

General Description

The AOZ7271 is a 600V AlphaZBL™ product that uses an internal 125mΩ N-channel MOSFET to replace a diode when used in AC/DC diode-bridge application. The AOZ7271 reduces power consumption and heat dissipation.

The diode bridge rectifier is a classic circuit used for full-wave AC-to-DC rectification and DC polarity correction. The high forward voltage of high voltage diodes causes high power loss and poses a thermal challenge.

The AOS AlphaZBL product uses a controller and a 600V MOSFET to enable ideal diode operation and can be used to replace the diode. Replacing the 4 diodes in a full-wave bridge rectifier circuit with low loss MOSFETs reduces power dissipation and results in an improved thermal performance and higher reliability operation.

The AOZ7271 is self-powered from the AC line without the need of an extra voltage supply.

The AOZ7271 is available in a 8mm×8mm DFN-4L package and is rated over a -40°C to +125°C ambient temperature range.

Features

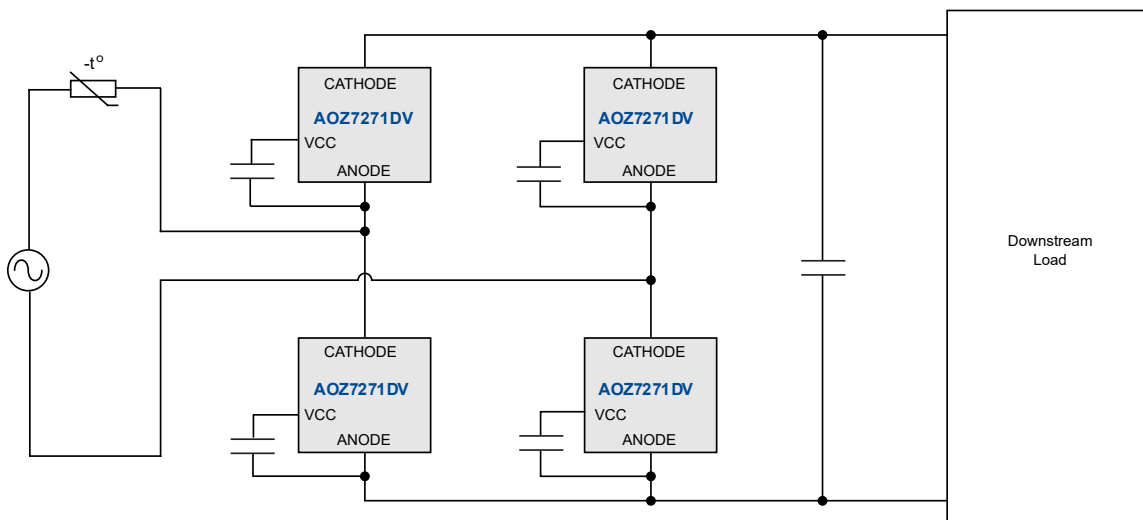
- Replaces a power diode in HV bridge rectifier
- Self-powered in AC system
- Internal 0.125Ω 600V N-channel MOSFET
- Low reverse threshold 0.8mV
- Low quiescent current 5μA
- Thermally enhanced

Applications

- AC/DC
- HV bridge rectifier



Typical Application



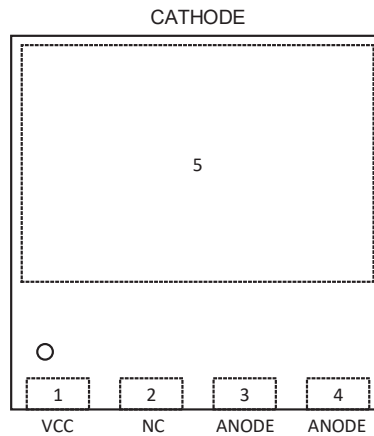
Ordering Information

Part Number	Ambient Temperature Range	Package	Environmental
AOZ7271DV	-40 °C to +125 °C	DFN8x8-4L	RoHS



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



8mm x 8mm DFN-4L
(Top View)

Pin Description

Pin Number	Pin Name	Pin Function
1	VCC	Power source for controller.
2	NC	No connection.
3-4	ANODE	Anode of diode; reference ground of controller.
5	CATHODE	Cathode of diode; drain of internal N-MOSFET.

Absolute Maximum Ratings

Exceeding the Absolute Maximum Ratings may damage the device.

