AOZ1334DI-02
Single Channel Smart Load Switch

General Description
The AOZ1334DI-02 is a single channel load switch with very low on-resistance in a small package. It contains an n-channel MOSFET for up to 5.5V input voltage operation and 10A current channel with 5V bias supply. The load switch is controlled by a low voltage control signal through ON pin.

The AOZ1334DI-02 integrates an internal 220Ω load resistor for quick output discharge when load switch is off.

The AOZ1334DI-02 is available in a 3mm x 3mm DFN-8L package with bottom thermal pad and is rated over a -40°C to +85°C ambient temperature range.

Features
- 0.8V to 5.5V input voltage range
- 10A continuous current
- Low RDS(ON) internal NFETs
  - 3.6mΩ at VBIAS = 5V, VIN = 1.05V
- 60µA low quiescent current
- 0.5ms turn on rise time at VBIAS = 5V and VIN = 1.05V
- 2.5V to 5.5V bias voltage
- Integrated quick output discharge resistor
- Thermally enhanced 3mm x 3mm DFN-8L package

Applications
- Portable computers
- Ultrabooks
- Tablet PCs
- Set top boxes
- LCD TVs
- Telecom/Networking/Datacom equipment
- SSD
- Consumer electronics

Typical Application

```
VIN  CIN   OUT  VOUT
IN   OUT   IN   OUT
VBIAS CBIAS ON  OFF
ON  GND
```

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Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Temperature Range</th>
<th>Package</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOZ1334DI-02</td>
<td>-40°C to +85°C</td>
<td>3mm x 3mm DFN-8L</td>
<td>Green</td>
</tr>
</tbody>
</table>

All AOS products are offered in packages with Pb-free plating and compliant to RoHS standards. Please visit www.aosmd.com/media/AOSGreenPolicy.pdf for additional information.

Pin Configuration

![Pin Configuration Diagram]

Pin Description

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Pin Name</th>
<th>Pin Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, EPAD</td>
<td>IN</td>
<td>Load Switch Input. Bypass capacitor is recommended to minimize input voltage dip. Recommended voltage range of this pin is 0.8V to 5.5V to obtain optimal RON.</td>
</tr>
<tr>
<td>3</td>
<td>VBIAS</td>
<td>Bias Voltage. Power supply input for the device. Recommended voltage range is 2.5V to 5.5V.</td>
</tr>
<tr>
<td>4</td>
<td>ON</td>
<td>Active High Switch Control Input. Do not leave floating.</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground.</td>
</tr>
<tr>
<td>6, 7, 8</td>
<td>OUT</td>
<td>Load switch output.</td>
</tr>
</tbody>
</table>
Functional Block Diagram

Absolute Maximum Ratings
Exceeding the Absolute Maximum ratings may damage the device.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN, ON, VBIAS, OUT to GND</td>
<td>-0.3V to 6V</td>
</tr>
<tr>
<td>Junction Temperature (TJ)</td>
<td>+150°C</td>
</tr>
<tr>
<td>Storage Temperature (TS)</td>
<td>-65°C to +150°C</td>
</tr>
<tr>
<td>ESD Rating HBM/CDM</td>
<td>2kV/1kV</td>
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</table>

Recommend Operating Ratings
The device is not guaranteed to operate beyond the Maximum Operating Ratings.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
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</thead>
<tbody>
<tr>
<td>Supply Voltage (VIN)</td>
<td>5.5V</td>
</tr>
<tr>
<td>Ambient Temperature (TA)</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Package Thermal Resistance</td>
<td></td>
</tr>
<tr>
<td>3x3 DFN-8 (θJC)</td>
<td>8°C/W</td>
</tr>
<tr>
<td>3x3 DFN-8 (θJA)</td>
<td>60°C/W</td>
</tr>
</tbody>
</table>

