

## DIO32321EN8

### Ultra High Bandwidth (> 2 GHz) Dual SPDT Data Switch

#### Features

- Super high bandwidth (-3 dB): > 2.0 GHz
- $V_{CC}$  operation at 2.7 V to 5.5 V
- Low Con: 5 pF (typ.)
- Low  $R_{on}$ : 5.5  $\Omega$  (typ.)
- Low power consumption: 1  $\mu$ A (max.)
- Low  $I_{CCT}$  : 0.5  $\mu$ A (typ.) at  $V_{IN}$  = 1.8 V,  $V_{CC}$  = 3.6 V
- Packaged in Green DFN1.6\*1.2-8
- 6 kV HBM ESD on all pins
- Power-off/on protection on common ports  
D+/D- pins tolerate up to 5.5 V

#### Descriptions

The DIO32321 is a low power, dual SPDT2-port high-speed analog switch. It handles bidirectional signal flow optimized for switching a high-speed (480Mbps) source or a full-speed (12Mbps) source.

DIO32321 has high channel-to-channel noise isolation and low bit-to-bit skew which allows it to pass high-speed differential signals with good signal integrity. Each switch offers little or no attenuation of the high-speed signals at the outputs.

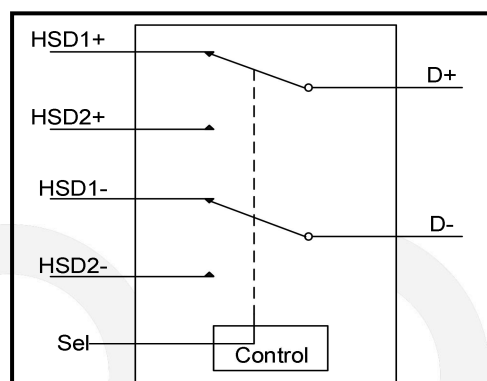
The DIO32321 contains special circuitry on the D+/D- pins, which can tolerate up to 5.5 V when the USB devices either powered off or powered on.

DIO32321 is available in type Green package: DFN1.6\*1.2-8.

#### Applications

- Cell-Phone/PDA
- MP3/MP4/PMP
- STB/LCDTV

#### Block Diagram



#### Ordering Information

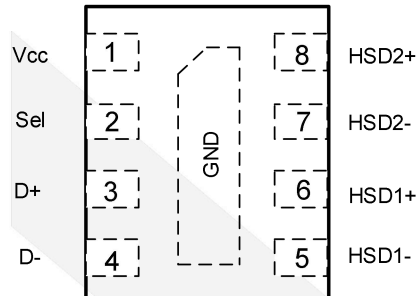
| Order Part Number | Top Marking |       | $T_A$       | Package      |                   |
|-------------------|-------------|-------|-------------|--------------|-------------------|
| DIO32321EN8       | YWBA        | Green | -40 to 85°C | DFN1.6*1.2-8 | Tape & Reel, 5000 |



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### Pin Assignment



DFN1.6\*1.2-8  
Figure 1. Top View

### Pin Descriptions

| Pin Name     | Description               |
|--------------|---------------------------|
| Sel          | Switch select             |
| D+, D-       | USB data bus              |
| HSDn+, HSDn- | Multiplexed source inputs |

### Truth Table

| Sel | Function              |
|-----|-----------------------|
| L   | D+, D- = HSD1+, HSD1- |
| H   | D+, D- = HSD2+, HSD2- |



## DIO32321EN8

### Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table 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 maximum rating conditions for extended periods may affect device reliability.

| Symbol      | Parameter                            | Min. | Max.           | Unit |
|-------------|--------------------------------------|------|----------------|------|
| $V_{CC}$    | Supply voltage                       | -0.3 | 6.0            | V    |
| $V_{sel}$   | DC input voltage (Sel)               | -0.3 | $V_{CC}$       | V    |
| $V_{SW}$    | DC input I/O voltage                 | -0.3 | $V_{CC} + 0.3$ | V    |
|             | DC input I/O voltage (D+/D-)         | -0.3 | 6.0            | V    |
| $V_{D+/D-}$ | D+/D- DC voltage <sup>(Note 1)</sup> | -0.3 | 9              | V    |
| $I_{IK}$    | DC input diode current               | -50  |                | mA   |
| $I_{OUT}$   | DC output current                    |      | 50             | mA   |
| $T_{STG}$   | Storage temperature                  | -65  | 150            | °C   |
| ESD         | JEDEC: JESD22-A114, all pins         | 6    |                | kV   |