Parameter	Rating
V _{CC} to ANODE	-0.3V to 24V
CATHODE to ANODE	600V
Junction Temperature (T _J)	150°C
Storage Temperature (T _S)	-65°C to +150°C
ESD Rating ⁽¹⁾	2kV

Note:

1. Devices are inherently ESD sensitive, handling precautions are required. Human body model rating: 1.5kΩ in series with 100pF.

Recommended Operating Conditions

The device is not guaranteed to operate beyond the Maximum Recommended Operating Conditions.

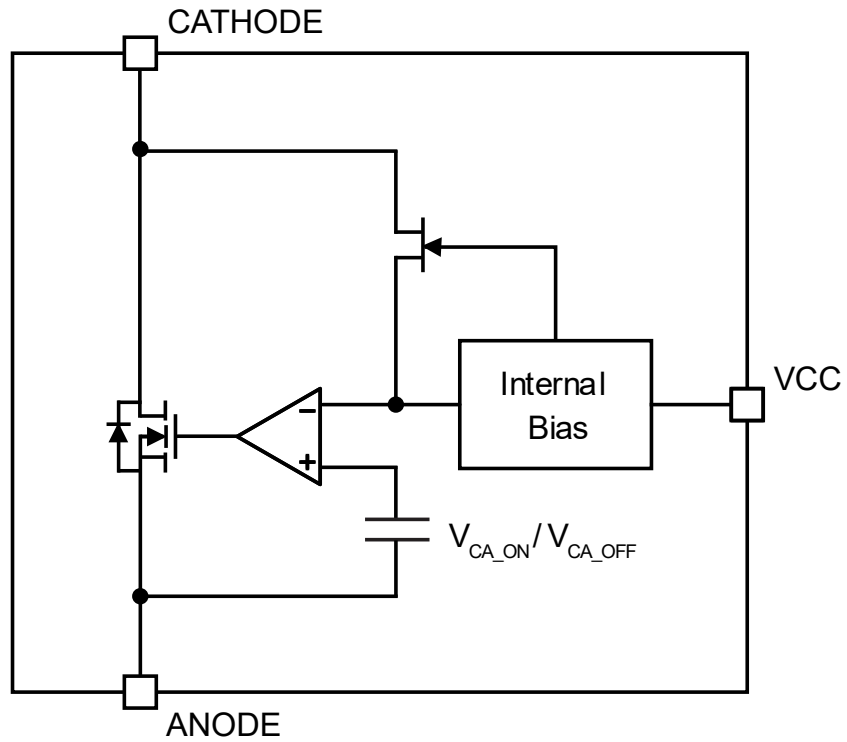
Parameter	Rating
Supply Voltage (V _{CC})	17V
Ambient Temperature (T _A)	-40°C to +125°C
Package Thermal Resistance 8x8 DFN-4 Θ _{JA}	50°C/W
Package Thermal Resistance 8x8 DFN-4 Θ _{JC}	0.6°C/W

Electrical Characteristics

T_A = 25°C, V_{CC} = 16V, V_{ANODE} = 0V, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V _{RRM}	Repetitive Peak Reverse Voltage	I _{CATHODE} = 250 μA, measure V _{CA}	600			V
R _{DS(ON)}	Static CATHODE-ANODE On-resistance	I _{AC} = 10mA			0.125	Ω
V _{CC_UP}	V _{CC} UVLO Rising	V _{CA} = -0.2V, V _{CC} rising	13.5	15.2	17	V
V _{CC_UVLO}	V _{CC} UVLO Falling	V _{CA} = -0.2V, V _{CC} falling	11	12.9	14	V
I _{Charge}	Charging for V _{CC}	V _{CA} = 30V, V _{CC} = 12V	1			mA
I _{OP}	V _{CC} Operation Current at On-state	V _{CA} = -0.2V		22		μA
I _Q	V _{CC} Quiescent Current at Off-state	V _{CA} = 0.1V		5		μA
V _{CA_ON}	Switch Turn-on Threshold	V _{CA} falling		-110		mV
V _{CA_OFF}	Switch Turn-off Threshold	V _{CA} rising		0.8		mV
V _{SD}	Diode Forward Voltage	V _{CC} = 0V, I _{AC} = 0.2A		0.66		V

Functional Block Diagram



Typical Characteristics

$T_A = 25\text{ }^\circ\text{C}$, $V_{\text{ANODE}} = 0\text{ V}$, $V_{\text{CC}} = 16\text{ V}$, unless otherwise specified.

