

Four-Pole Single-Throw (4PST) Depletion Mode Isolation Switch

■ Features

- Support 4-pole single-throw
- Depletion mode MOSFETs
- $V_{CC(OFF)}$: 1.6 V to 3.0 V
- R_{ON} : 0.5 Ω typical
- $R_{FLAT(ON)}$: 0.01 Ω typical
- THD+N: 0.001% typical
- Package: WLCSP-12

■ Applications

- Cell phones
- Smart phones
- Tablets
- MP3s
- GPS

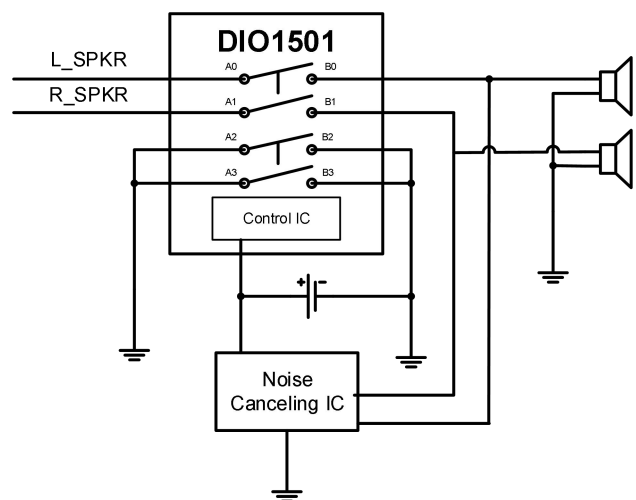
■ Package Information

Part Number	Package	Body Size
DIO1501	WLCSP-12	1.16mm × 1.56mm

■ Description

The DIO1501 is a high-performance four-pole single-throw (4PST) analog switch with wide V_{CC} range. The key feature of the DIO1501 is the depletion-mode isolation technology. That allows the device to conduct signals when there is no V_{CC} available and to isolate the signals when V_{CC} is present. In additional, select pins allow the internal oscillator frequency to be adjusted between 790 kHz and 1.12 MHz in 110 kHz steps when V_{CC} is present. This feature can improve electromagnetic interference (EMI).

■ Simplified Schematic



■ Ordering Information

Ordering Part No.	Top Marking	MSL	RoHS	T _A	Package	
DIO1501WL12	1501	1	Green	-40 to 85°C	WLCSP-12	Tape & Reel, 3000

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.

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1. Pin Assignment and Functions

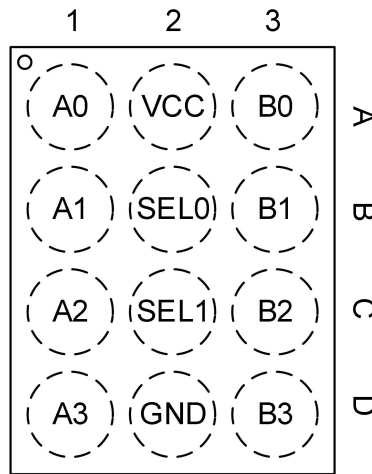


Figure 1. WLCSP-12 (Top view)

Name	Type	Description
A0	I/O	A0-port
A1	I/O	A1-port
A2	I/O	A2-port
A3	I/O	A3-port
VCC	Supply/Control	Isolation circuit supply voltage (see Table 1)
SEL0	I	Oscillator frequency control (see Table 2). Used to shift the electromagnetic interference (EMI) signature to meet the customer specifications.
SEL1	I	
GND	Ground	System ground
B0	I/O	B0-port
B1	I/O	B1-port
B2	I/O	B2-port
B3	I/O	B3-port

Table 1. Truth table

V_{CC}	Function
0 V to 0.2 V	B0-B3 = A0-A3
1.6 V to 3.0 V	Disconnect, B0-B3 $\neq$ A0-A3

Table 2. Oscillator frequency step logic

SEL1	SEL0	Frequency (Typ.)
LOW	LOW	790 kHz
LOW	HIGH	900 kHz
HIGH	LOW	1.01 MHz
HIGH	HIGH	1.12 MHz

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/control voltage	-0.3 to 5.5	V
V_{IN}	Input voltage (select pins)	-0.3 to V_{CC}	V
$V_{SW(ON)}$	DC switch I/O voltage (switch conducting)	-5 to 5	V
$V_{SW(OFF)}$	DC switch I/O voltage (switch isolated) ⁽¹⁾	-1.5 to 3	V
I_{IK}	DC input diode current	-50	mA
I_{SW}	Switch I/O current	350	mA
I_{SWPEAK}	Peak switch current	500	mA
T_A	Absolute maximum operating temperature	-40 to 85	°C
T_{STG}	Storage temperature	-65 to 150	°C

Note:

(1) When a switch is isolated (OFF), V_{SW} value must be $< V_{CC}$.

