



## Descriptions

The PI3USB4000DQ1ZUAEX is a bidirectional low-power dual port, high-speed, USB 2.0 analog switch with integrated protection for USB Type-C™ systems. The device is configured as a dual 2:1 or 1:2 switch. It is optimized for use with the USB 2.0 DP/DM lines in a USB Type-C™ system.

The PI3USB4000DQ1ZUAEX integrated over-voltage protection on the C0+/- pins can withstand up to DC 30V with automatic shutoff circuitry in order to protect system components behind the switch. GPIO controls of SEL and \_EN are 1.8V logic compatible. The PI3USB4000DQ1ZUAEX is available in QFN1520(UQFN-10(1.5x2)) with Pb-free and Halogen-free making it a perfect candidate for mobile and space constrained applications.

## Order Information

Package	Part Number	Top-Side Marking
QFN1520(UQFN-10(1.5x2))	Tape and Reel	PI3USB4000DQ1ZUAEX

## Features

- Pin-to-Pin FSUSB42UMX, NX3DV42GU, DIO5000, PI3USB4000, SGM7227YU
- Supply Range 2.5 V to 5.5 V
- Differential 2:1 or 1:2 Switch/Multiplexer
- Up to DC 30V Overvoltage Protection (OVP) on C0+/- Ports
- IEC 64000-4-5 Surge Protection w/o External TVS onto C0+/- Ports:  $\pm 30V$
- System Side Clamp Voltage Pulse Less than 9V, Duration Less than 200nS
- Powered Off Protection When VDD = 0 V
- Low RON of 10  $\Omega$  Typical
- Insertion loss: -1dB@200MHz, -2dB@650MHz, -3dB@1GHz
- $C_{ON}$  of 4.8 pF , 1.8-V Compatible Logic Inputs, Standard Temperature Range of 0°C to 85°C

## Applications

- Anywhere a USB Type-C™ or Micro-B Connector is Used
- Mobile Phones, Tablets and Notebooks



## Functions and Pin Configuration

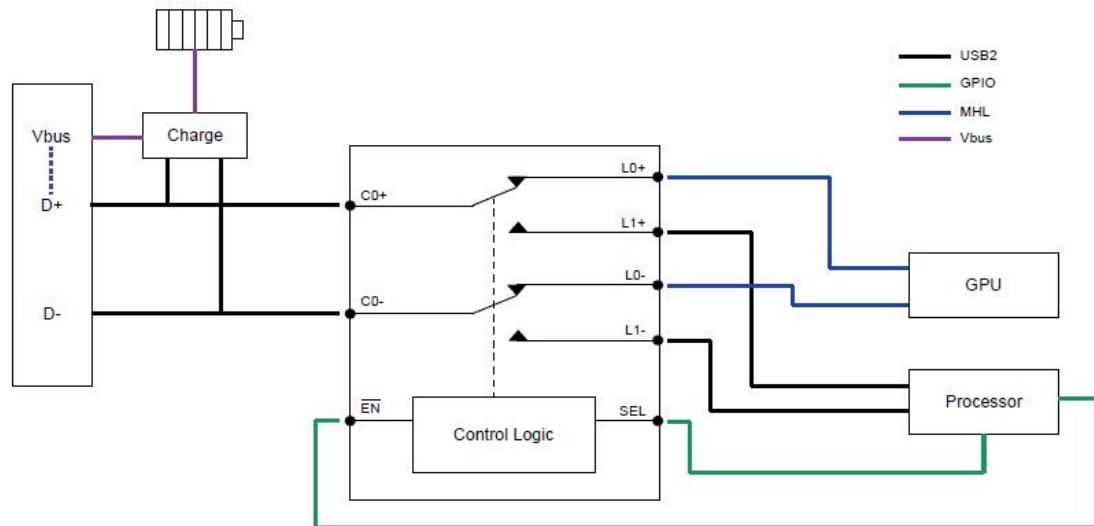


Fig.1 Functional Diagram

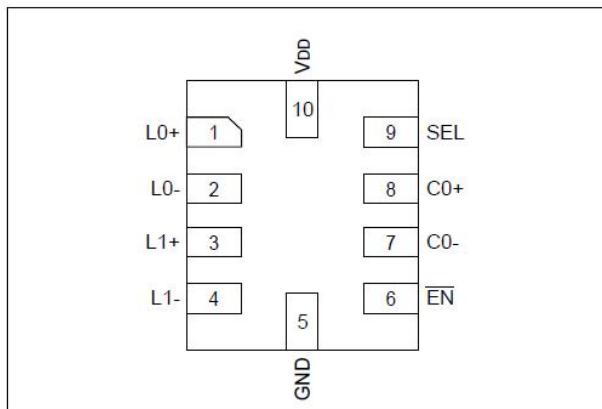


Fig.2 QFN1520(UQFN-10(1.5x2))

