_L = 10pF	+25℃		0.5		ns
O_{ISO}	Off Isolation	Signal = 0dBm, R_L = 50Ω, f = 250MHz, Test Circuit 4	+25℃		-51		dB
X_{TALK}	Channel-to-Channel Crosstalk	Signal = 0dBm, R_L = 50Ω, f = 250MHz, Test Circuit 5	+25℃		-26		dB
BW	-3dB Bandwidth	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6	+25℃		500		MHz
t_{SKEW}	Channel-to-Channel Skew	R_L = 50Ω, C_L = 10pF	+25℃		130		ps
Q	Charge Injection Select Input to Common I/O	V_G = GND, C_L = 1.0nF, R_G = 0Ω, Q = C_L × V_{OUT} , Test Circuit 7	+25℃		1.5		pC
C_{ON}	HSD+, HSD-, D+, D- ON Capacitance	f = 1MHz	+25℃		11		pF
Power Requirements							
V_{CC}	Power Supply Range		Full	1.8		4.3	V
I_{CC}	Power Supply Current	V_{CC} = 3.0V, V_S , V_{OE} = 0V or V_{CC}	Full			1	μA

Block Diagram

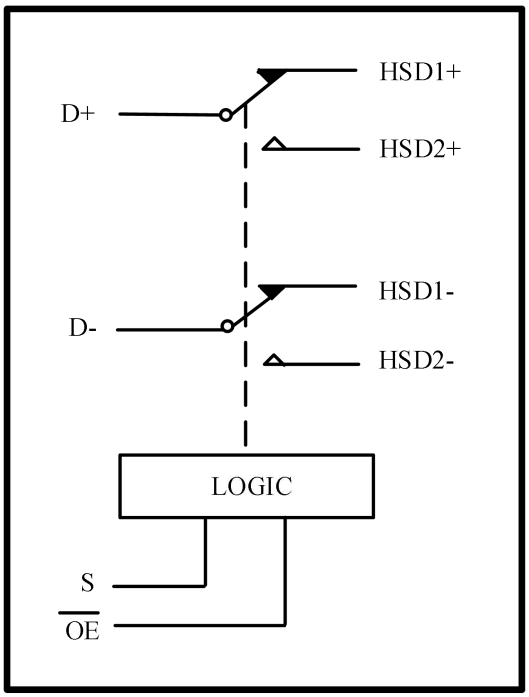


Figure 2 Block Diagram

Function Table

$\overline{OE}$	S	HSD1+,HSD1-	HSD2+,HSD2-
0	0	ON	OFF
0	1	OFF	ON
1	X	OFF	OFF

NOTE: Switches shown for logic "0" input.

Application Information

1. Power-Off Protection

When D+ or D- is shorted to V BUS , there is a special protection circuit inside the SL7227, so that the device will not be damaged within 24 hours. In case of power-down or over-voltage event, the protection circuit can prevent the leakage signal on D+/D- pins to ensure the reliability of the system.，

2. USB2.0 Signal Quality Compliance Test Results

Required Tests

- Overall result:

Pass!

- Signal eye:

Eye passes

- EOP width: 7.91 bits

EOP width passes

- Measured signaling rate: 480.0551MHz

Signal rate passes

- Rising Edge Rate:

889.18V/μs (719.77ps equivalent rise-time)

Passes

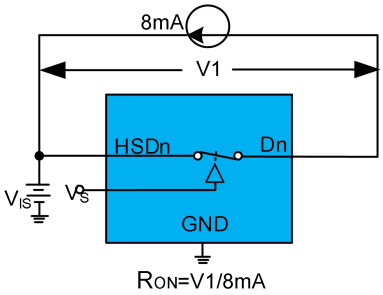
3. Power-On Protection

The USB 2.0 specification requires USB device to ensure that the device will not be damaged even if V BUS short-circuit occurs during data transmission. Therefore, under over-voltage conditions, the SL7227 will limit the current flowing back to the V CC track, and the current will not exceed the safe operating range

