DIO3202A

USB2.0 High-Speed and Audio/USB/UART Switch with Negative Swing Capacity

Features

- Low Ron Audio/USB analog switch
- Low USB Con: 5pF
- Negative Signal Swing Capable
- Low Audio Distortion
- USB Switch -3dB Bandwidth: 720MHz
- High Crosstalk and Off-isolation
- Voltage Supply Operation: 2.7 to 5.5V
- Three Green Packaged: DQFN-10, QFN-10, MSOP-10

Applications

- Cell-Phone/PDA
- MP3/MP4/PMP
- Portable Instrumentation
- Battery Powered Communications
- Computer Peripherals

Descriptions

The DIO3202A is dual SPDT (Single Pole/Double Throw) switch which combines low distortion audio/USB/UART and USB2.0 high-speed data signal switching in the same low voltage device. This architecture is designed to allow negative signal passing as low as 2V below ground. When a voltage is detected on V_{BUS}, DIO3202A will immediately switch to USB mode. Due to ultra low capacitance design, the audio channels (pin 3 and pin 4 input/outputs) are able to not only switch audio signal but also high speed USB signal or low voltage UART signal as well.

DIO3202A provides packages with Green or RoHS tiny 10L packages, and operates over a temperature range of -40°C to 85°C.

Block Diagram
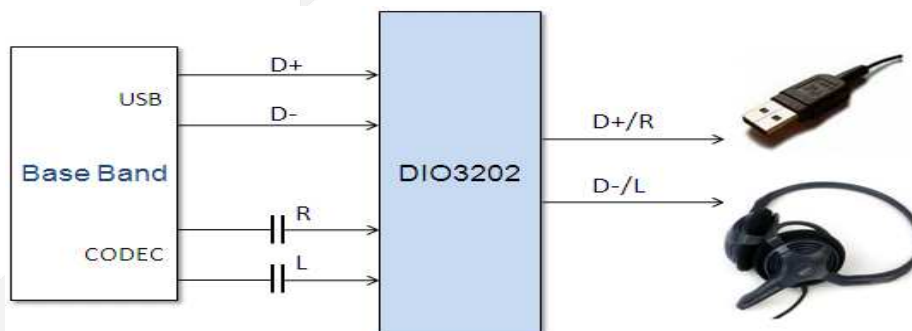
Ordering Information

Order Part Number	Top Marking		T_A		Package
DIO3202ALP10	YWGF	Green	-40 to +85°C	DQFN-10	Tape & Reel, 3000
DIO3202AQN10	YWGF	Green	-40 to +85°C	QFN-10	Tape &Reel, 3000
DIO3202AMP10	D3202A	Green	-40 to +85°C	MSOP-10	Tape &Reel, 3000