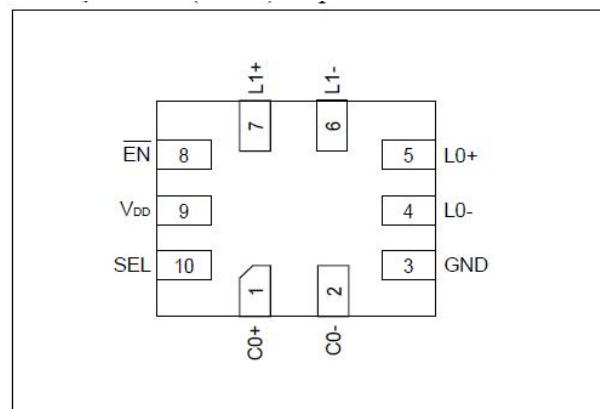


Fig.3 QFN1418



### Pin Descriptions

QFN1520 (UQFN-10(1.5x2))	QFN1418	Pin Name	Signal Type	Description
8	1	C0+	I/O	Signal I/O, Common Port
7	2	C0-	I/O	Signal I/O, Common Port
3	7	L1+	I/O	Signal I/O, Channle 1
4	6	L1-	I/O	Signal I/O, Channle 1
1	5	L0+	I/O	Signal I/O, Channle 0
2	4	L0-	I/O	Signal I/O, Channle 0
9	10	SEL	I	Operation Model Select (when SEL=0: C0→L0, when SEL=1: C0→L1)
6	8	_EN	I	_EN=1, Power Down is Enabled.
10	9	VDD	PWR	Positive Supply Voltage
5	3	GND	GND	Power Ground

