DIO3202B

USB2.0 High-Speed and Audio 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
- 5.5V Tolerant on COM pin
- Green Packaged: DQFN10

Applications

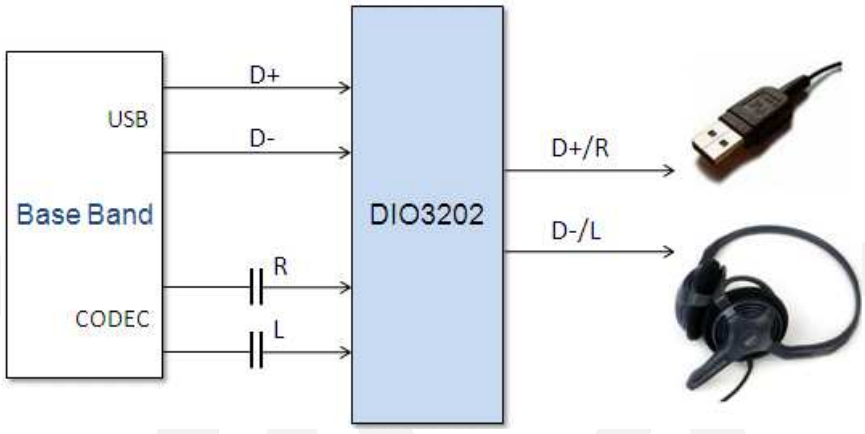
- Cell-Phone/PDA
- MP3/MP4/PMP
- Portable Instrumentation
- Battery Powered Communications
- Computer Peripherals

Descriptions

The DIO3202B is dual SPDT (Single Pole/Double Throw) switch which combines low distortion audio and accurate 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}, DIO3202B will immediately switch to USB mode.

DIO3202B provide package with Green or RoHS tiny 10L package, and operates over a temperature range of -40°C to 85°C.

Block Diagram



Ordering Information

Order Part Number	Top Marking		T_A	Package	
DIO3202BLP10	YWGG	Green	-40 to +85°C	DQFN-10	Tape & Reel, 3000

Pin Assignment

DQFN-10

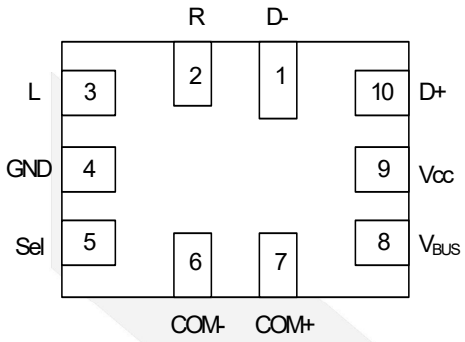


Figure 1 Top View

Pin Descriptions

Pin Name	Direction	Description
D+, D- / R, L	I/O	Data / Audio Port
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, R	D+, D-	Function
Low	Low	ON	OFF	L=COM+, R=COM-
Low	High	OFF	ON	D+=COM+, D-=COM-
High	Low	OFF	OFF	Low power mode
High	High	ON	OFF	Audio Override on USB

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	1.4			V
V_{IL}	A_{SEL} Control Input Low Voltage	V_{CC}=2.7-4.2V			0.5	V
I_{IN}	A_{SEL} Control Input Leakage Current	0≤V_{SW}≤V_{CC}	-2		2	μA
V_{IH}	V_{BUS} Control Input High Voltage	V_{CC}=2.7-4.2V	1.4			V
V_{IL}	V_{BUS} Control Input Low Voltage	V_{CC}=2.7-4.2V			0.7	V
I_{IN}	V_{BUS} Control Input Leakage Current	0≤V_{SW}≤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
R_{FLAT}	On Resistance Flatness	I_{ON}=40mA, V_{SW}=-0.85 to 0.85V		0.6	1	Ω
ΔR_{ON}	On Resistance Matching	I_{ON}=40mA, V_{SW}=-0.85 to 0.85V		0.05		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
R_{FLAT}	On Resistance Flatness	I_{ON}=8mA, V_{SW}=0.4V		0.4	0.6	Ω

Electrical Characteristics (Continued)