Electrical Characteristics
TA = 25°C, VBIAS = 5V, VIN = 1.05V, unless otherwise specified. Specifications in **BOLD** indicate a temperature range of -40°C to +85°C.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
<td>IN Supply Voltage</td>
<td>VON = 5V</td>
<td>0.8</td>
<td>1.05</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>VBIAS</td>
<td>VBIAS Supply Voltage</td>
<td></td>
<td>2.5</td>
<td>5</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>ID</td>
<td>Maximum Continuous Current</td>
<td>VON = 5V</td>
<td>10</td>
<td></td>
<td></td>
<td>A</td>
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<tr>
<td>IPLS</td>
<td>Maximum Pulsed Switch Current</td>
<td>VON = VBIAS = 5V, Pulse &lt; 300µs, 2% Duty Cycle</td>
<td>12</td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>IQ</td>
<td>Quiescent Supply Current of VBIAS</td>
<td>IOUT = 0V, VON = 5V</td>
<td>60</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>IOFF</td>
<td>VBIAS Shutdown Supply Current</td>
<td>VON = 0V, VOUT = 0V</td>
<td>2</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>INOFF</td>
<td>IN Shutdown Supply Current</td>
<td>VON = 0V, VOUT = 0V</td>
<td>2</td>
<td></td>
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<td>µA</td>
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<tr>
<td>ION</td>
<td>ON Leakage Current</td>
<td>VON = 5V</td>
<td>1</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>VONH</td>
<td>ON High Level Voltage</td>
<td></td>
<td>1.2</td>
<td></td>
<td></td>
<td>V</td>
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<tr>
<td>VONL</td>
<td>ON Low Level Voltage</td>
<td></td>
<td>0.5</td>
<td></td>
<td></td>
<td>V</td>
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</table>

Switching ON Resistance

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>RON</td>
<td>Switch ON-State Resistance</td>
<td>IOUT = -6A, VON = 5V, VBIAS = 5V</td>
<td>4.5</td>
<td>5</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td>RPD</td>
<td>Output Pull-Down Resistance</td>
<td>IOUT = 15mA, VON = 0V</td>
<td>220</td>
<td>300</td>
<td></td>
<td>Ω</td>
</tr>
</tbody>
</table>
## Switching Characteristics

![Switching Characteristics Diagram](image)

Test conditions: $T_A = 25^\circ\text{C}$, $C_{IN} = 1\mu\text{F}$, $C_L = 0.1\mu\text{F}$ (unless otherwise specified).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{VIN} = 1.05\text{V}, \text{VBIAS} = \text{VON} = 5\text{V}, \text{RL} = 10\Omega$</td>
<td>$t_{\text{ON}}$</td>
<td>Turn-ON Time</td>
<td>800</td>
<td></td>
<td>$\mu\text{s}$</td>
</tr>
<tr>
<td>$t_{\text{D-ON}}$</td>
<td>Turn-ON Delay time</td>
<td>350</td>
<td>500</td>
<td>650</td>
<td></td>
</tr>
<tr>
<td>$t_{\text{R}}$</td>
<td>Turn-ON Rise Time</td>
<td>350</td>
<td>500</td>
<td>650</td>
<td></td>
</tr>
<tr>
<td>$t_{\text{OFF}}$</td>
<td>Turn-OFF Time</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_{\text{F}}$</td>
<td>Turn-OFF Fall Time</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{VIN} = 1.5\text{V}, \text{VBIAS} = \text{VON} = 5\text{V}, \text{RL} = 10\Omega$</td>
<td>$t_{\text{ON}}$</td>
<td>Turn-ON Time</td>
<td>830</td>
<td></td>
<td>$\mu\text{s}$</td>
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<td>$t_{\text{D-ON}}$</td>
<td>Turn-ON Delay time</td>
<td>336</td>
<td>480</td>
<td>624</td>
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<tr>
<td>$t_{\text{R}}$</td>
<td>Turn-ON Rise Time</td>
<td>420</td>
<td>600</td>
<td>780</td>
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</tr>
<tr>
<td>$t_{\text{OFF}}$</td>
<td>Turn-OFF Time</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_{\text{F}}$</td>
<td>Turn-OFF Fall Time</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{VIN} = 1.05\text{V}, \text{VBIAS} = \text{VON} = 5\text{V}, \text{IOUT} = -6\text{A}$</td>
<td>$t_{\text{ON}}$</td>
<td>Turn-ON Time</td>
<td>1140</td>
<td></td>
<td>$\mu\text{s}$</td>
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<tr>
<td>$t_{\text{D-ON}}$</td>
<td>Turn-ON Delay time</td>
<td>660</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>$t_{\text{R}}$</td>
<td>Turn-ON Rise Time</td>
<td>700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_{\text{OFF}}$</td>
<td>Turn-OFF Time</td>
<td>2.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_{\text{F}}$</td>
<td>Turn-OFF Fall Time</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{VIN} = 1.5\text{V}, \text{VBIAS} = \text{VON} = 5\text{V}, \text{IOUT} = -6\text{A}$</td>
<td>$t_{\text{ON}}$</td>
<td>Turn-ON Time</td>
<td>1120</td>
<td></td>
<td>$\mu\text{s}$</td>
</tr>
<tr>
<td>$t_{\text{D-ON}}$</td>
<td>Turn-ON Delay time</td>
<td>630</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_{\text{R}}$</td>
<td>Turn-ON Rise Time</td>
<td>770</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_{\text{OFF}}$</td>
<td>Turn-OFF Time</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_{\text{F}}$</td>
<td>Turn-OFF Fall Time</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Typical Characteristics