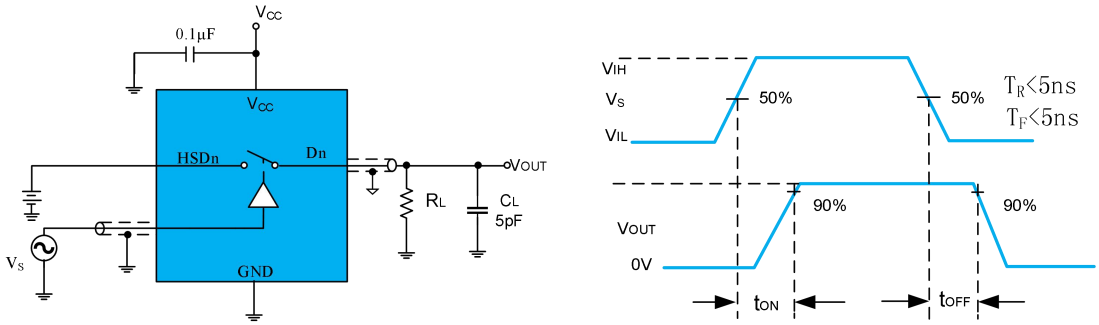
Additional Information

Consecutive jitter range:
-61.770ps to 39.668ps, RMS jitter 21.900ps
Paired JK jitter range:
-47.800ps to 42.890ps, RMS jitter 21.591ps
Paired KJ jitter range:
-50.590ps to 49.704ps, RMS jitter 23.281ps

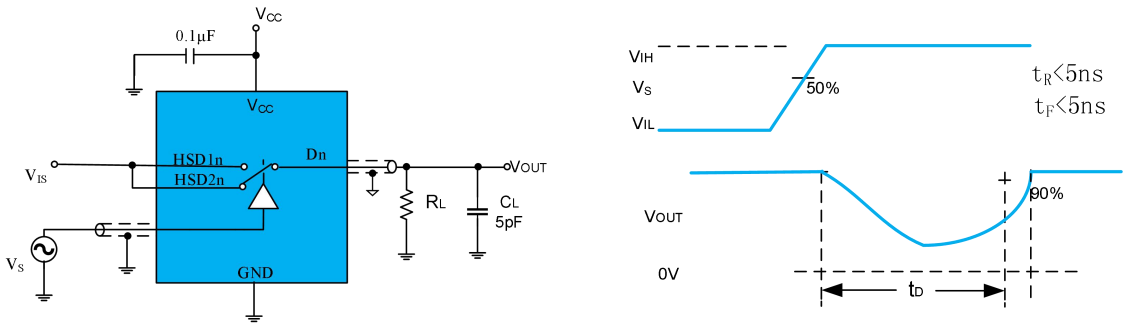
Test Circuits



Test Circuit 1 On Resistance

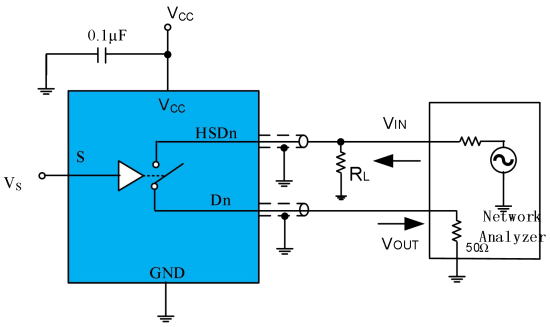


Test Circuit 2 Switching Times (t_{ON},t_{OFF})

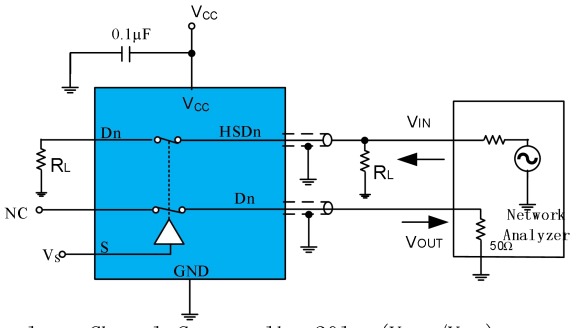


Test Circuit 3 Break-Before-Make Time(t_D)

