



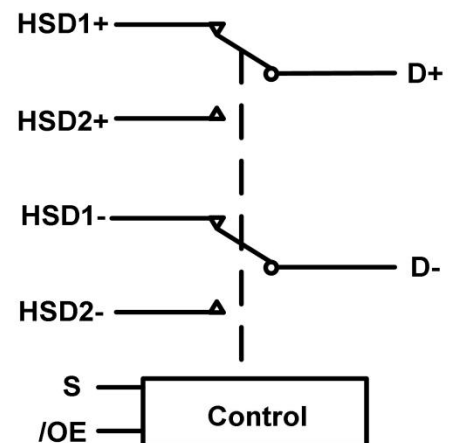
High-Speed USB2.0 (480Mbps) DPDT Analog Switch

1 Features

- ◆ Supply range: 1.8 V to 5.5 V
- ◆ Rail-to-Rail Signal Range
- ◆ On-Resistance Matching: 0.05Ω (TYP)
- ◆ ON-Resistance: 4.5Ω (TYP) at 4.5V
- ◆ ON-Resistance Flatness: 0.9Ω (TYP) at 4.5 V
- ◆ High Off Isolation: -32 dB at 250 MHz
- ◆ -41 dB (250 MHz) Crosstalk Rejection Reduces
- ◆ Break-Before-Make Switching
- ◆ -3 dB Bandwidth: 720 MHz
- ◆ Operation temperature range: -40°C to $+125^{\circ}\text{C}$

switch. Its wide bandwidth and low bit-to-bit skew allow it to pass high-speed differential signals with good signal integrity. Each switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. Its high channel-to-channel crosstalk rejection results in minimal noise interference.

4 Circuit diagram



2 Application

- ◆ Cell phones
- ◆ PADS
- ◆ Portable instrumentation
- ◆ Differential Signal Data Routings
- ◆ USB 2.0 Signal Routing

3 Description

The WB4227 is a high bandwidth, fast double-pole double-throw (DPDT) analog



5 Device Pin and Packages

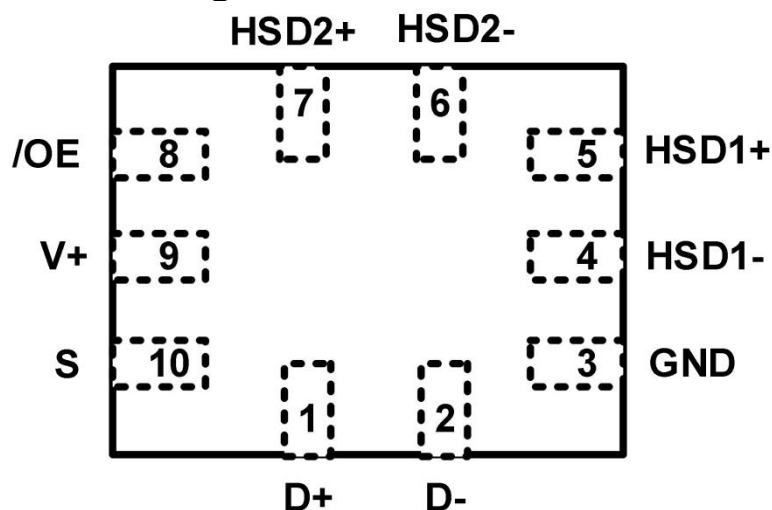


Table 5-1 Pin definition

Name	Pin	Description
V+	9	Positive Power Supply
S	10	Select Input
D+,D-	1,2	Data ports
HSD1+,HSD1-	5,4	Data ports 1
HSD2+,HSD2-	7,6	Data ports 2
/OE	8	Output Enable
GND	3	Ground