**Quiescent Current vs. VBIAS**
(\(V_{IN}=V_{BIAS}=V_{ON}=5V\))

- VBIAS (V):
  - 3.0
  - 3.3
  - 3.5
  - 3.8
  - 4.0
  - 4.3
  - 4.5
  - 4.8
  - 5.0
  - 5.3
  - 5.5

- IBIAS (\(\mu A\)):
  - 3.0
  - 4.5
  - 5.0
  - 3.5
  - 4.0
  - 3.3
  - 4.8
  - 5.3
  - 3.8
  - 4.3
  - 5.5

**RON vs. VIN**
(VBIAS=5.5V, IOUT=-6A)

- VBIAS (V):
  - 40°C
  - 25°C
  - 70°C
  - 85°C

- RDSON (mΩ):
  - 25°C
  - 0.8
  - 1.3
  - 2.8
  - 3.3
  - 4.8
  - 5.3
  - 3.8
  - 4.3
  - 5.8
  - 1.8

**VOUT vs. VON**
(TA=25°C, VIN=2V)

- VBIAS (V):
  - 2.5
  - 2.0
  - 1.5
  - 1.0
  - 0.5

- VOUT (V):
  - 2.5
  - 2.0
  - 1.5
  - 1.0
  - 0.5

**RSDON vs. VIN**
(VBIAS=2.5V, IOUT=-6A)

- VBIAS (V):
  - 25°C
  - 3.0
  - 4.0
  - 3.3
  - 4.8
  - 5.3
  - 3.8
  - 4.3

- RDSON (mΩ):
  - 25°C
  - -40°C
  - 70°C
  - 85°C

- VIN (V):
  - 0.8
  - 1.0
  - 1.2
  - 1.4
  - 1.6
  - 1.8

- RSDON (mΩ):
  - 0.8
  - 1.3
  - 2.8
  - 3.3
  - 4.8
  - 5.3
  - 3.8
  - 4.3

- VIN (V):
  - 0.8
  - 1.3
  - 1.8
  - 2.3
  - 2.8
  - 3.3
  - 3.8
  - 4.3
  - 4.8
  - 5.3
Typical Characteristics (Continued)

**tON vs. VIN** (VBIAS=2.5V)

-40°C  
25°C  
70°C  
85°C  

**tD-ON vs. VIN** (VBIAS=5.5V)

-40°C  
25°C  
70°C  
85°C  

**tON vs. VIN** (VBIAS=5.5V)

**tR vs. VIN** (VBIAS=2.5V)

-40°C  
25°C  
70°C  
85°C  

**tD-ON vs. VIN** (VBIAS=2.5V)

**tR vs. VIN** (VBIAS=5.5V)
Typical Characteristics (Continued)

![Graphs showing tOFF vs. VIN for VBIAS=2.5V and VBIAS=5.5V at different temperatures: -40°C, 25°C, 70°C, 85°C.](image)

![Graphs showing tF vs. VIN for VBIAS=2.5V and VBIAS=5.5V at different temperatures: -40°C, 25°C, 70°C, 85°C.](image)
Functional Characteristics