**Note 1:** This rating only applies to the D+/D- pin with respect to GND.  $V_{CC}$  must be powered within the recommended operating conditions of 2.7 V to 5.5 V. Any condition where  $V_{CC}$  is unpowered must reference the rest of the Absolute Maximum Ratings Table.

### 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                         | Min. | Max.     | Unit |
|-----------|-----------------------------------|------|----------|------|
| $V_{CC}$  | Supply voltage                    | 2.7  | 5.5      | V    |
| $V_{sel}$ | Control input voltage (Sel)       | 0    | $V_{CC}$ | V    |
| $V_{SW}$  | Switch I/O voltage (HSD1±, HSD2±) | 0    | $V_{CC}$ | V    |
|           | Switch I/O voltage (D+, D-)       | 0    | 5.5      | V    |
| $T_A$     | Operating temperature             | -40  | 85       | °C   |



## DIO32321EN8

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### DC Electrical Characteristics

All typical value are at  $T_A = 25^\circ\text{C}$  unless otherwise specified.

| Symbol          | Parameter                                                        | Conditions                                                                      | Vcc (V)    | Min  | Typ | Max  | Unit          |
|-----------------|------------------------------------------------------------------|---------------------------------------------------------------------------------|------------|------|-----|------|---------------|
| $V_{IH}$        | Input voltage high                                               |                                                                                 | 2.7 to 5.5 | 0.85 |     |      | V             |
| $V_{IL}$        | Input voltage low                                                |                                                                                 | 2.7 to 5.5 |      |     | 0.35 | V             |
| $I_{IN}$        | Control input leakage                                            | $V_{SW} = 0 \text{ to } V_{CC}$                                                 | 3.6        | -1   |     | 1    | $\mu\text{A}$ |
| $I_{OZ}$        | Off state leakage                                                | $0 \leq D_n, \text{HSD1n}, \text{HSD2n} \leq 3.6 \text{ V}$                     | 3.6        | -1   |     | 1    | $\mu\text{A}$ |
| $I_{OFF}$       | Power-off leakage current<br>(all common ports)                  | $V_{SW} = 0 \text{ V to } 3.6 \text{ V}, V_{CC} = 0 \text{ V},$<br>See Figure 9 | 0          | -1   |     | 1    | $\mu\text{A}$ |
| $R_{ON}$        | HS switch on resistance                                          | $V_{SW} = 0.4 \text{ V}, I_{ON} = 8 \text{ mA},$<br>See Figure 8                | 3.3        |      | 5.5 | 8    | $\Omega$      |
| $\Delta R_{ON}$ | HS delta $R_{ON}$                                                | $V_{SW} = 0.4 \text{ V}, I_{ON} = 8 \text{ mA}$                                 | 3.3        |      | 0.1 |      | $\Omega$      |
| $I_{CC}$        | Quiescent supply current                                         | $V_{sel} = 0 \text{ or } V_{CC},$                                               | 3.6        |      | 0.4 | 1    | $\mu\text{A}$ |
| $I_{CCT}$       | Increase in $I_{CC}$ current per<br>control voltage and $V_{CC}$ | $V_{sel} = 2.6 \text{ V}, V_{CC} = 3.6 \text{ V}$                               | 3.6        |      | 0.5 | 1    | $\mu\text{A}$ |
|                 |                                                                  | $V_{sel} = 1.8 \text{ V}, V_{CC} = 3.6 \text{ V}$                               | 3.6        |      | 0.5 | 1    | $\mu\text{A}$ |

**Note:** Specifications subject to change without notice.



## DIO32321EN8

Ultra High Bandwidth (> 2 GHz) Dual SPDT Data Switch

### AC Electrical Characteristics

All typical value are for  $V_{CC} = 3.3\text{ V}$  at  $25^\circ\text{C}$  unless otherwise specified.