Table-1 Pin Descriptions

### Truth Table

Function	SEL	_EN
C0+/- to L0+/-	L	L
C0+/- to L1+/-	H	L
All Switches Hi-Z	X	L

Table-2 Truth Table



**Electrical Characteristics (Ta=25°C, VDD=3.3V, unless otherwise specified)**

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Power Supply</b>						
Supply Voltage Range	VDD		2.5	3.3	5.5	V
Supply Current	I <sub>CC</sub>	_EN =1 disconnection		5	13	uA
		_EN =0 connection		33	60	uA
<b>SEL/_EN Digital Input Control</b>						
control input logic high	V <sub>IH</sub>		1.6		5.5	V
control input logic low	V <sub>IL</sub>		-0.1		0.5	V
Internal pull-down resistor	R <sub>PD</sub>			2		MΩ
<b>Switch On Resistance And Off Leakage</b>						
On-Resistance	R <sub>ON</sub>	V <sub>IS</sub> = 0V~0.4V I <sub>OUT</sub> =8mA		10	11	Ω
R <sub>ON</sub> Flatness <sup>(1)</sup>	R <sub>FLAT</sub>	V <sub>IS</sub> = 0V~0.4V I <sub>OUT</sub> =8mA		0.3	0.5	Ω
R <sub>ON</sub> Matching Between Channels <sup>(2)</sup>	ΔR <sub>ON</sub>	V <sub>IS</sub> = 0V~0.4V I <sub>OUT</sub> =8mA		0.1	0.2	Ω
OFF Leakage Current	I <sub>LEAK</sub>	V <sub>C0+/-</sub> = 10V V <sub>L1+/-</sub> = V <sub>D2+/-</sub> = 0V		31	50	uA
<b>Switch Dynamics</b>						
On Capacitance	C <sub>ON</sub>	V <sub>C0+/-</sub> = 0.2V, f = 1MHz		4		pF
Off Capacitance	C <sub>OFF</sub>	V <sub>C0+/-</sub> = 0.2V, f = 1MHz		3		pF
Off Isolation	Off	f = 250MHz, R <sub>T</sub> = 50Ω, C <sub>L</sub> = 0pF		-38		dB
Crosstalk <sup>(3)</sup> (Channel-to-Channel)	X <sub>TALK</sub>	f = 250MHz, R <sub>T</sub> = 50Ω, C <sub>L</sub> = 0pF		-41		dB
-3dB Bandwidth	BW	R <sub>T</sub> =50Ω, C <sub>L</sub> =0pF Signal Power 0dBm	1.0	1.1		GHz
Break-Before-Make	BBM	V <sub>L1+/-</sub> = V <sub>D2+/-</sub> = 0.4V, R <sub>L</sub> =50Ω		1.5		uS
Turn-on Time	t <sub>ON</sub>	V <sub>C0+/-</sub> = 0.4V, R <sub>L</sub> =50Ω _EN switches from High to Low		20		uS
Turn-off Time	t <sub>OFF</sub>	V <sub>C0+/-</sub> = 0.4V, R <sub>L</sub> =50Ω _EN switches from Low to High		1.2		uS
Propagation Delay	t <sub>PD</sub>	V <sub>C0+/-</sub> = 0.4V, R <sub>L</sub> =50Ω		200		pS
<b>Over Voltage Protection</b>						
OVP Lockout Threshold	V <sub>OVP</sub>	V <sub>C0+/-</sub> Rising Edge	4.6	4.9	5.2	V
OVP Hysteresis	V <sub>HYS</sub>	V <sub>C0+/-</sub> Falling Edge		200		mV
Clamp Voltage on L1+/- and D <sub>2+/-</sub>	V <sub>CLAMP</sub>	10V shorts to C0+/- with R <sub>L</sub> =1KΩ @ L1+/- and D <sub>2+/-</sub>		6.5	8	V
OVP Response Time	t <sub>FP</sub>	10V shorts to C0+/- with R <sub>L</sub> =1KΩ @ L1+/- and D <sub>2+/-</sub>		200	300	nS
OVP Recovery Time	t <sub>FPR</sub>	V <sub>C0+/-</sub> jumps from 6V to 1V step	30	45	60	uS

**Table-4 Electrical Characteristics**

**Note:**

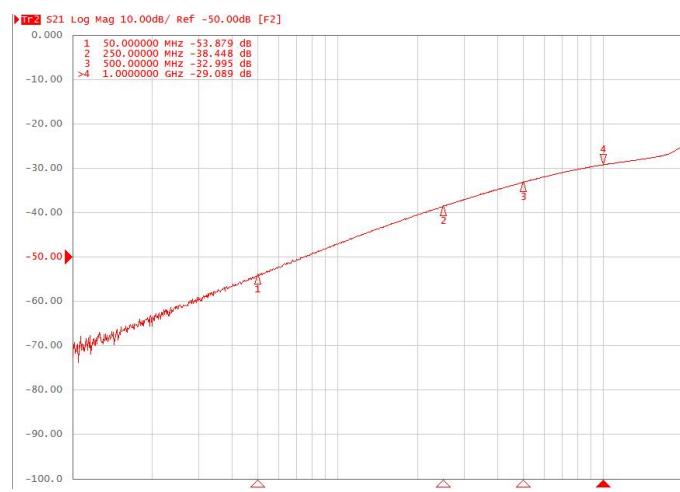
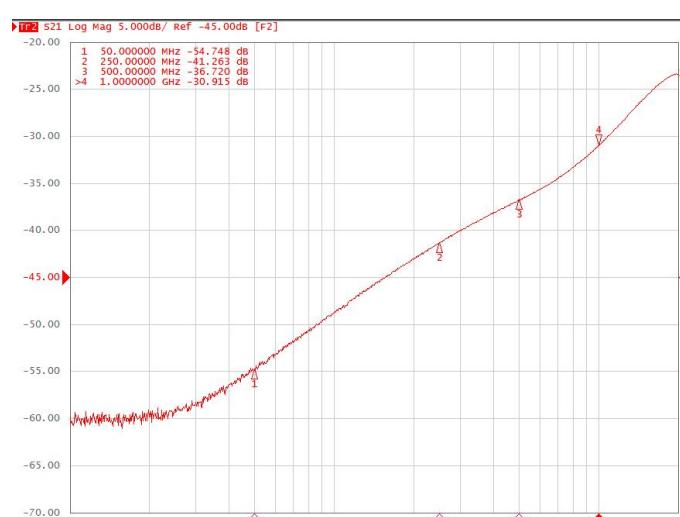
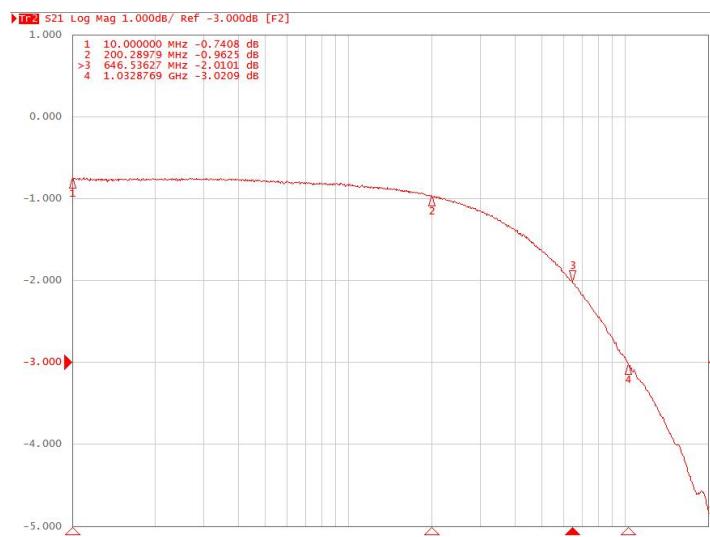
(1) Flatness is defined as the difference between maximum and minimum value of ON-resistance at the specified analog signal voltage points.