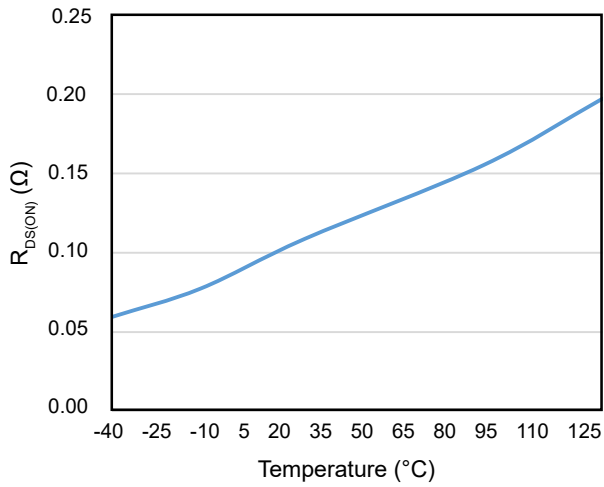


Figure 1. $R_{\text{DS(ON)}}$ vs. Temperature

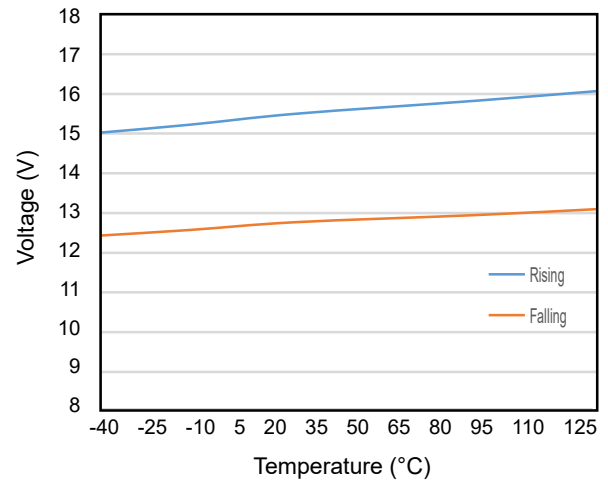


Figure 2. UVLO vs. Temperature

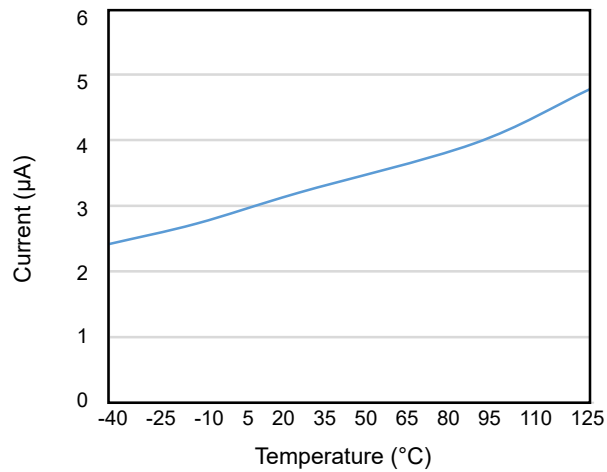


Figure 3. Quiescent Current vs. Temperature

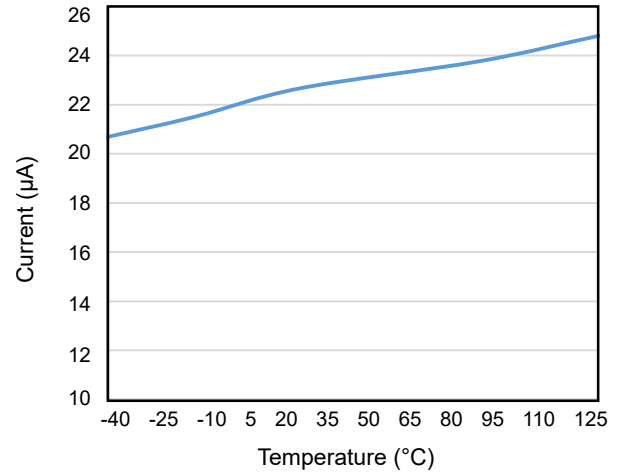


Figure 4. Operation Current vs. Temperature

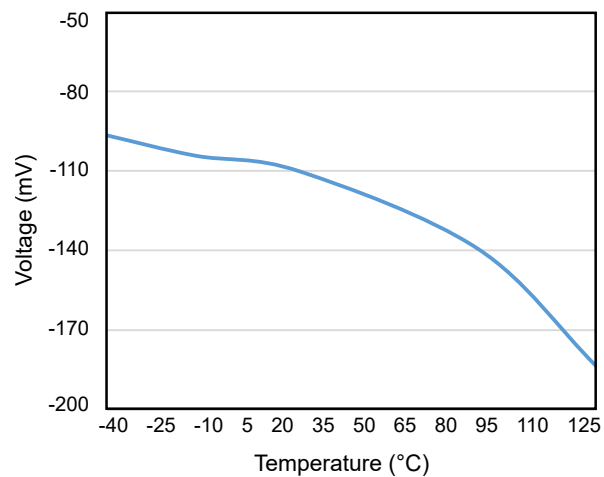


Figure 5. $V_{\text{CA_ON}}$ vs. Temperature

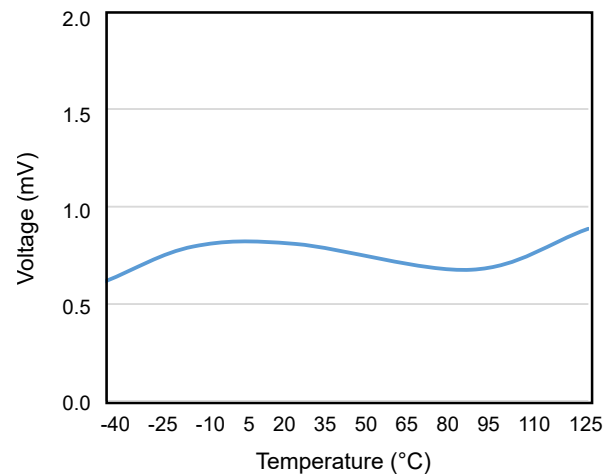


Figure 6. $V_{\text{CA_OFF}}$ vs. Temperature

Detailed Description

The AOZ7271 with a low-voltage capacitor can replace each diode in a high-voltage bridge rectifier application. In normal operation, after V_{CC} is charged to UVLO rising level, AOZ7271 senses the voltage between the CATHODE and ANODE. If the voltage is less than V_{CA_ON} (-110mV typical), the controller turns on the internal switch and the conduction loss is reduced. When the internal switch is on, the controller keeps monitoring the voltage between CATHODE and ANODE. When this voltage is larger than V_{CA_OFF} (0.8mV typical), the controller turns off the switch.

There is a high voltage depletion MOSFET that could help to charge the V_{CC} capacitor. In normal operation, the charging procedure happens at low voltage drop and it helps to reduce the quiescent power. The value of the V_{CC} capacitor is recommended not smaller than $1\mu\text{F}/25\text{V}$ for typical application.