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	Condition	Min	Typ	Max	Unit
$V_{CC(ON)}$	Supply voltage with switch conducting		0		0.2	V
$V_{CC(OFF)}$	Supply voltage with switch isolated		1.6		3.0	V
$V_{SW(ON)}$	DC switch I/O voltage (switch conducting)	$V_{CC} = 0\text{ V}$	-2		2	V
$V_{SW(OFF)}$	DC switch I/O voltage (switch isolated)	$V_{CC} = 1.6\text{ V to }3.0\text{ V}$	-1.5		1.5	V

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	Metric	Value	Unit
Human-body model (HBM)	ANSI/ESDA/JEDEC JS-001	± 6500	V
Charged device model (CDM)	ANSI/ESDA/JEDEC JS-002	± 2000	V

5. Electrical Characteristics

$T_A = 25^\circ\text{C}$, unless otherwise noted.

Symbol	Parameter	Condition	V_{CC} (V)	Min	Typ	Max	Unit
DC electrical characteristics							
I_{ON}	Switch-to-GND leakage current (switch conducting)	$A_n = -1.0\text{ V to }1.4\text{ V}$, $B_n = \text{Float}$	0	0		1.0	μA
I_{OFF}	Switch-to-GND leakage current (switch isolated)	$A_n = 0.4\text{ V to }1.4\text{ V}$, $B_n = \text{Float}$	3	0		1.0	μA
		$A_n = 0.4\text{ V to }1.4\text{ V}$, $B_n = \text{GND}$		0		1.0	
R_{ON}	Switch on resistance ⁽¹⁾	$I_{SW} = \pm 24\text{ mA}$, $V_{SW} = -1.0\text{ V to }1.4\text{ V}$	0		0.5		Ω
$R_{FLAT(ON)}$	On resistance flatness ⁽¹⁾	$I_{SW} = \pm 24\text{ mA}$, $V_{SW} = -1.0\text{ V to }1.4\text{ V}$	0		0.01		Ω
I_{CC}	Quiescent supply current	$SEL0 = SEL1 = V_{CC}$	3	0	60	70	μA
V_{IH}	Input voltage high (select pins) ⁽²⁾⁽³⁾		3	$0.8 V_{CC}$			V
V_{IL}	Input voltage low (select pins) ⁽²⁾⁽³⁾		3			$0.2 V_{CC}$	V
I_{IN}	Input leakage current (select pins)		3	-1		1	μA
AC electrical characteristics							
t_{ON}	Turn-on time V_{CC} to output ⁽⁴⁾	$R_L = 32\ \Omega$, $C_L = 10\text{ pF}$, $V_{SW} = 1.4\text{ V}$	1.6		150		ns
t_{OFF}	Turn-off time V_{CC} to output ⁽⁴⁾	$R_L = 32\ \Omega$, $C_L = 10\text{ pF}$, $V_{SW} = 1.4\text{ V}$	1.6		140		μs
OIRR	Off isolation ⁽⁴⁾	$R_L = 32\ \Omega$, $f = 20\text{ kHz}$, $V_{SW} = 0.35 V_{RMS}$	1.6		-90		dB
		$R_L = 32\ \Omega$, $f = 20\text{ kHz}$, $V_{SW} = 1 V_{RMS}$	1.6		-82		dB
X_{TALK}	Crosstalk ⁽⁴⁾	$R_L = 32\ \Omega$, $f = 20\text{ kHz}$, $V_{SW} = 1 V_{RMS}$	0		-78		dB
BW	-3 dB bandwidth	$R_L = 50\ \Omega$, $C_L = 0\text{ pF}$	0		330		MHz
THD+N	Total harmonic distortion + noise ⁽⁴⁾	$R_L = 32\ \Omega$, $f = 20\text{ Hz to }20\text{ kHz}$, $V_{SW} = 1 V_{RMS}$	0		0.001		%

Note:

- (1) Guaranteed by test and characterization.
- (2) Voltages on select control pins must be $\leq V_{CC}$.
- (3) Guaranteed by design.
- (4) $SEL0 = SEL1 = \text{LOW}$.
- (5) Specifications subject to change without notice.