**Turn-ON & Turn-ON Rise Times**
(VINX=1.05V, VBias=5V, CIN=1μF, CL=0.1μF, RL=10Ω)

- VON (5V/div)
- VOUT (200mV/div)

**Turn-OFF & Turn-OFF Fall Times**
(VINX=1.05V, VBias=5V, CIN=1μF, CL=0.1μF, RL=10Ω)

- VON (5V/div)
- VOUT (200mV/div)

**Turn-ON & Turn-OFF at IOUT=-6A**
(VINX=1.05V, VBias=5V, CIN=1μF, CL=0.1μF)

- VON (5V/div)
- VOUT (500mV/div)
- IOUT (2A/div)

**Turn-ON & Turn-ON Rise Times**
(VINX=1.5V, VBias=5V, CIN=1μF, CL=0.1μF, RL=10Ω)

- VON (5V/div)
- VOUT (200mV/div)

**Turn-OFF & Turn-OFF Fall Times**
(VINX=1.5V, VBias=5V, CIN=1μF, CL=0.1μF, RL=10Ω)

- VON (5V/div)
- VOUT (200mV/div)

**Turn-ON & Turn-OFF at IOUT=-6A**
(VINX=1.5V, VBias=5V, CIN=1μF, CL=0.1μF)

- VON (5V/div)
- VOUT (500mV/div)
- IOUT (2A/div)
Detailed Description

ON/OFF Control
The AOZ1334DI-02 is enabled when the ON pin is on active high with 1.2V or above voltage. The device is disabled when the ON pin voltage is 0.5V or lower. The EN input is compatible with both TTL and CMOS logic.

VBIAS Voltage Range
For optimal on-resistance of load switch, make sure the voltage is within 2.5V to 5.5V. On-resistance of load switch will be higher if the condition is not satisfied. Resistance curves of a typical sample device at \( V_{\text{BIAS}} = V_{\text{IN}} \) and at different output currents are shown as below.

Applications Information

The basic AOZ1334DI-02 application circuit is shown in the first page. Component selection is explained below.

Input Capacitor
A capacitor of 10\( \mu \)F or higher value is recommended to be place close to the IN pins of AOZ1334DI-02. This capacitor can reduce the voltage drop caused by the in-rush current during the turn-on transient of the load switch. A higher value capacitor can be used to further reduce the voltage drop during high-current application.

Output Capacitor
A capacitor of 10\( \mu \)F or higher value is recommended to be place between the OUT pins and GND. The capacitance does not affect the turn-on slew rate. However, a larger capacitor makes the initial turn-on transient smoother.

Thermal Considerations
To ensure proper operation, the maximum junction temperature of the AOZ1334DI-02 should not exceed 150ºC. Several factors attribute to the junction temperature rise: load current, MOSFET on-resistance, junction-to-ambient thermal resistance, and ambient temperature. The maximum load current can be determined by:

\[
I_{\text{LOAD(MAX)}} = \frac{T_{J_{\text{MAX}}} - T_C}{\Theta_J \times R_{DS(\text{ON})}}
\]

It is noted that the maximum continuous load current is 10A. Exceeding the maximum continuous load current may cause permanent damage to the device.

Layout Guidelines
Good PCB is important for improving the thermal performance of AOZ1334DI-02. Place the input and output bypass capacitors close to the IN and OUT pins. The input and output PCB traces should be as wide as possible for the given PCB space. Use a ground plane to enhance the power dissipation capability of the device.
**Package Dimensions, DFN3x3_8L, EP1_S**

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### Top View

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### Bottom View

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### Side View

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### Recommended Land Pattern

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### Dimensions in millimeters

