High Speed Overvoltage Protection USB2.0 Switch

■ Features

- Power supply voltage range: 2.1 V to 5.5 V
- Bidirectional dual channel/differential channel OVP
- 36 V DC tolerance on the connector side pins
- -3 dB bandwidth: 1.3 GHz
- Active supply current: 24 µA
- IEC 61000 4-2 contact
    - 8 kV with power supply
    - 6 kV without power supply
- IEC 61000-4-5 8/20 µs
    - 40 V and -20 V surge capable on DP, DN pins
- Operating temperature range: -40°C to 85°C

■ Applications

- Mobile phone
- Tablet
- Notebook

■ Package Information

Part Number	Package	Body Size
DIO5010	DFN-6	1.5 mm × 1.0 mm

■ Description

The DIO5010 is a low power, 1.3 GHz high bandwidth, USB2.0 double pole single throw analog switch, which is designed to operate from a single 2.1 V to 5.5 V supply. The DIO5010 supports overvoltage protection up to 36 V.

The DIO5010 is available in a green package: DFN1.5*1-6. It is specified over ambient temperature range of -40°C to 85°C, which meets the requirements of consumer and industry applications.

■ Simplified Schematic
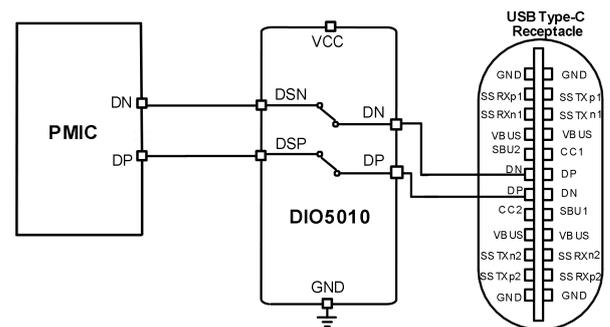
■ **Ordering Information**

Ordering Part No.	Top Marking	MSL	RoHS	T_A	Package	
DIO5010QL6	AVYW	1	Green	-40 to 85 °C	DFN1.5*1*0.75-6	Tape and Reel, 3000
DIO5010QH6	1AYW	1	Green	-40 to 85 °C	DFN1.5*1*0.55-6	Tape and Reel, 5000

If you encounter any issue in the process of using the device, please contact our customer service at marketing@dioo.com or phone us at (+86)-21-62116882. If you have any improvement suggestions regarding the datasheet, we encourage you to contact our technical writing team at docs@dioo.com. Your feedback is invaluable for us to provide a better user experience.

Table of Contents

List of Figures

1. Pin Assignment and Functions

*Figure 1. DFN1.5*1-6 (Top view)*

Pin No.	Pin Name	Description
1	VCC	Power supply
2,3	DSN, DSP	Output/ Input. Internal system side data path N,P
4,5	DP, DN	Output/ Input. Connector side data path N,P (high voltage)
6	GND	Ground

2. Absolute Maximum Ratings

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impact the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter		Rating	Unit
V_{CC}	Supply voltage		-0.5 to 6	V
$V_{I/O}$	Input/output DC voltage	DP, DN	-0.5 to 36	V
		DSP, DSN	-0.5 to 6	V
T_{STG}	Storage temperature		-65 to 150	°C
T_A	Operating temperature		-40 to 85	°C
T_J	Junction temperature		-40 to 125	°C

3. Recommended Operating Conditions

Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter		Rating	Unit
V_{CC}	Supply voltage		2.1 to 5.5	V
$V_{I/O}$	Analog input/output voltage	DP, DN, DSP, DSN	0 to 3.6	V
$I_{I/O}$	Analog input/output port continuous current	DP, DN, DSP, DSN	-50 to 50	mA

4. ESD Ratings

When a statically-charged person or object touches an electrostatic discharge sensitive device, the electrostatic charge might be drained through sensitive circuitry in the device. If the electrostatic discharge possesses sufficient energy, damage might occur to the device due to localized overheating.