6. Test Diagrams

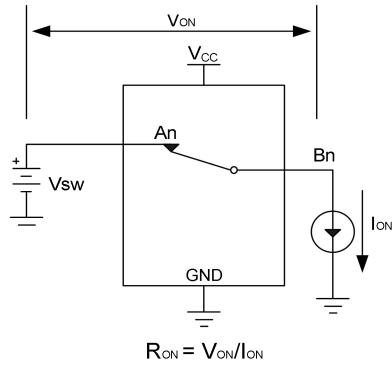


Figure 2. Switch on resistor

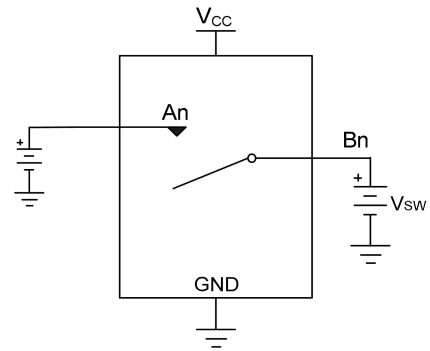


Figure 3. Switch off leakage

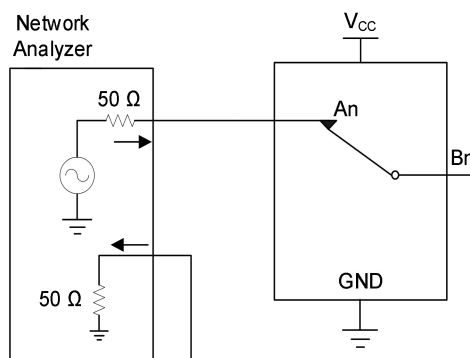


Figure 4. Bandwidth

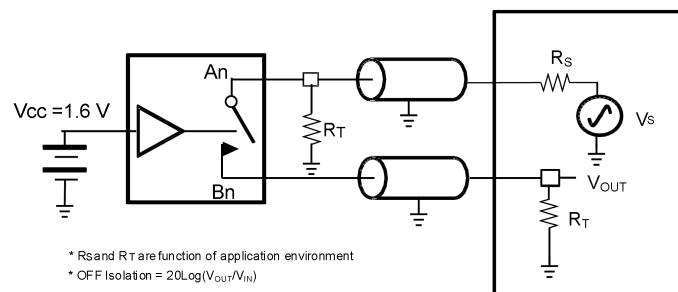


Figure 5. Off isolation

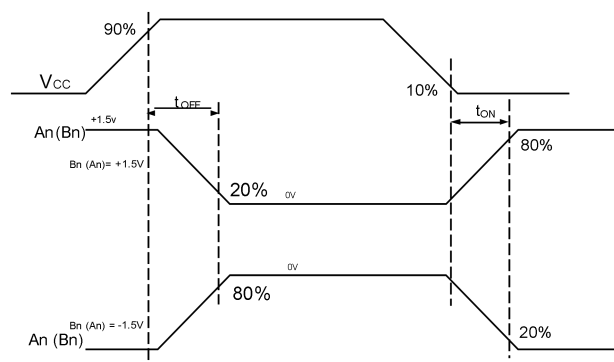


Figure 6. t_{ON}/t_{OFF} V_{CC} to output timing

7. Typical Characteristics

$T_A = 25^\circ\text{C}$, unless otherwise specified.