Test Circuits

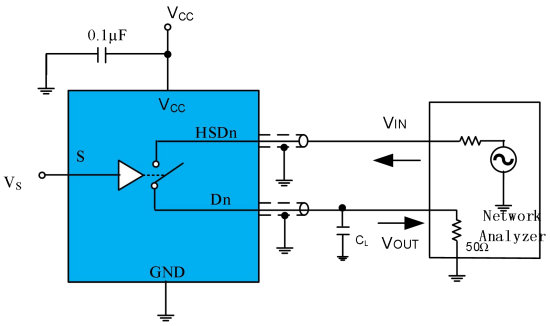


Test Circuit 4 Off Isolation



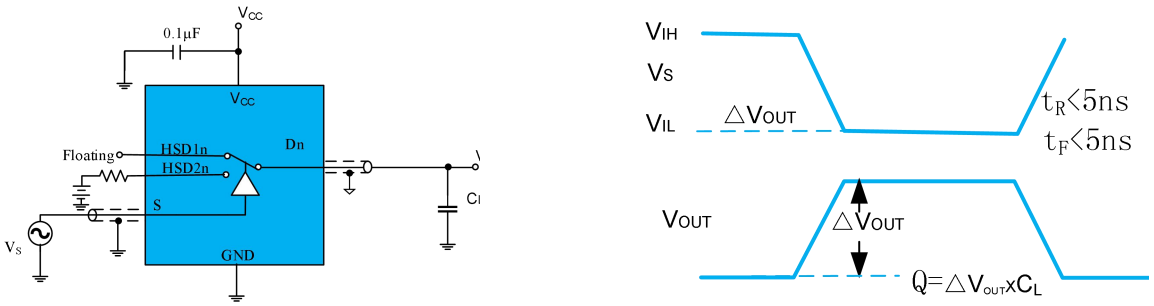
Chanel-to-Chanel Crosstalk=-20log(V_{HSDn}/V_{OUT})

Test Circuit 5 Chanel to Chanel Crosstalk



Test Circuit 6 -3dB Bandwidth

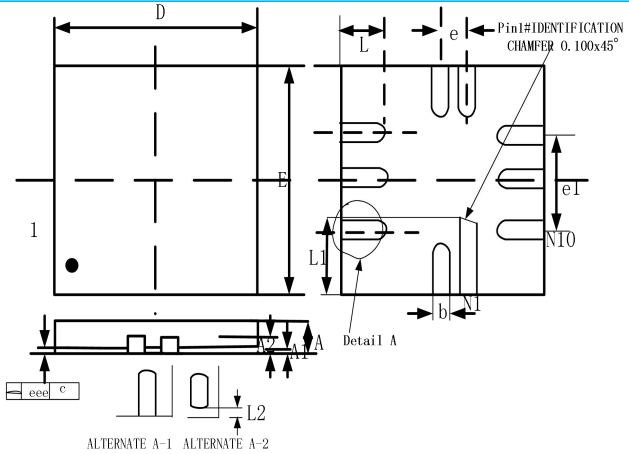
Test Circuits



Test Circuit 7 Charge Injection（Q）

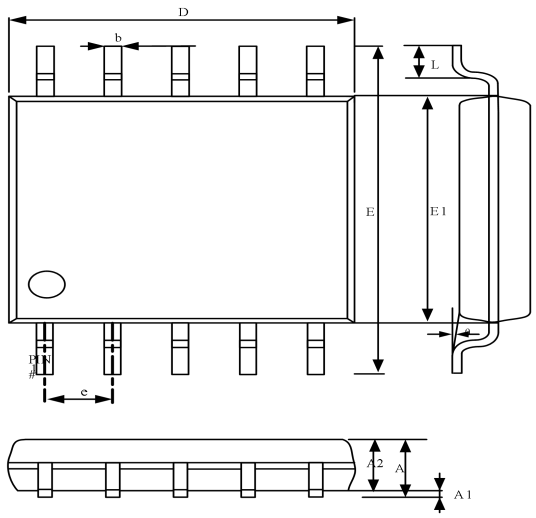
Package Information

QFN1.8*1.4-10L



Symbol	Dimensions In Millimeters		
	Min	NOD	Max
A	0.450	-	0.600
A1	0.000	-	0.050
A2	0.152REF		
b	0.150	0.200	0.250
D	1.750	1.800	1.850
E	1.350	1.400	1.450
e	0.400TYP		
e1	0.800REF		
L	0.350	0.400	0.450
L1	0.450	0.500	0.550
L2	0.000	-	0.100
eee	-	0.080	-

MSOP-10



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	2.900	3.100	0.114	0.122
e	0.500 BSC		0.020 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°