Model	Condition		Value	Unit
HBM	ANSI/ESDA/JEDEC JS-001	VCC, DP, DN	±8	kV
		DSN, DSP	±6.5	kV
CDM	ANSI/ESDA/JEDEC JS-002		±2	kV

5. Electrical Characteristics

5.1. DC characteristics

T_A = 25 °C, V_{CC} = 2.1 to 5.5 V. Typical values are at V_{CC} = 3.3 V, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{CC}	Power supply voltage		2.1	3.3	5.5	V
I_{CC}	Active supply current			24	34	µA
R_{ON}	ON-state resistance	$V_{I/O}$ = 0.4 V, I_{SINK} = 8 mA	3.5	4.8	7.5	Ω
ΔR_{ON}	ON-state resistance match between channels	$V_{I/O}$ = 0.4 V, I_{SINK} = 8 mA			0.3	Ω
$R_{ON\ (FLAT)}$	ON-state resistance match flatness	$V_{I/O}$ = 0 V to 0.4 V, I_{SINK} = 8 mA		0.1	0.4	Ω
I_{OFF}	I/O pin OFF leakage current	$V_{DP/N}$ = 0 V or 3.6 V	-1	0.7	2	µA
		$V_{DP/N}$ = 32 V		110		µA
I_{ON}	ON leakage current	$V_{DP/N}$ = 0 V or 3.6 V	-1	0.7	2	µA
Z_{ON}	ON state impedance to GND		3	5		MΩ
V_{OVP_TH}	OVP positive threshold		4.8	5.1	5.4	V
V_{OVP_HYST}	OVP threshold hysteresis			220		mV
V_{NEG}	Negative voltage transmission capability	$I_{LEAK(DP/DN)}$ = 1 mA, R_L = open		-0.66		V

Note:

(1) Guaranteed by design.

(2) Specifications subject to change without notice.

5.2. AC characteristics

T_A = 25 °C, V_{CC} = 2.1 to 5.5 V. Typical values are at V_{CC} = 3.3 V, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{ON} [1]	ON capacitance	f = 240 MHz		4		pF
BW	Bandwidth	R_L = 50 Ω, switch on		1.3		GHz
t_{ON}	Device turn ON time (VCC to output)	$V_{DP/N}$ = 0.8 V, R_L = 50 Ω		140		µs
t_{OVP}	OVP protection time	Between trigger voltage and off, R_L = 50 Ω		550		ns
t_{OVP_rec}	OVP recovery time	Between trigger voltage and 90% input voltage		2		µs
V_{RESID} [1]	Residual voltage of DSP/N	$V_{DP/N}$ = 16 V surge, R_L = open		5.9		V
		$V_{DP/N}$ = 16 V surge, R_L = 50 Ω		4.5		V

Note:

(1) Guaranteed by design.