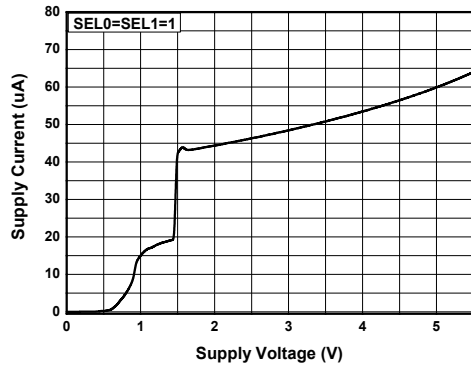


Figure 7. I_{CC} vs. V_{CC}

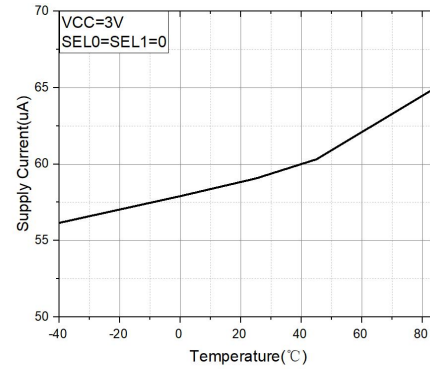


Figure 8. I_{CC} vs. Temperature

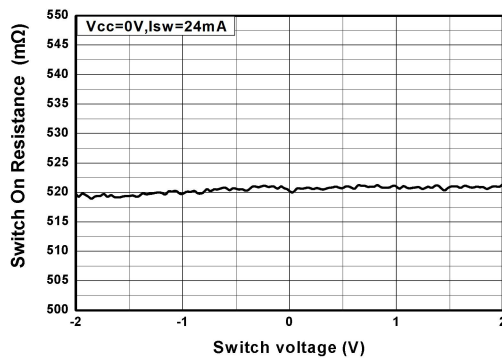


Figure 9. R_{ON} vs. V_{SW}

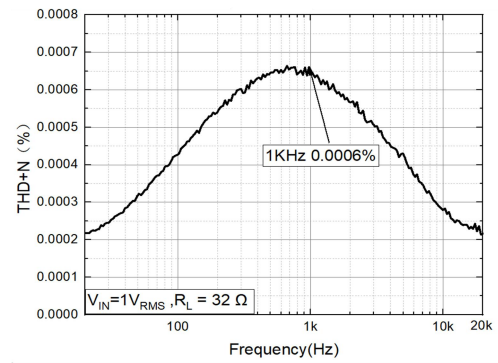


Figure 10. THD+N vs. Frequency

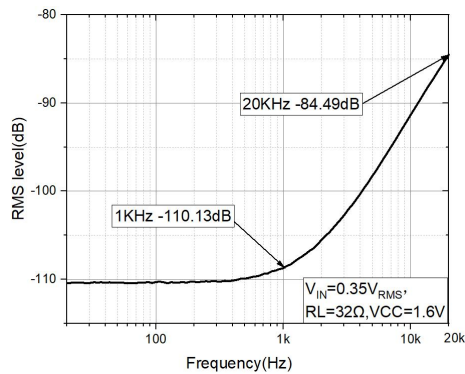


Figure 11. OIRR vs. Frequency

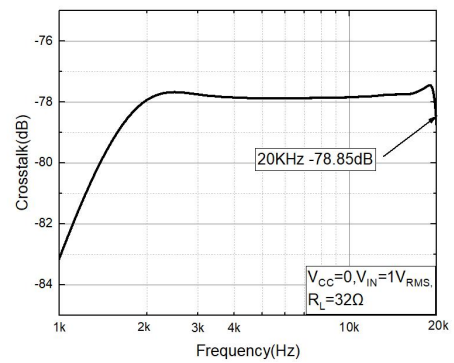


Figure 12. Crosstalk vs. Frequency

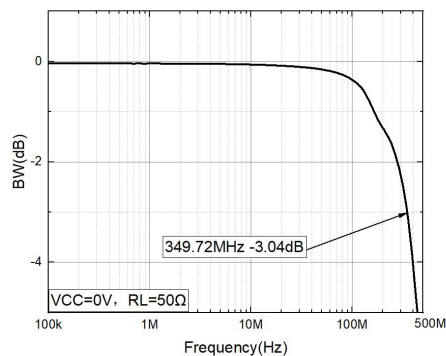


Figure 13. Bandwidth

8. Application Information

Important notice: Validation and testing are the most reliable ways to confirm system functionality. The application information is not part of the specification and is for reference purposes only.