(2) R<sub>ON</sub> matching between channels is calculated by subtracting the channel with the lowest max Ron value from the channel with the highest max Ron value.

(3) Crosstalk is inversely proportional to source impedance



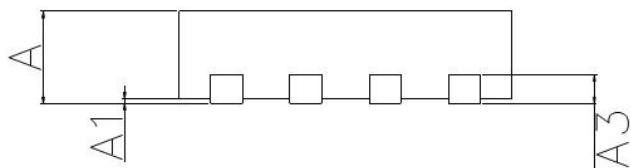
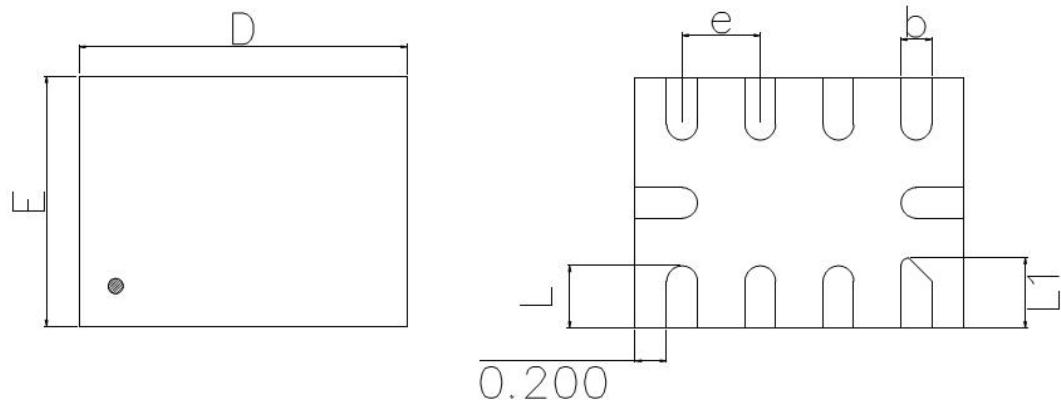
**Typical Performance Curves (Ta=25°C, VDD=3.0V, CAP=0.1uF, unless otherwise noted)**





## Package Outline Dimensions

QFN1520(UQFN-10(1.5x2))



Symbol	Dimension in Millimeters		
	Min.	Typ.	Max.
A	0.500	0.550	0.600
A1	0.000		0.050
A3	0.150 Ref.		
D	1.950	2.000	2.050
E	1.450	1.500	1.550
b	0.150	0.200	0.250
e	0.500 (BSC)		
L	0.300	0.350	0.400
L1	0.350	0.400	0.450



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