Table 5-2 Logic Function Table

/OE	S	HSD1+,HSD1-	HSD2+,HSD2-
0	0	ON	OFF
0	1	OFF	ON
1	X	OFF	OFF



6 Voltage, Temperature, ESD and Thermal Ratings

6.1 Absolute Maximum Ratings⁽¹⁾

Parameters		Min.	Max.	Unit
V _{CC}	Supply voltage range	-0.3	6.0	V
V _{IS}	Analog,digital voltage range ⁽²⁾	-0.3	(V _{CC})+0.3	V
I _{IN}	Continuous Current HSDn or Dn	-100	+100	mA
I _{PEAK}	Peak Current HSDn or Dn	-150	+150	mA
T _J	Junction temperature		150	°C
T _{stg}	Storage temperature	-65	150	°C

(1)Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2)The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

6.2 ESD Ratings

ESD			Value	Unit
V(ESD)	Electrostatic discharge	Human-Body Model (HBM) ⁽¹⁾	4.5K	V
		Charged-Device Model (CDM) ⁽²⁾	2K	V

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

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions⁽¹⁾

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameter	Min	Max	Units
V _{CC}	Supply voltage	1.8	5.5	V
T _A	Ambient temperature	-40	125	°C

(1) All unused digital inputs of the device must be held at VCC or GND to ensure proper device operation.

6.4 Thermal Information

Package Type	θ _{JA}	θ _{JC}	Unit
QFN1.4* 1.8-10L	120	46	°C/W



7 Electrical Specifications

7.1 DC Electrical Characteristics

$V_+ = 1.8V$ to $5.5V$, $GND = 0V$ FULL = $-40^{\circ}C$ to $+125^{\circ}C$. Typical values are at $T_A = +25^{\circ}C$ (unless otherwise noted)

Parameter	Symbol	Conditions	V+	Temp	Min	Typ	Max	Units
Analog Switch								
On-Resistance	R_{ON}	$V_{IS}=0V$ to $0.4V$, $I_D=10mA$, See Fig.8-1.	4.5V	+25°C		4.5	5	Ω
				Full			7	
			3V	+25°C		6.5	7	Ω
				Full			10	
On-Resistance Flatness	R_{FLAT}	$V_{IS}=0V$ to $1.0V$, $I_D=10mA$, See Fig.8-1.	4.5V	+25°C		0.9	1.2	Ω
				Full			1.5	
			3V	+25°C		3.2	3.5	Ω
				Full			4.5	
On-Resistance Matching	ΔR_{ON}	$V_{IS}=0V$ to $0.4V$, $I_D=10mA$, See Fig.8-1.	4.5V	+25°C		0.05	0.1	Ω
				Full			0.15	
			3V	+25°C		0.05	0.1	Ω
				Full			0.15	
Increase In I_{CC} per Control Voltage	I_{CCT}	V_S or $V_{IOE}=2.6V$	4.3V	Full			20	μA
Source Off Leakage Current	$I_{HSD2(OFF)}$ $I_{HSD1(OFF)}$	$V_{IS}=5V/0.5V$, $V_D=0.5V/5V$	5.5V	Full			1	μA
Channel On Leakage Current	$I_{HSD2(ON)}$ $I_{HSD1(ON)}$	$V_{IS}=5V/0.5V$, $V_D=floating$	5.5V	Full			1	μA
Digital Control Inputs								
Input High Voltage	V_{IH}		3.3V	Full	1.7			V
Input Low Voltage	V_{IL}		3.3V	Full			0.5	V
Input Leakage current	I_{IN}	V_S , $V_{IOE}=0V$ or V_+	5.5V	Full			1	μA
Power Requirements								
Power Supply Range	V_+			Full	1.8		5.5	V
Quiescent Supply Current	I_{CC}	V_S , $V_{IOE}=0V$ or V_+	5.5V	Full			1	μA