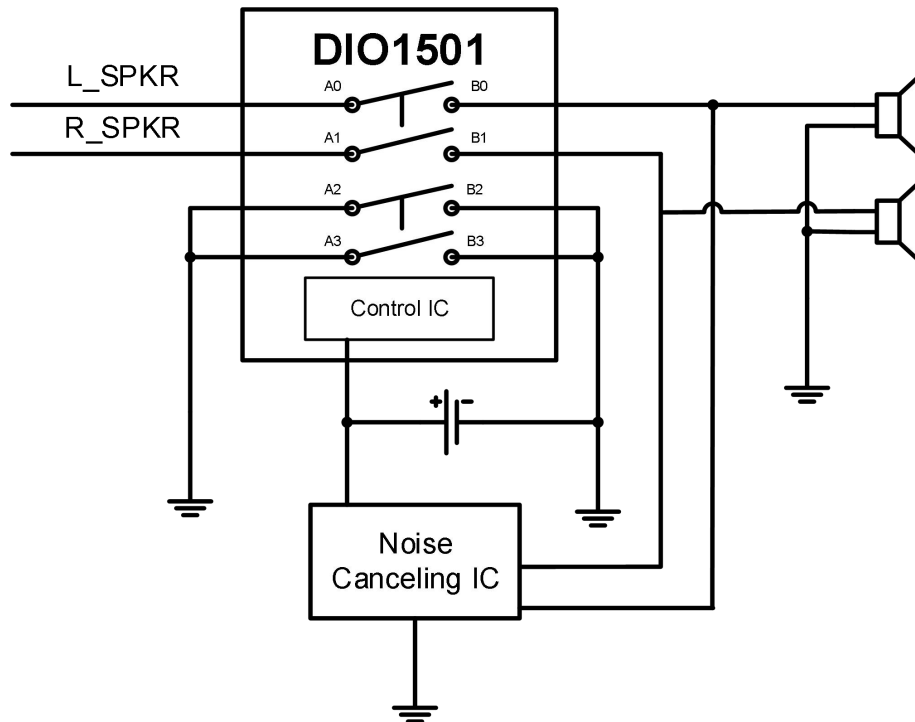
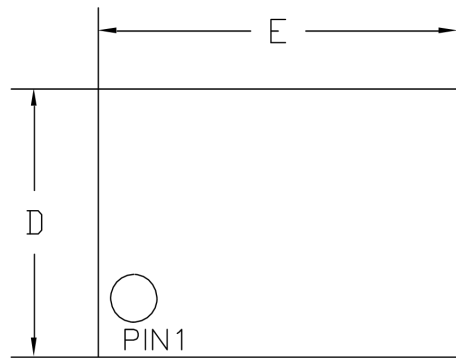
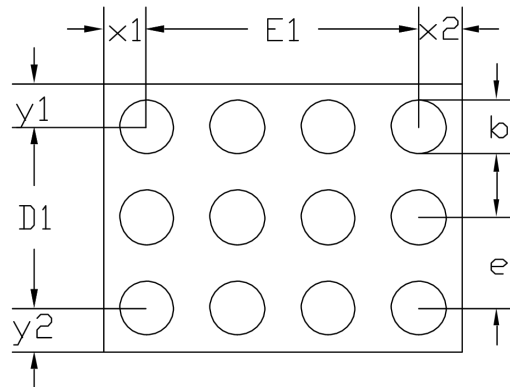


Figure 14. Typical application circuit

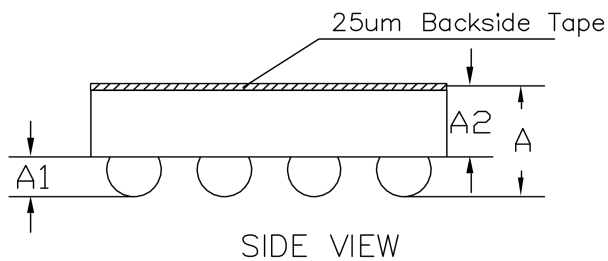
9. Physical Dimensions: WLCSP-12



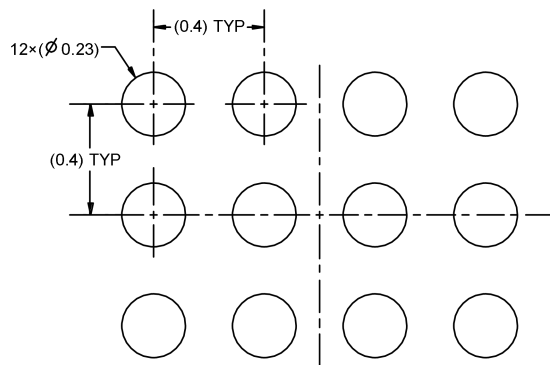
TOP VIEW
(MARK SIDE)



BOTTOM VIEW
(BALL SIDE)



SIDE VIEW



LAND PATTERN

Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.548	0.588	0.628
A1	0.188	0.208	0.228
A2	0.360	0.380	0.400
D	1.130	1.160	1.190
D1	0.800 BSC		
E	1.530	1.560	1.590
E1	1.200 BSC		
b	0.240	0.260	0.280
e	0.400 BSC		
x1	0.180 REF		
x2	0.180 REF		
y1	0.180 REF		
y2	0.180 REF		

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