| Symbol      | Parameter                                             | Conditions                                                                               | $V_{CC}(\text{V})$ | Temp                 | Min | Typ  | Max | Unit |
|-------------|-------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------|----------------------|-----|------|-----|------|
|             |                                                       |                                                                                          |                    | ( $^\circ\text{C}$ ) |     |      |     |      |
| $t_{ON}$    | Turn-on time<br>Sel to output                         | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ,<br>$V_{SW} = 0.8\text{ V}$ ,<br>See Figure 15 | 3.0 to 3.6         | full                 |     |      | 3.0 | us   |
| $t_{OFF}$   | Turn-off time<br>Sel to output                        | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ,<br>$V_{SW} = 0.8\text{ V}$ ,<br>See Figure 15 | 3.0 to 3.6         | full                 |     |      | 14  | ns   |
| $t_{PD}$    | Propagation delay                                     | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$                                                 | 3.3                | $25^\circ\text{C}$   |     | 0.25 |     | ns   |
|             |                                                       |                                                                                          |                    | full                 |     |      | 5.0 | ns   |
| $t_{BBM}$   | Break-before-make                                     | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ,<br>$V_{SW} = 0.8\text{ V}$ ,<br>See Figure 14 | 3.0 to 3.6         | $25^\circ\text{C}$   |     | 12   |     | ns   |
|             |                                                       |                                                                                          |                    | full                 | 10  |      | 28  | ns   |
| OIRR        | Off Isolation                                         | $R_L = 50\ \Omega$ , $f = 240\text{ MHz}$<br>See Figure 13                               | 3.0 to 3.6         | $25^\circ\text{C}$   |     | -37  |     | dB   |
| Xtalk       | Non-adjacent<br>Channel Crosstalk                     | $R_L = 50\ \Omega$ , $f = 240\text{ MHz}$<br>See Figure 12                               | 3.0 to 3.6         | $25^\circ\text{C}$   |     | -45  |     | dB   |
| BW          | -3dB bandwidth                                        | $R_L = 50\ \Omega$ , $C_L = 0\text{ pF}$ ,<br>See Figure 11                              | 3.0 to 3.6         | $25^\circ\text{C}$   |     | 2000 |     | MHz  |
|             |                                                       | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ,<br>See Figure 11                              |                    | $25^\circ\text{C}$   |     | 720  |     | MHz  |
| $t_{SK(P)}$ | Skew of opposite<br>transitions of the<br>same output | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$                                                 | 3.0 to 3.6         | $25^\circ\text{C}$   |     | 20   |     | ps   |

### Capacitance

| Symbol   | Parameter                        | Conditions                                                  | Temp                 | Min | Typ | Max | Unit |
|----------|----------------------------------|-------------------------------------------------------------|----------------------|-----|-----|-----|------|
|          |                                  |                                                             | ( $^\circ\text{C}$ ) |     |     |     |      |
| $C_{IN}$ | Control Pin input<br>Capacitance | $V_{CC}=0\text{V}$                                          | $25^\circ\text{C}$   |     | 1.2 |     | pF   |
| $C_{ON}$ | D+/D- on Capacitance             | $V_{CC}=3.3\text{V}$ , $f=240\text{MHz}$ ,<br>See Figure 10 | $25^\circ\text{C}$   |     | 5   |     |      |

Specifications subject to change without notice.

## Typical Performance Characteristics

$T_A = 25^\circ\text{C}$ ,  $V_{CC} = 3.6\text{ V}$ , unless otherwise specified.