**7.2 Switch And AC Characteristics**

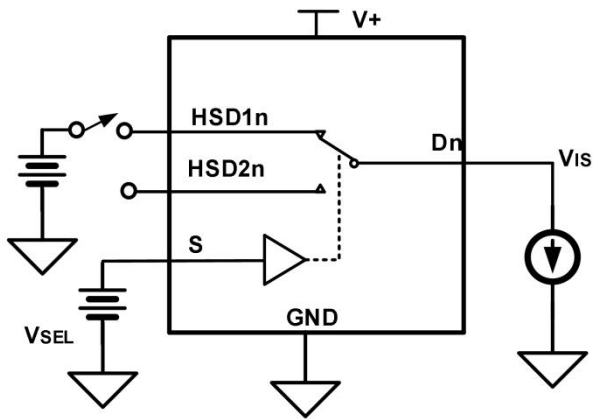
$V_+ = 1.8V$ to $5.5V$, $GND = 0V$, $FULL = -40^{\circ}C$ to $+125^{\circ}C$. Typical values are at $T_A = +25^{\circ}C$ (unless otherwise noted)

Parameter	Symbol	Conditions	V+	Temp	Min	Typ	Max	Units
Turn-On Time	t_{ON}	$V_{IS}=0.8V$, $R_L=50\Omega$, $C_L=10pF$, See Fig.8-2.	5V	$+25^{\circ}C$		12		ns
			3.3V	$+25^{\circ}C$		14		ns
Turn-Off Time	t_{OFF}	$V_{IS}=0.8V$, $R_L=50\Omega$, $C_L=10pF$, See Fig.8-2.	5V	$+25^{\circ}C$		6		ns
			3.3V	$+25^{\circ}C$		8		ns
Break-Before-Make Delay	t_{BBM}	$V_{IS}=0.8V$, $R_L=50\Omega$, $C_L=10pF$, See Fig.8-3.	5V	$+25^{\circ}C$		5		ns
			3.3V	$+25^{\circ}C$		4		ns
-3 dB Bandwidth	BW	Signal=0dBm, $R_L=50\Omega$, $C_L=5pF$, See Fig.8-6.	5V	$+25^{\circ}C$		720		MHz
			3.3V	$+25^{\circ}C$		700		MHz
Off-Isolation	O_{IRR}	Signal=0dBm, $R_L=50\Omega$, $f=250MHz$, See Fig.8-4.	5V	$+25^{\circ}C$		-32		dB
			3.3V	$+25^{\circ}C$		-32		dB
Non-Adjacent Channel Crosstalk	XTALK	Signal=0dBm, $R_L=50\Omega$, $f=250MHz$, See Fig.8-5.	5V	$+25^{\circ}C$		-41		dB
			3.3V	$+25^{\circ}C$		-41		dB
Channel-to-Channel Skew	t_{SKEW}	$R_L=50\Omega$, $C_L=10pF$	5V	$+25^{\circ}C$		0.1		ns
		$R_L=50\Omega$, $C_L=10pF$	3.3V	$+25^{\circ}C$		0.1		ns
Charge Injection	Q	$R_G=0\Omega$, $C_L=1nF$, See Fig.8-7.	5V	$+25^{\circ}C$		6		pC
		$R_G=0\Omega$, $C_L=1nF$, See Fig.8-7.	3.3V	$+25^{\circ}C$		4		pC
On Capacitance	C_{ON}		5V	$+25^{\circ}C$		6		pF
			3.3V	$+25^{\circ}C$		6		pF



8 Measurement Information

WB4227



Channel On

$$R_{ON} = (V_{HDS1n \text{ or } V_{HSD2n}} - V_{IS}) / I_D$$

$V_{SEL} = V_{IH} \text{ or } V_{IL}$

Fig.8-1. ON-State Resistance (R_{ON})