DIO3202A

Pin Assignment

DQFN-10

MSOP-10

QFN-10
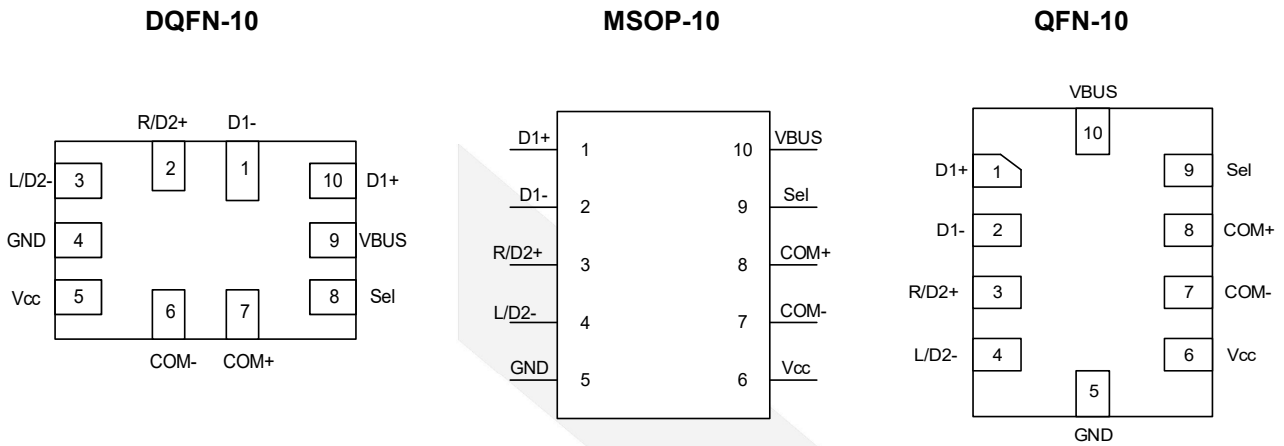
Figure 1 Top View

Pin Descriptions

Pin Name	Direction	Description
D1+, D1-	I/O	Differential USB Data Input 1
R/D2+, L/D2-	I/O	Audio R/L or differential USB data input 2
V_{BUS}	I	Switch Select
COM+/COM-	I/O	Data/Audio Common Port
Sel	I	Control Input
Vcc/ GND	P	Power

Truth Table

Sel	V_{BUS}	L/D2-, R/D2+	D1+, D1-
Low	Low	ON	OFF
Low	High	OFF	ON
High	X	ON	OFF

Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maxim rating conditions for extended periods may affect device reliability.

Symbol	Parameter		Rating	Unit
V_{CC}	Supply Voltage		-0.5 to 6.5	V
V_{BUS}	V_{BUS} Control Input Voltage		-0.5 to 6.5	V
V_{IN}	A_{SEL} Control Input Voltage		-0.5 to 6.5	V
V_{SW}	USB Path Analog Signal Voltage		-0.5 to 6.5	V
	Audio Path Analog Signal Voltage		-2.5 to 6.5	
	Storage Temperature		-65 to 150	°C
I_{IN}	A_{SEL} Control Input Current		5	µA
	V_{BUS} Control Input Current		5	
I_{SW_CON}	Analog Signal Continuous Current		±100	mA
I_{SW_PK}	Analog Signal Peak Current		±500	mA
ESD	HBM, JEDEC: JESD22-A114	I/O to GND	4	kV
		Others	8	

Recommend Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended Operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not Recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Rating	Unit
V_{CC}	Supply Voltage	2.7 to 5.5	V
V_{IN}	V_{BUS} Control Input Voltage	0 to 5.5	V
	A_{SEL} Control Input Voltage	0 to V_{CC}	
V_{SW}	USB to COM Analog Signal Voltage	0 to V_{CC}	V
	Audio to COM Analog Signal Voltage	-2 to V_{CC}	
T_A	Operating Temperature Range	-40 to 85	°C

DC Electrical Characteristics

All typical value are at T_A = 25°C unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
CONTROL INPUT (T_A=25°C, V_{CC}=3.3V)						
V_{IH}	A_{SEL} Control Input High Voltage	V_{CC}=2.7-4.2V	1.3			V
V_{IL}	A_{SEL} Control Input Low Voltage	V_{CC}=2.7-4.2V			0.7	V
I_{IN}	A_{SEL} Control Input Leakage Current	$0 \leq V_{SW} \leq V_{CC}$	-2		2	µA
V_{IH}	V_{BUS} Control Input High Voltage	V_{CC}=2.7-4.2V	3.5			V
V_{IL}	V_{BUS} Control Input Low Voltage	V_{CC}=2.7-4.2V			2.3	V
I_{IN}	V_{BUS} Control Input Leakage Current	$0 \leq V_{SW} \leq V_{CC}$	-2		2	µA
SUPPLY CURRENT AND LEAKAGE (T_A=25°C, V_{CC}=3.3V)						
I_{D+}, I_{D-} (OFF)	Off State Leakage	V_{CC}=4.2V, V_{BUS} = 0V, V_{SEL} = 4.2V; V_{COM-}, V_{COM+} = 0V, 4.2V; V_{D+}, V_{D-} = 4.2V, 0V; V_L and V_R = float			80	nA
$I_{COM (ON)}$	On State Leakage	V_{CC}=4.2V; V_{COM-}, V_{COM+} = 0 V, 4.2 V; V_{D+}, V_{D-} = float; V_L, V_R = float			100	nA
I_{CC}	Quiescent Supply			95	120	µA
AUDIO SWITCHES (R, L) (T_A=25°C, V_{CC}=3.3V)						
R_{ON}	On Resistance	I_{ON}=40mA, V_{SW}=-0.85 to 0.85V		2	2.5	Ω
ΔR_{ON}	On Resistance Matching	I_{ON}=40mA, V_{SW}=-0.85 to 0.85V		0.5		Ω
USB SWITCHES (D+, D-) (T_A=25°C, V_{CC}=3.3V)						
R_{ON}	On Resistance	I_{ON}=8mA, V_{SW}=0.4V		4	4.5	Ω
ΔR_{ON}	On Resistance Matching	I_{ON}=8mA, V_{SW}=0.4V		0.5		Ω