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ΔR_{ON}	On Resistance Matching	I_{ON}=8mA, V_{SW}=0.4V		0.05		Ω
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=10pF		60		ns
t_{OFF}	USB Turn-off Time	V_{CC}=2.7V, R_L=50Ω, C_L=10pF		15		ns
t_{ON}	Audio Turn-on Time	V_{CC}=2.7V, R_L=50Ω, C_L=10pF		75		ns
t_{OFF}	Audio Turn-off Time	V_{CC}=2.7V, R_L=50Ω, C_L=10pF		40		ns
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} ($2V_{PP}$)		-100		dB
THD+N	Total Harmonic Distortion + Noise	V_{BUS}=0V, V_{SEL}=3.3V, R_L=32Ω f=20Hz to 20kHz, V_{COM}=$2V_{PP}$		0.05		%
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}=0 V, V_{SEL}=3.3V		9		pF
C_{OFF}	USB OFF Capacitance	V_{BUS}=0 V, V_{SEL}=3.3V		3		pF
C_{OFF}	Audio OFF Capacitance	V_{BUS}=4.2 V, V_{SEL}=0 V		4		pF

Applications Design Guide

DIO3202B 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.

DIO3202B 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 DIO3202B be powered by 2.8V, no need of being powered by 4.3V directly. This will help designers to be freed from the complex logic designs to ensure the part will get into sleep mode.

DIO3202B'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, DIO3202B 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 pins of DIO3202B is required to have decoupling capacitors to reduce the supply ripples.

The below is the DIO3202B USB 2.0 high speed (480Mbps) eye diagram compliance test under near-end mode (most challenging mode).

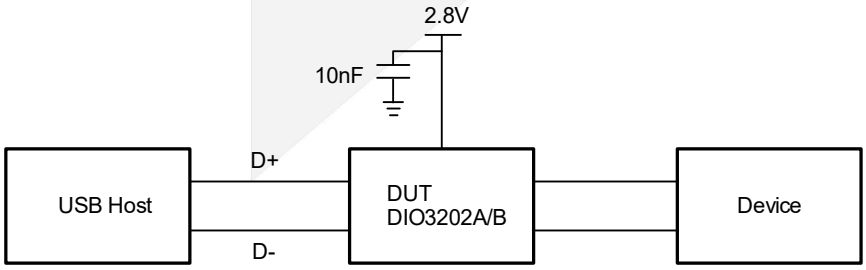
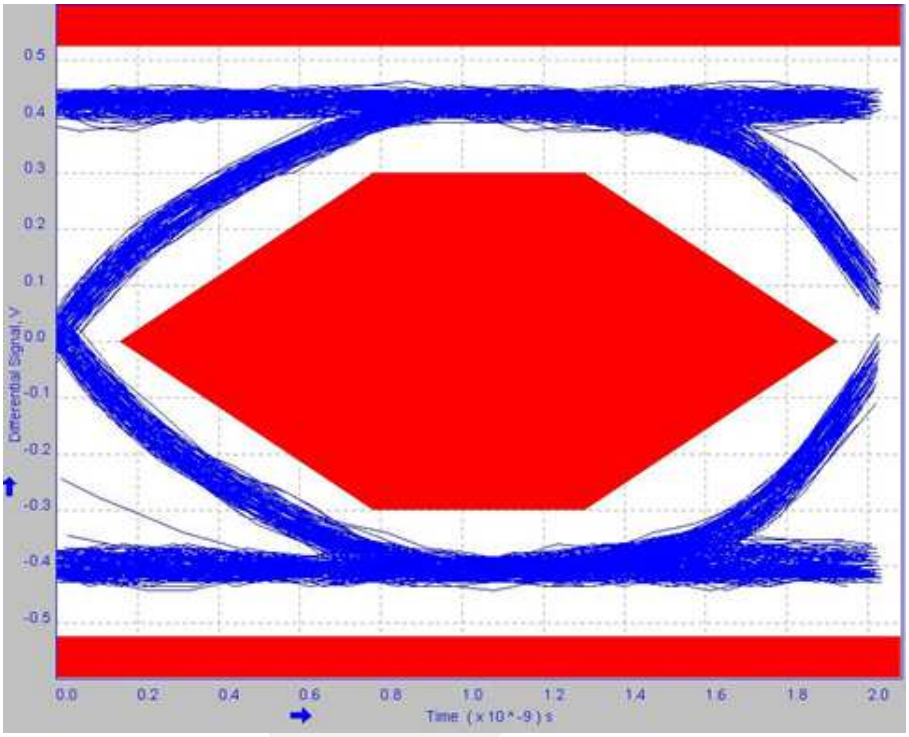


Figure 2. USB2.0 high speed eye diagram test circuit

DIO3202B USB 2.0 high speed (480Mbps) eye pattern

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

VOLTAGE SCALE (0.1V/DIV)



TIME SCALE (0.2ns/DIV)

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

CONTACT US

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