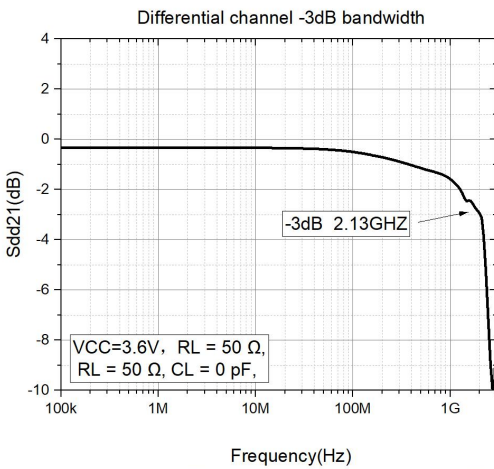


Figure 2. -3dB bandwidth vs. frequency

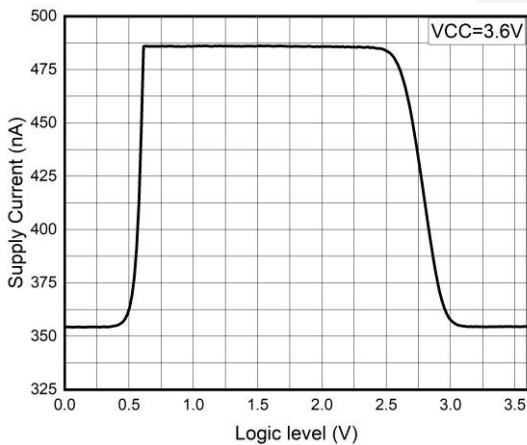


Figure 4. Supply current vs. Logic level

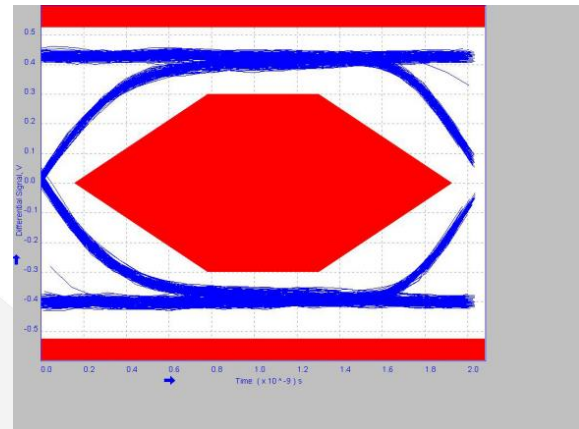


Figure 3. 480 Mbps with USB switch in signal path

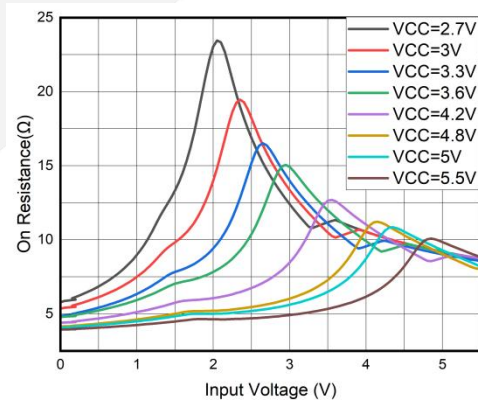


Figure 5. On resistance vs. input voltage

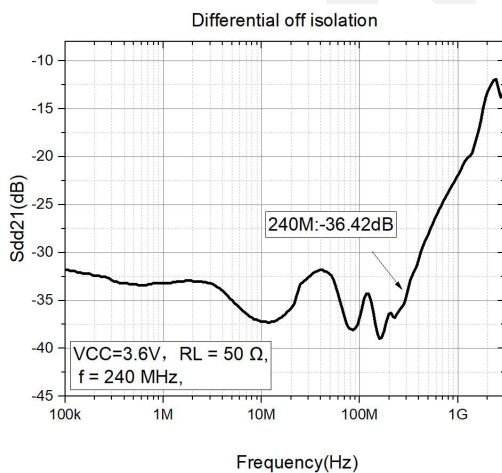


Figure 6. Off-isolation vs. frequency

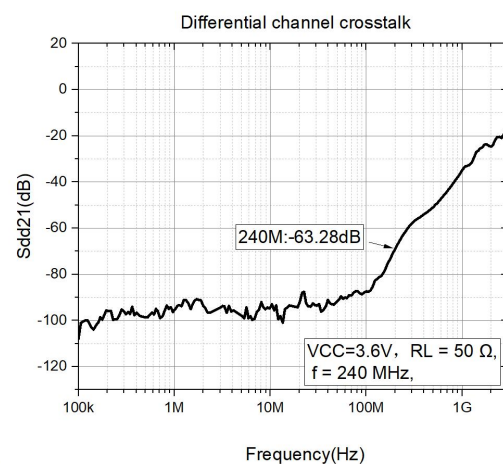


Figure 7. Crosstalk vs. frequency

## Test Diagrams

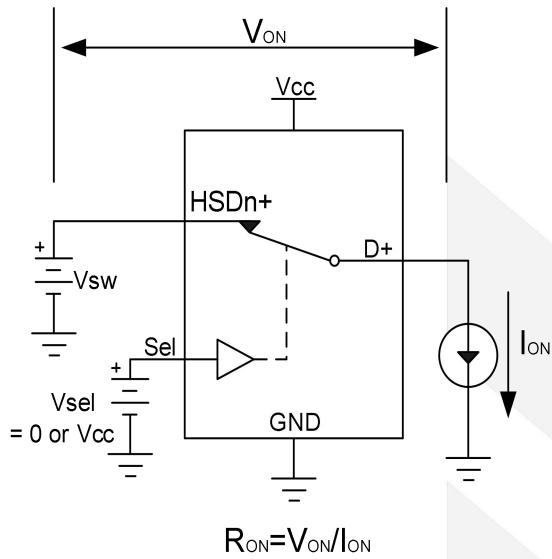


Figure 8. Switch on resistor

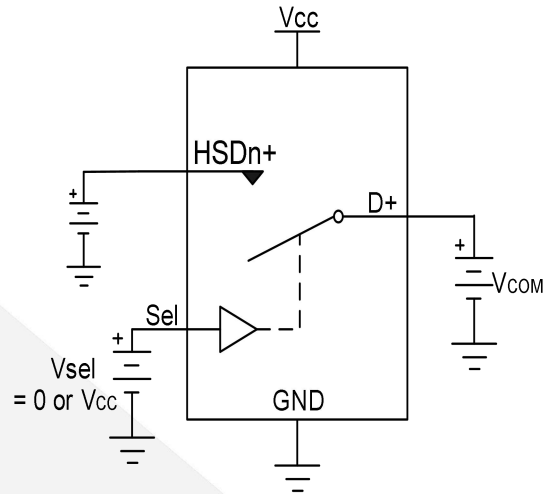