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Electrical Characteristics (Continued)

All typical value are at 25°C unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
AC Parameter (T_A=25°C, V_{CC}=3.3V, R_L=50Ω, C_L=5pF, unless otherwise specified)						
t_{ON}	USB Turn-on Time	V_{CC}=2.7V, R_L=50Ω, C_L=50pF		16		µs
t_{OFF}	USB Turn-off Time	V_{CC}=2.7V, R_L=50Ω, C_L=50pF		1.5		µs
t_{ON}	Audio Turn-on Time	V_{CC}=2.7V, R_L=50Ω, C_L=50pF		24		µs
t_{OFF}	Audio Turn-off Time	V_{CC}=2.7V, R_L=50Ω, C_L=50pF		1.2		µs
T_{BBM}	Break Before Make Time	V_{CC}=2.7V		7		µs
BW	-3dB Bandwidth USB Channel	R_L=50Ω		720		MHz
OIRR	OFF-Isolation	V_{CC}=3.3V, R_L=32Ω, f = 20Hz to 20kHz		105		dB
X_{TALK}	USB Crosstalk	V_{CC}=3.3V, R_L=50Ω, f=100kHz		-100		dB
X_{TALK}	Audio Crosstalk	V_{CC}=3.3V, V_{BUS}= float, V_{SEL}=3.3V, R_L=32Ω, f=20Hz to 20kHz, V_R or V_L = 0.707V_{RMS} (2V_{PP})		-80		dB
THD+N	Total Harmonic Distortion + Noise	V_{BUS}=0V, V_{SEL}=3.3V, R_L=32Ω f=20Hz to 20kHz, V_{COM}=2V_{PP}		0.08		%
CAPACITANCE (T_A=25°C, V_{CC}=3.3V, R_L=50Ω, C_L=5pF, f=1MHz, A_{SEL}=0V, unless otherwise specified)						
C_{IN}	A_{SEL} Control Input Capacitance	V_{CC}= 0V		2		pF
C_{ON}	USB ON Capacitance	f=1MHz, V_{CC}=3.3V, V_{BUS}= 4.2V, V_{SEL} = 0V, V_{D-} or V_{D+} = V_{COMX} = 0V		5		pF
C_{ON}	Audio ON Capacitance	V_{BUS}=0V, V_{SEL}=3.3V		9		pF
C_{OFF}	USB OFF Capacitance	V_{BUS}=0V, V_{SEL}=3.3V		3		pF
C_{OFF}	Audio OFFCapacitance	V_{BUS}=4.2V, V_{SEL}=0V		4		pF

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Applications Design Guide

DIO3202A is used in applications where the slim and thin smart phone designs are expected. By sharing the USB connector between USB2.0 data lines and audio headphone outputs, the designers can eliminate the using of bulky headphone jacks. Meanwhile, using the mini-USB connectors as audio outputs allows the end users to reduce the cost to buy too many different types of cell phone accessories.

DIO3202A unique architectures allow the part to allow the part to have constant Ron, Ron (flatness) and THD performance independent of Vcc supply value. So in some applications such as mobile cell phone designs, if the designers want to achieve the lowest standby power consumption when the battery is turned OFF, it is highly recommended that DIO3202A be powered by 2.8V, no need of being powered by battery (4.3V) directly. This will help designers to be freed from the complex logic designs to ensure the part will get into sleep mode.