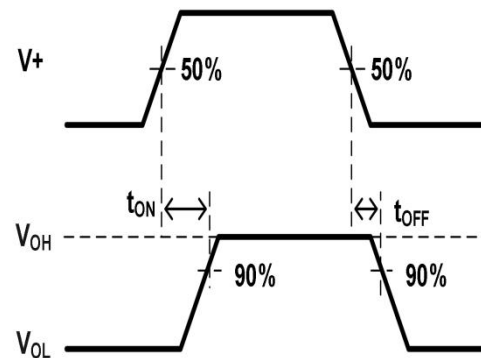
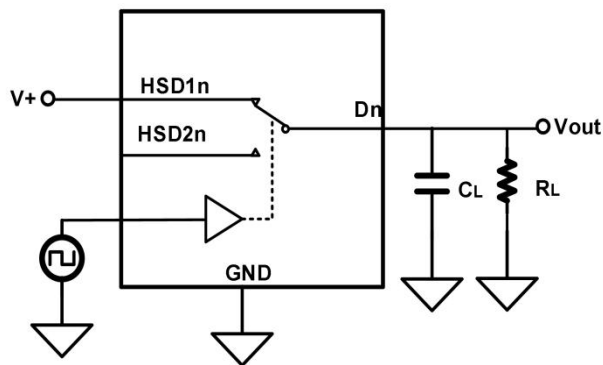


Fig.8-2. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

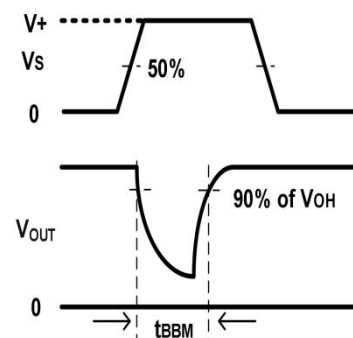
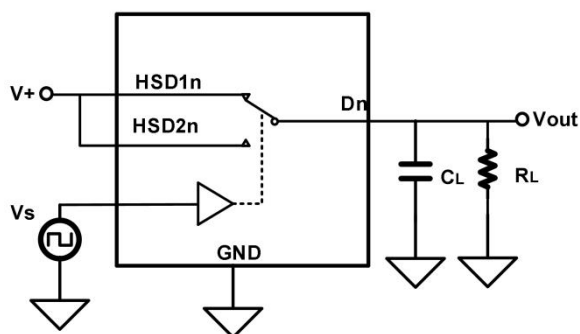


Fig.8-3. Break-Before-Make Time Delay (t_{BBM})



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8 Measurement Information(Continued)

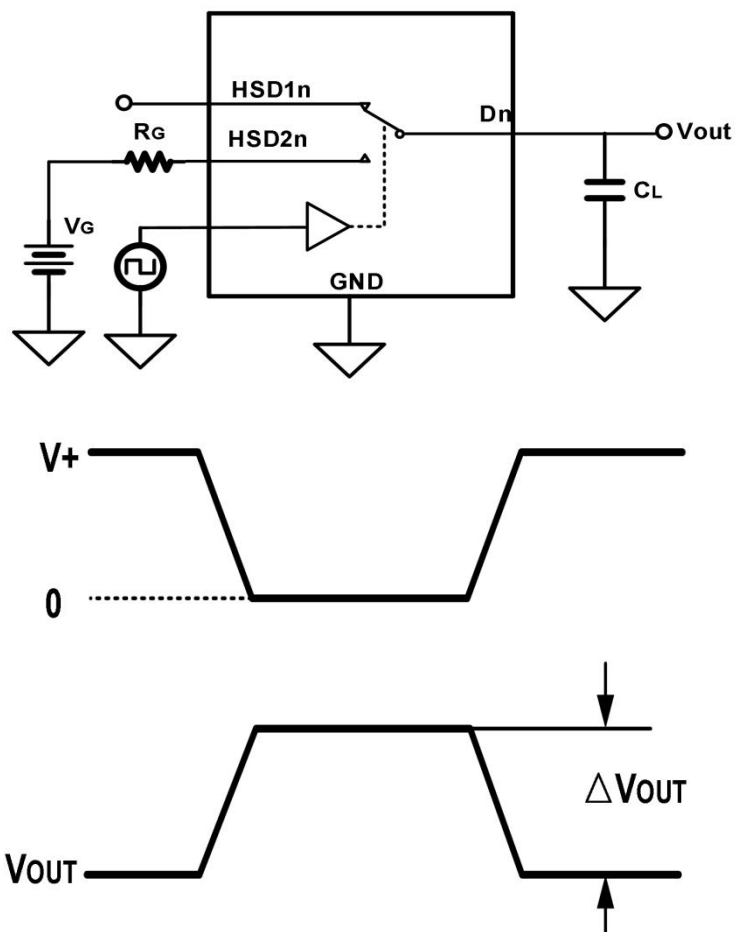


Fig.8-7. Charge Injection (Q)



9 Applications Note

There are many USB applications in which the USB hubs or controllers have a limited number of USB I/Os. The WB4227 solution can effectively expand the limited USB I/Os by switching between multiple USB buses in order to interface them to a single USB hub or controller. WB4227 can also be used to connect a single controller to two USB connectors or controllers.