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.70</td>
<td>0.75</td>
<td>0.80</td>
</tr>
<tr>
<td>A1</td>
<td>0.00</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>b1</td>
<td>1.55</td>
<td>1.60</td>
<td>1.65</td>
</tr>
<tr>
<td>b</td>
<td>0.25</td>
<td>0.30</td>
<td>0.35</td>
</tr>
<tr>
<td>c</td>
<td>---</td>
<td>0.203</td>
<td>---</td>
</tr>
<tr>
<td>D</td>
<td>2.90</td>
<td>3.00</td>
<td>3.10</td>
</tr>
<tr>
<td>D1</td>
<td>2.35</td>
<td>2.40</td>
<td>2.45</td>
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<td>1.70</td>
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<td>e</td>
<td>0.65 BSC</td>
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</tr>
<tr>
<td>L</td>
<td>0.35</td>
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<tr>
<td>R</td>
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</tr>
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<td>ccc</td>
<td>0.10</td>
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</tr>
<tr>
<td>ddd</td>
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</table>

### Dimensions in inches

<table>
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<th>Min.</th>
<th>Nom.</th>
<th>Max.</th>
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<td>0.031</td>
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<td>0.000</td>
<td>0.001</td>
<td>0.002</td>
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<tr>
<td>b1</td>
<td>0.061</td>
<td>0.063</td>
<td>0.065</td>
</tr>
<tr>
<td>b</td>
<td>0.010</td>
<td>0.012</td>
<td>0.014</td>
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<tr>
<td>c</td>
<td>---</td>
<td>0.008</td>
<td>---</td>
</tr>
<tr>
<td>D</td>
<td>0.114</td>
<td>0.118</td>
<td>0.122</td>
</tr>
<tr>
<td>D1</td>
<td>0.093</td>
<td>0.094</td>
<td>0.096</td>
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<td>E</td>
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<td>E1</td>
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<tr>
<td>e</td>
<td>0.026 BSC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>0.014</td>
<td>0.016</td>
<td>0.018</td>
</tr>
<tr>
<td>R</td>
<td>0.008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>aaa</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>bbb</td>
<td>0.004</td>
<td></td>
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</tr>
<tr>
<td>ccc</td>
<td>0.004</td>
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</tr>
<tr>
<td>ddd</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### Notes:

2. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.
3. Dimension b applies to metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip. If the terminal has the optional radius on the other end of the terminal, dimension b should not be measured in that radius area.
4. Coplanarity ddd applies to the terminals and all other bottom surface metallization.
Tape and Reel Dimensions, DFN3x3_8L, EP1_S

### Carrier Tape

![Carrier Tape Diagram]

<table>
<thead>
<tr>
<th>Package</th>
<th>A0</th>
<th>B0</th>
<th>K0</th>
<th>D0</th>
<th>D1</th>
<th>E</th>
<th>E1</th>
<th>E2</th>
<th>P0</th>
<th>P1</th>
<th>P2</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFN 3x3_EP</td>
<td>3.40</td>
<td>3.35</td>
<td>1.10</td>
<td>1.50</td>
<td>1.50</td>
<td>12.00</td>
<td>12.75</td>
<td>5.50</td>
<td>8.00</td>
<td>4.00</td>
<td>2.00</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>±0.10</td>
<td>±0.10</td>
<td>±0.10</td>
<td>+0.10/-0.0</td>
<td>+0.10/-0.0</td>
<td>±0.30</td>
<td>±0.10</td>
<td>±0.10</td>
<td>±0.10</td>
<td>±0.05</td>
<td>±0.05</td>
<td>±0.05</td>
</tr>
</tbody>
</table>

### Reel

![Reel Diagram]

<table>
<thead>
<tr>
<th>Tape Size</th>
<th>Reel Size</th>
<th>M</th>
<th>N</th>
<th>W</th>
<th>W1</th>
<th>H</th>
<th>K</th>
<th>S</th>
<th>G</th>
<th>R</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>12mm</td>
<td>ø330</td>
<td>ø330.00</td>
<td>±0.50</td>
<td>ø97.00</td>
<td>±0.10</td>
<td>13.00</td>
<td>±0.30</td>
<td>17.40</td>
<td>±1.00</td>
<td>ø13.00</td>
<td>±0.5/-0.2</td>
</tr>
</tbody>
</table>

### Leader / Trailer & Orientation

Unit Per Reel: 5000pcs

![Leader / Trailer & Orientation Diagram]
Package Marking

AOZ1334DI-02 (DFN3x3-8)

Part Number Code 1334
Extension Code XOAW
Year & Week Code LT
Assembly Lot Code O
Option Code T
Assembly Location Code

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