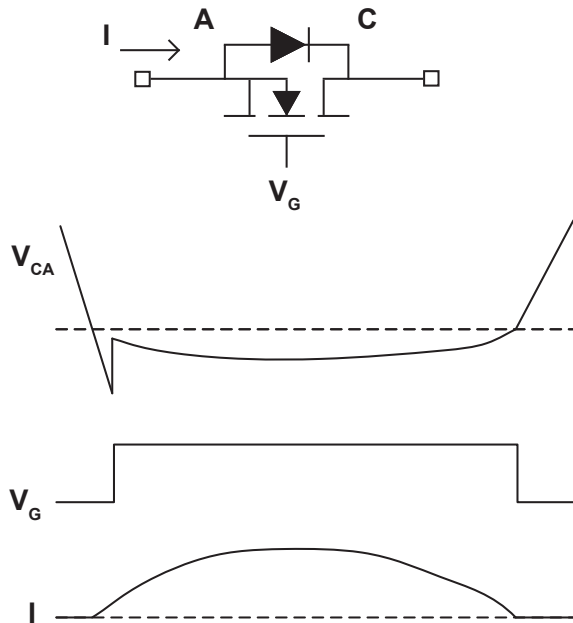


Figure 7. V_{CA} vs Switch Gate

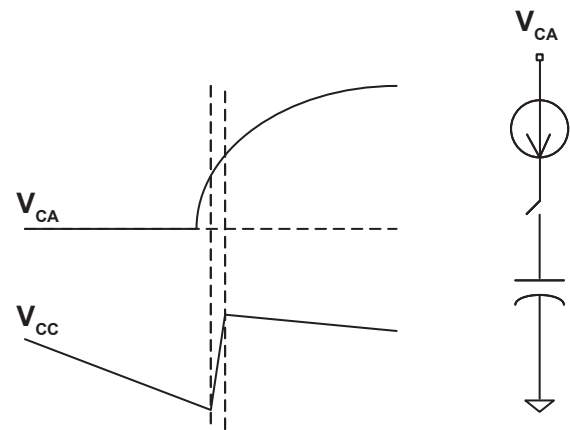


Figure 8. V_{CC} Charging

Application Information

NOTE: The description in this application information section is not part of the AOZ7271DV specification, and AOS does not guarantee its accuracy or totality. Customers should evaluate, test and validate their own implementation in the actual application conditions.

Lightning Surge Test

Test conditions:

- 220 V/60 Hz Input, 90 W adapter (without NTCR), full load
- Common mode lightning surge (L-FG; N-FG): Pass 2.2 kV
- Differential mode lightning surge (L-N): Pass 1.1 kV

Inrush Current Test

Without NTCR, EMI filter, TVS and varistor. Output capacitor is 120 μ F. Peak current > 1.2 kA peak and pulse width TP=100 μ s.

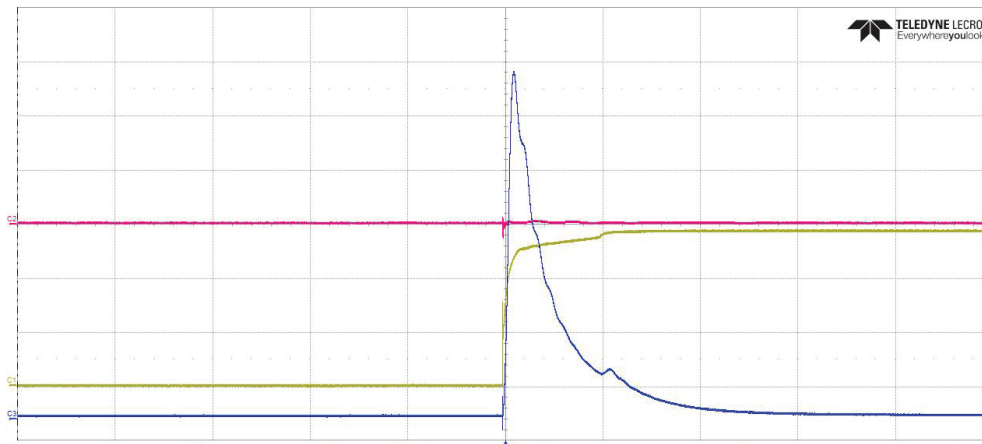


Figure 9. First Time Power On

Repeat inrush current test 10k times with the period of 1 second.