Design requirements of the USB 1.0, 1.1, and 2.0 standards should be followed. It is recommended that the digital control pins S and /OE be pulled up to V+ or down to GND to avoid undesired switch positions that could result from the floating pin.

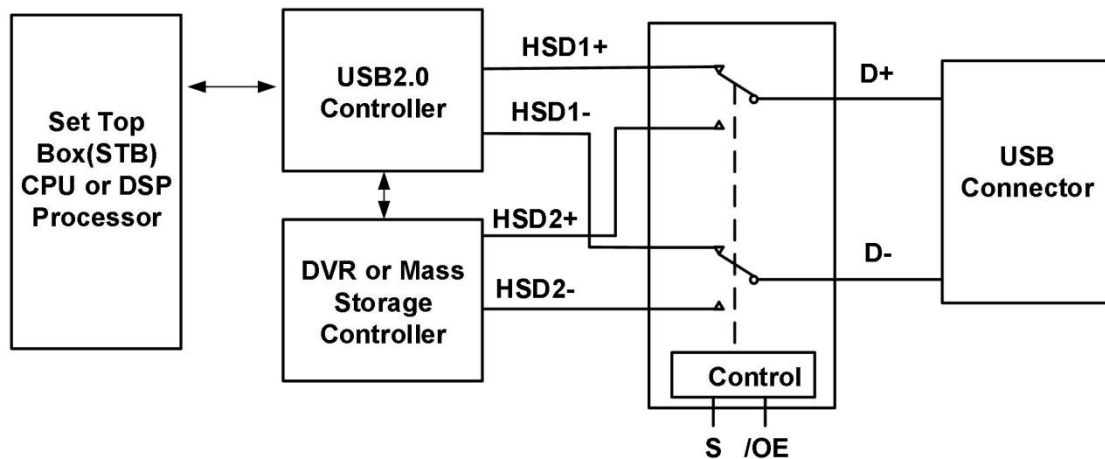


Fig.9-1. Application Diagram

9.1 Eye Diagram Measurements

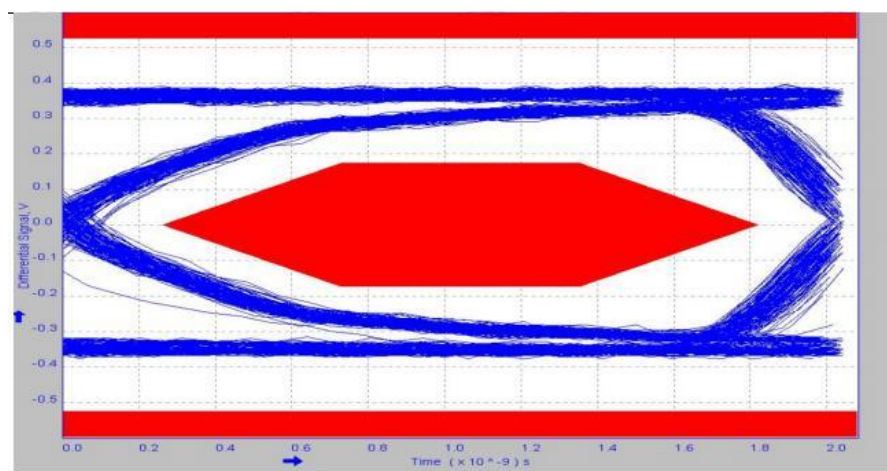


Fig.9-2. Eye Pattern:480Mbps USB Signal with No Switch (Through Path)