DIO3202A's control pins are 1.8V control logic compatible, so the parts can be controlled by baseband processor GPIO directly without worrying about the level shifting issues. Regarding high speed signal integrity, DIO3202A is recommended to be placed as close as possible to the USB controller outputs to reduce the signal reflection under high speed mode (480Mbps). In the meanwhile, the Vcc pin of DIO3202A is required to have decoupling capacitors to reduce the supply ripples.
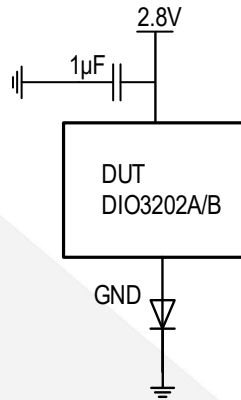
The below is the DIO3202A USB 2.0 high speed (480Mbps) eye diagram compliance test under near-end mode (most challenging mode).
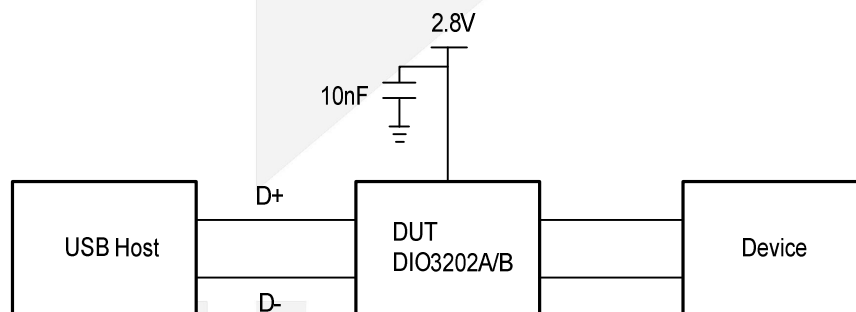
Figure 2. USB2.0 high speed eye diagram test circuit

DIO3202A is designed for -2V signal switch at all audio ports. If customer wants to pass signal up to -3V, design suggestions are:

1. Make sure when audio path (L/R ports) is ON, no signal should be applied at D+/D- port;

2. A Schottky diode is recommended between DIO3202A GND pin and system GND.

DIO3202A USB 2.0 high speed (480Mbps) eye pattern

T_A= 25°C, Vcc= 2.8V, unless other otherwise specified.
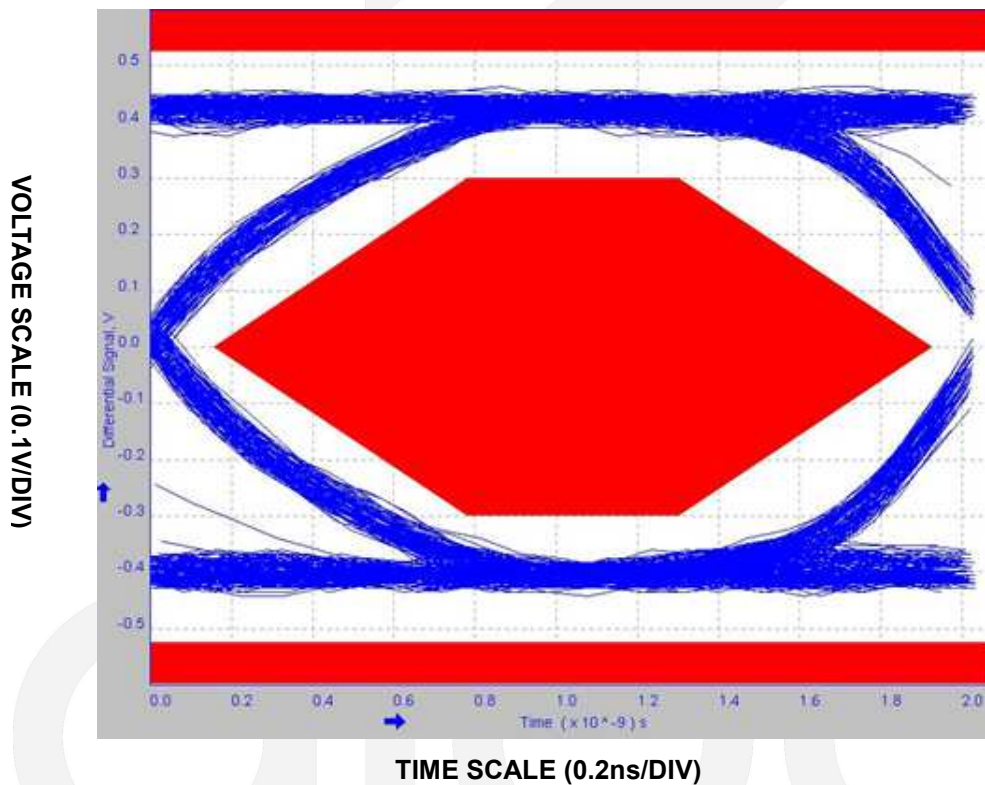

TIME SCALE (0.2ns/DIV)

Figure 3. Eye Pattern: 480Mbps with USB switch In signal path

CONTACT US

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