(2) Specifications subject to change without notice.
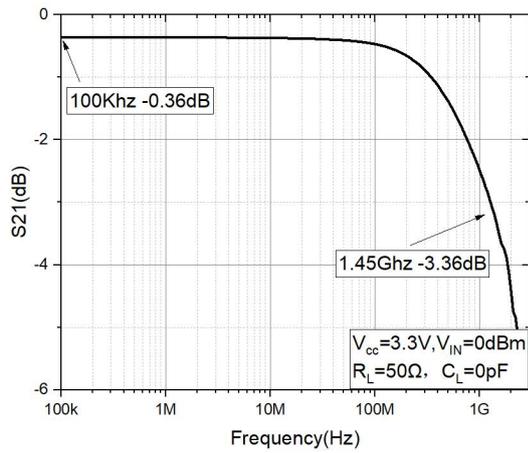
6. Typical Characteristics
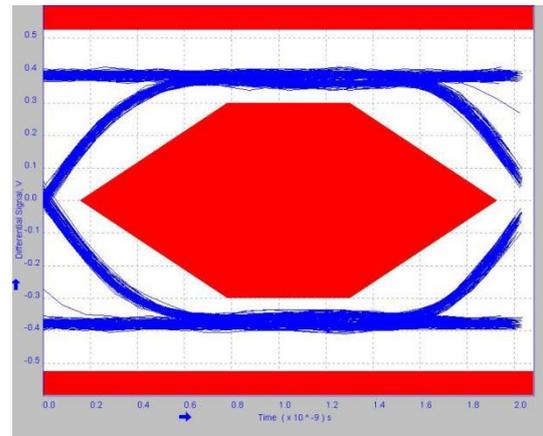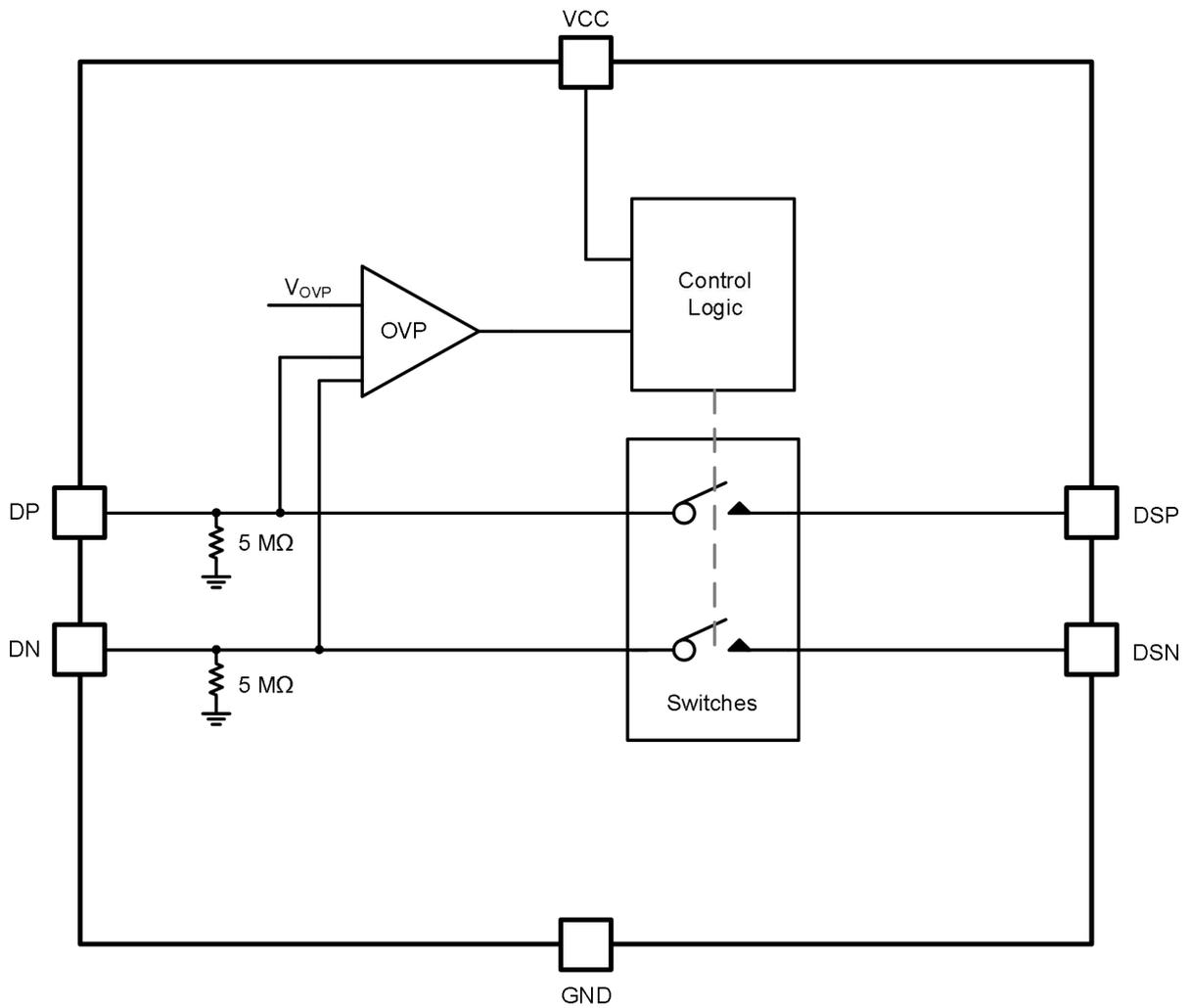