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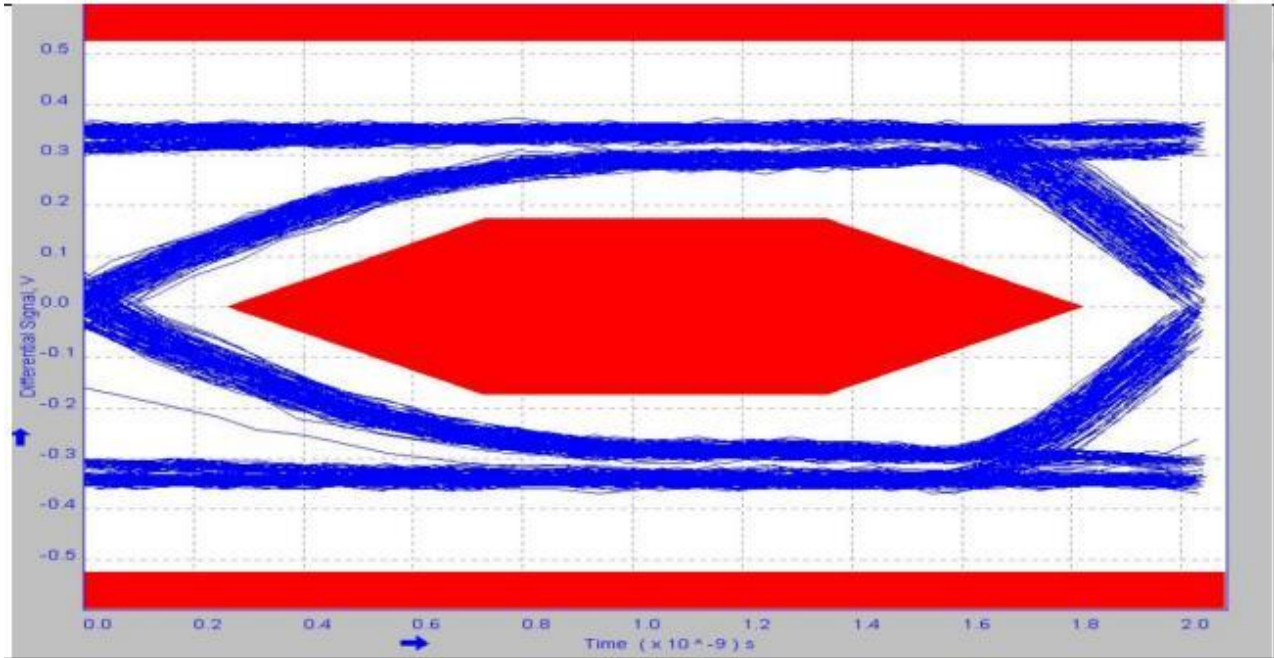