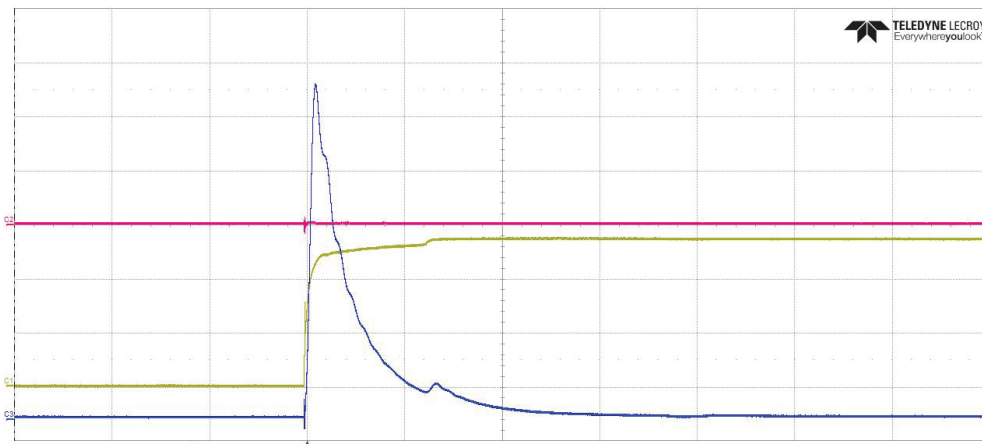


Figure 10. 10k Times Power On

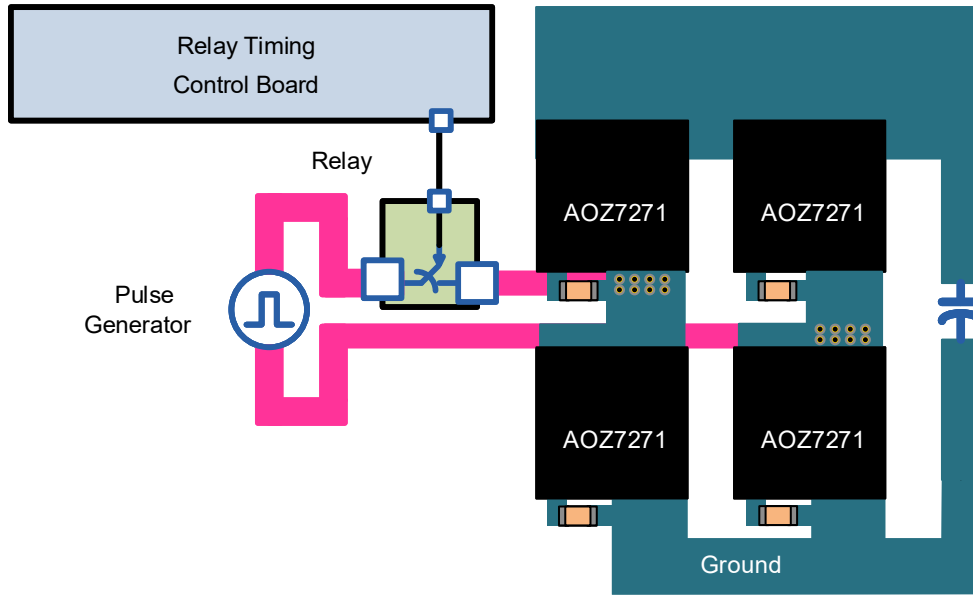


Figure 11. Inrush Test Fixture

Layout Considerations

1. Large copper plane and multi-layer PCB are recommended for cooling.
2. Adding vias on the exposed pad can let heat pass through to other layers easily. For MOSFET temperature characteristic, the AlphaZBL must be as cool as possible.
3. If using diodes and AlphaZBL together, e.g. AlphaZBL on the low side and diodes on the high side, split cooling
4. The below example shows the diodes on the high side and two AlphaZBL on the low side with split cooling areas. The temperature of the two AlphaZBL can be reduced compared to that of the diodes.