Figure 9. Switch off leakage

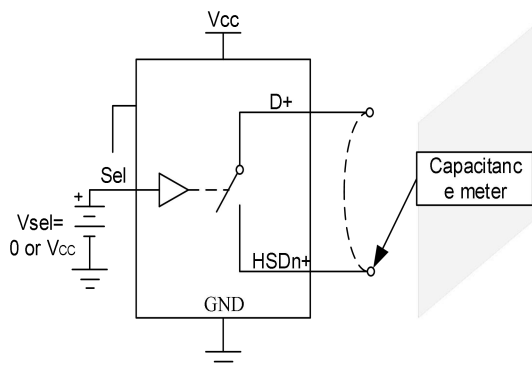


Figure 10. Channel ON/OFF capacitance

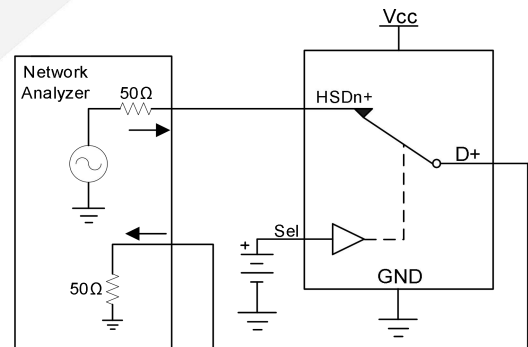


Figure 11. Bandwidth

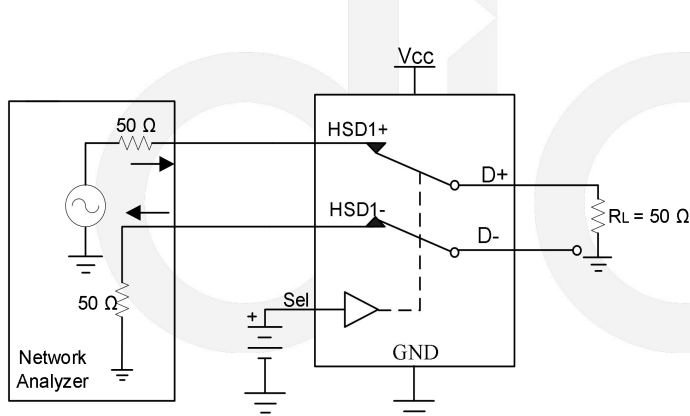


Figure 12. Channel-to-channel crosstalk

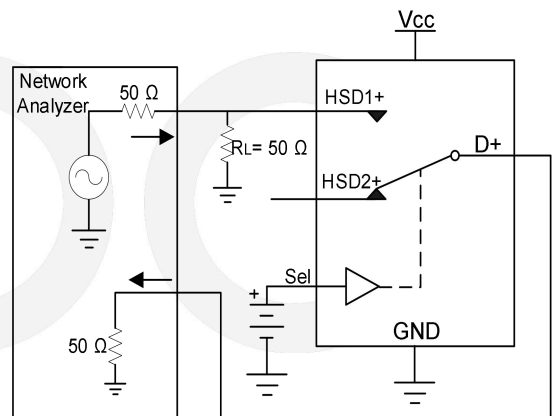


Figure 13. Off-isolation

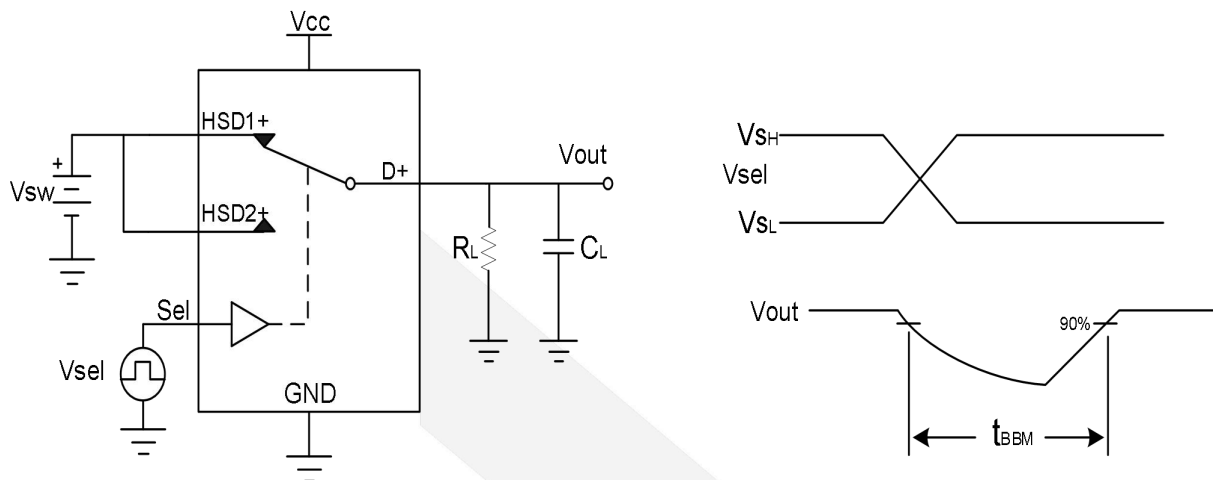


Figure 14. Break-before-make

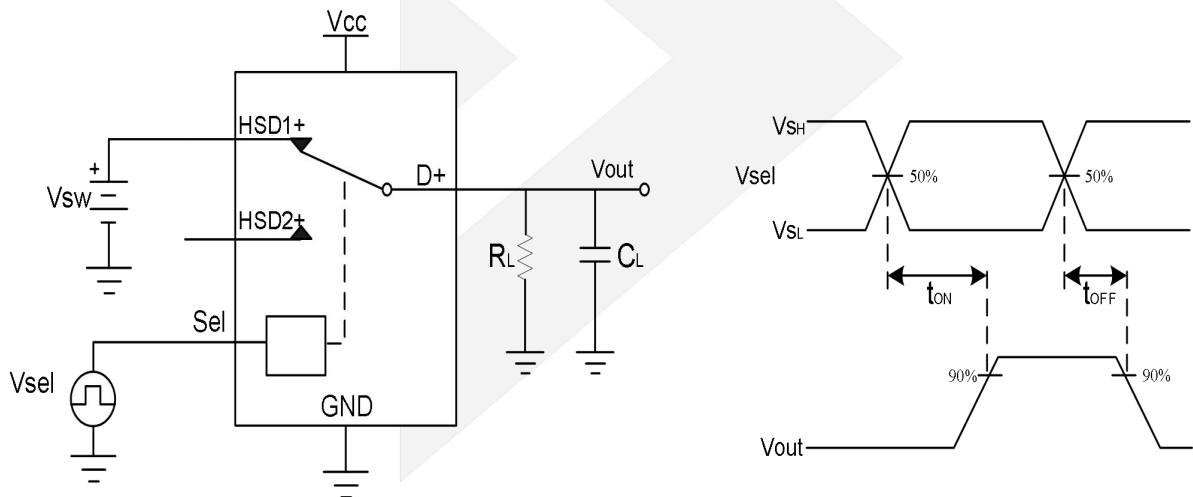
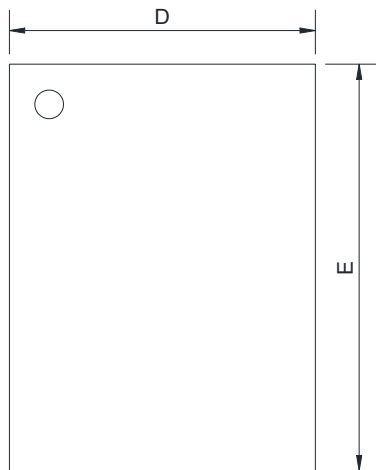
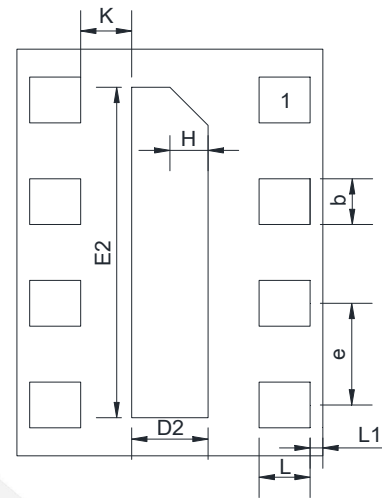


Figure 15. Turn-on/Turn-off

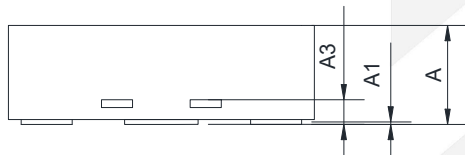
## Physical Dimension: DFN1.6\*1.2-8



TOP VIEW



BOTTOM VIEW



SIDE VIEW

| Symbol | Dimensions in Millimeters |      |      |
|--------|---------------------------|------|------|
|        | Min                       | Nom  | Max  |
| A      | 0.34                      | 0.37 | 0.40 |
| A1     | 0.00                      | 0.02 | 0.05 |
| A3     | 0.10REF                   |      |      |
| b      | 0.13                      | 0.18 | 0.23 |
| D      | 1.10                      | 1.20 | 1.30 |
| E      | 1.50                      | 1.60 | 1.70 |
| D2     | 0.25                      | 0.30 | 0.35 |
| E2     | 1.25                      | 1.30 | 1.35 |
| e      | 0.30                      | 0.40 | 0.50 |
| H      | 0.15REF                   |      |      |
| K      | 0.15                      | 0.20 | 0.25 |
| L      | 0.15                      | 0.20 | 0.25 |
| L1     | 0.00                      | 0.05 | 0.10 |

## CONTACT US

Dioo is a professional design and sales corporation for high-quality and performance analog semiconductors. The company focuses on industry markets, such as cell phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to <http://www.dioo.com> for a complete list of Dioo product families.

For additional product information or full datasheet, please contact our sales department or representatives.