Fig.9-3. Eye Pattern:480Mbps USB Signal with Switch D+ Path

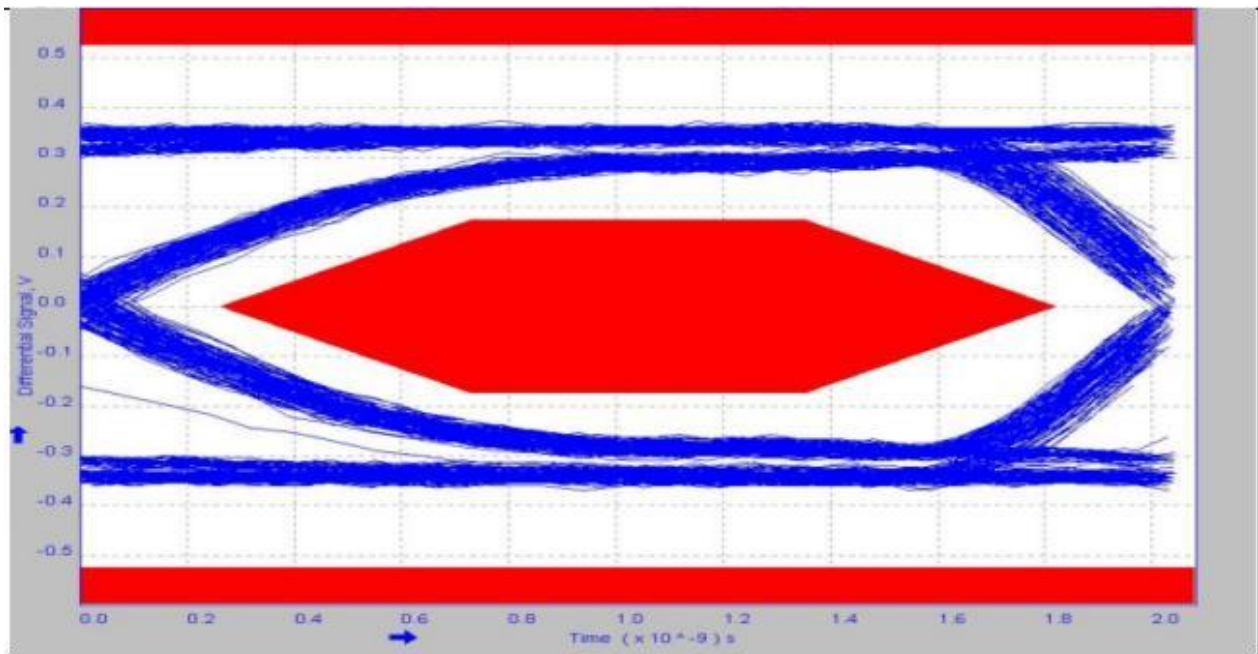


Fig.9-4. Eye Pattern:480Mbps USB Signal with Switch D- Path



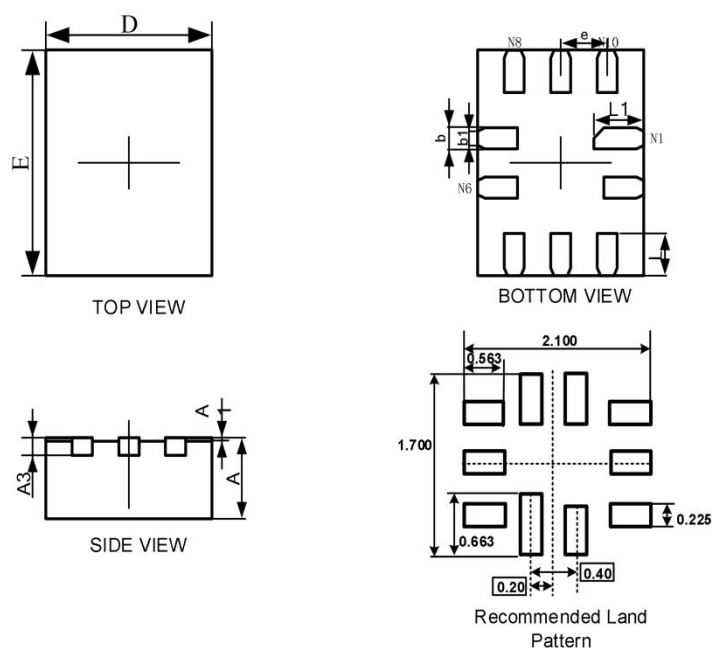
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10 Package Outline Dimension

QFN1.4*1.8-10L



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.152REF		0.006REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
D1	-	-	-	-
E1	-	-	-	-
k	-		-	
b	0.150	0.250	0.006	0.010
b1	0.100	0.200	0.004	0.008
e	0.400TY		0.016TYP	
L	0.350	0.450	0.014	0.018
L1	0.450	0.550	0.018	0.022



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Notes For Attention

- When making the purchase, please ensure you recognize the company's trademark. If you have any questions, please contact the company's headquarters.
- When designing the circuit, please do not exceed the absolute maximum ratings of the components; otherwise, it will affect the reliability of the entire machine.
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