Figure 2. Bandwidth

Figure 3. Eye diagram (USB2.0)
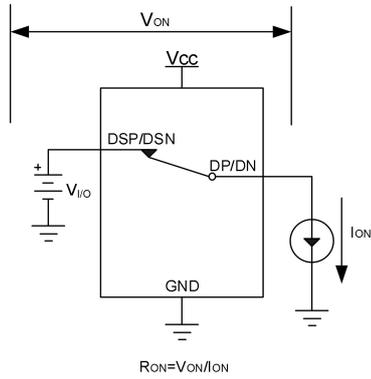
7. Block Diagram

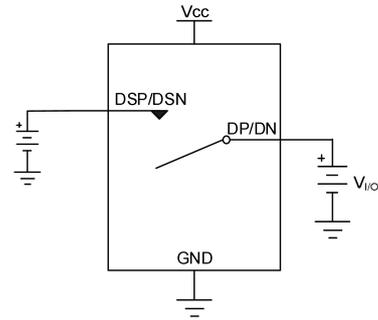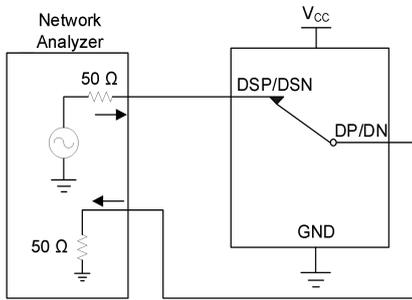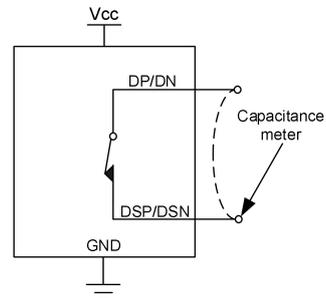# 8. Test Diagram

Figure 4. Switch on resistor

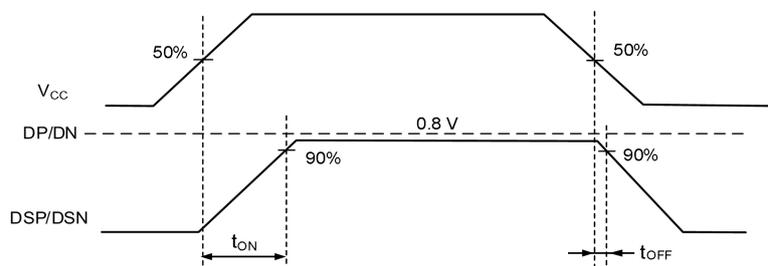

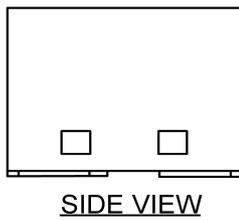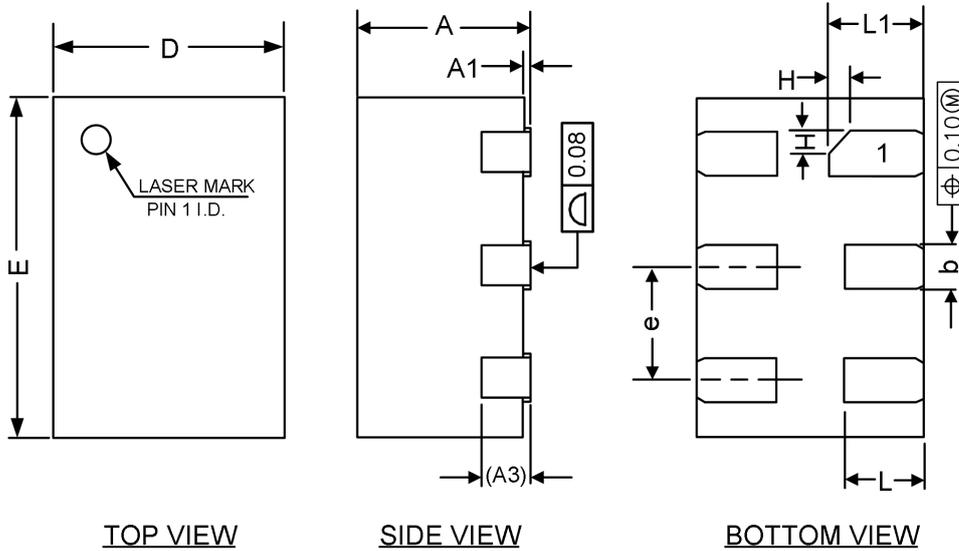Figure 5. Switch off leakage

Figure 6. Bandwidth

Figure 7. On capacitance test

Figure 8. t_{ON} /t_{OFF} VCC to output timing

9. Physical Dimensions

9.1. DFN1.5*1*0.75-6

TOP VIEW

SIDE VIEW

BOTTOM VIEW

LASER MARK
PIN 1 I.D.

SIDE VIEW

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.203 REF		
b	0.15	0.20	0.25
D	0.95	1.00	1.05
E	1.45	1.50	1.55
e	0.45	0.50	0.55
H	0.10 REF		
L	0.30	0.35	0.40
L1	0.375	0.425	0.475

9.2. DFN1.5*1*0.55-6

TOP VIEW

SIDE VIEW

SIDE VIEW

BOTTOM VIEW
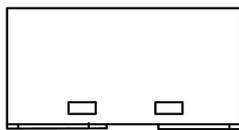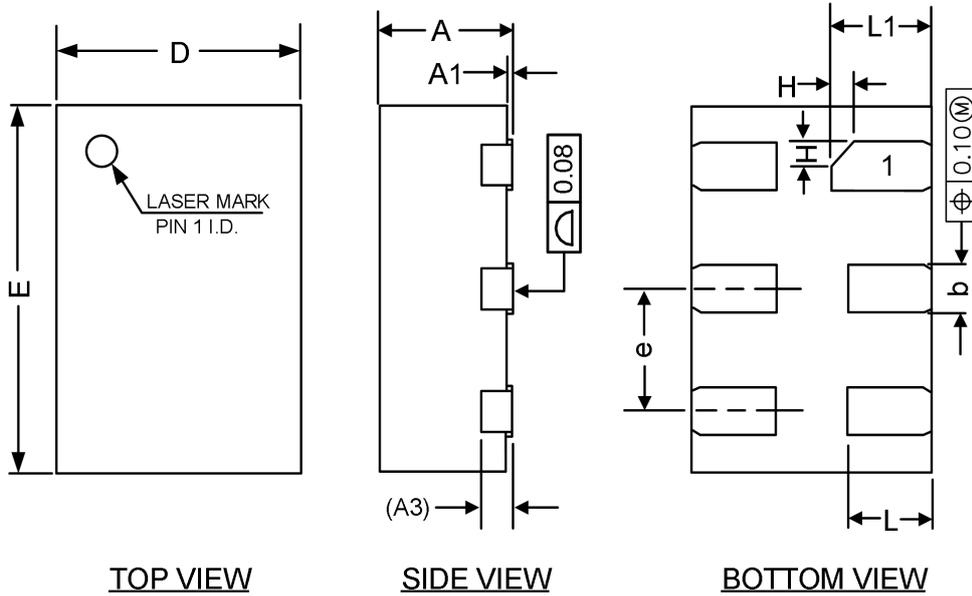
Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3	0.127 REF		
b	0.15	0.20	0.25
D	0.95	1.00	1.05
E	1.45	1.50	1.55
e	0.45	0.50	0.55
H	0.10 REF		
L	0.30	0.35	0.40
L1	0.375	0.425	0.475

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