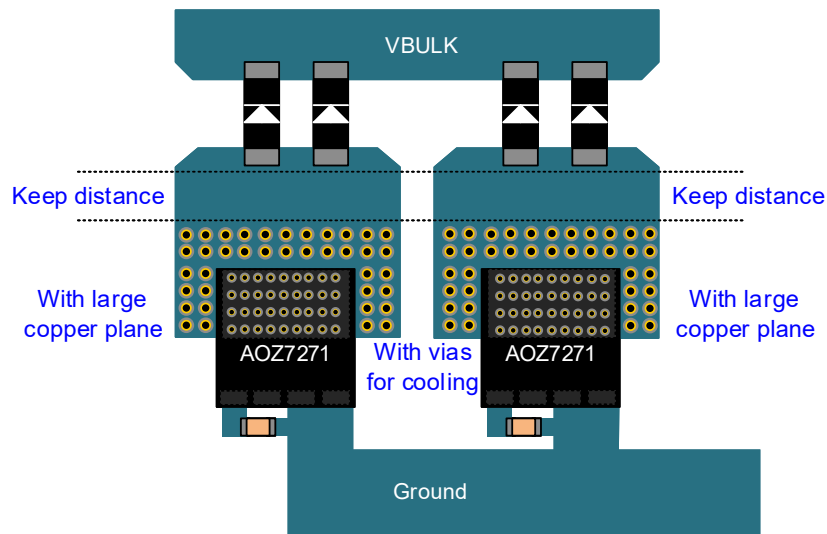
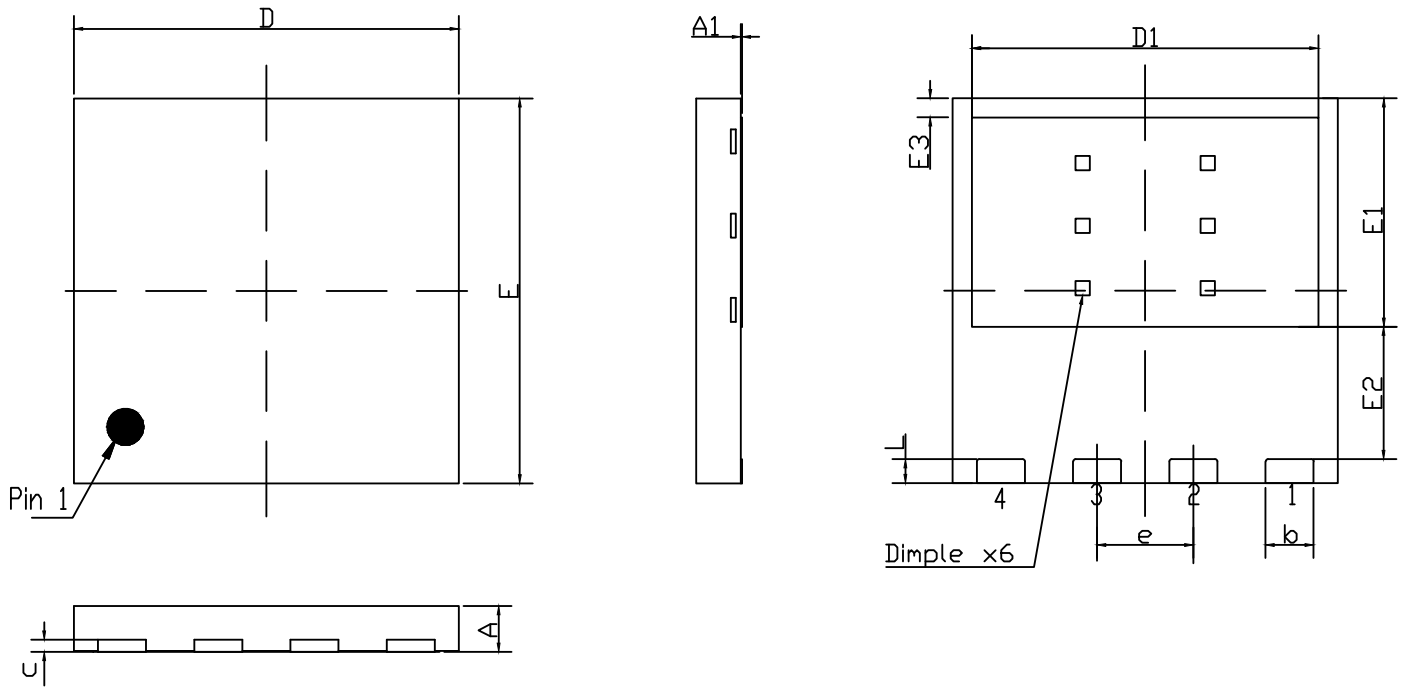
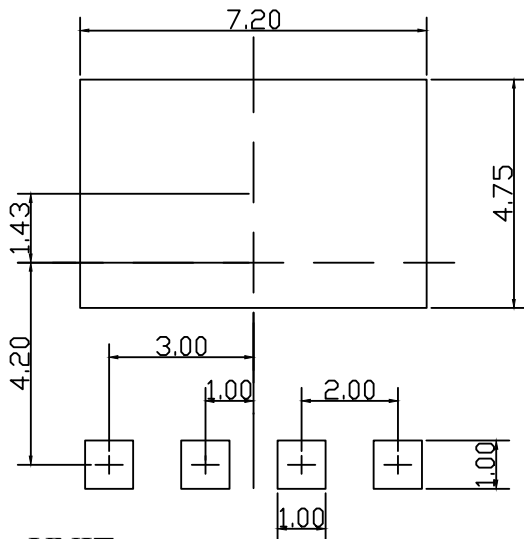


Figure 12. Layout Example Using AOZ7271DV on Low Side and Diodes on High Side

Package Dimensions, DFN8x8-4L



RECOMMENDED LAND PATTERN



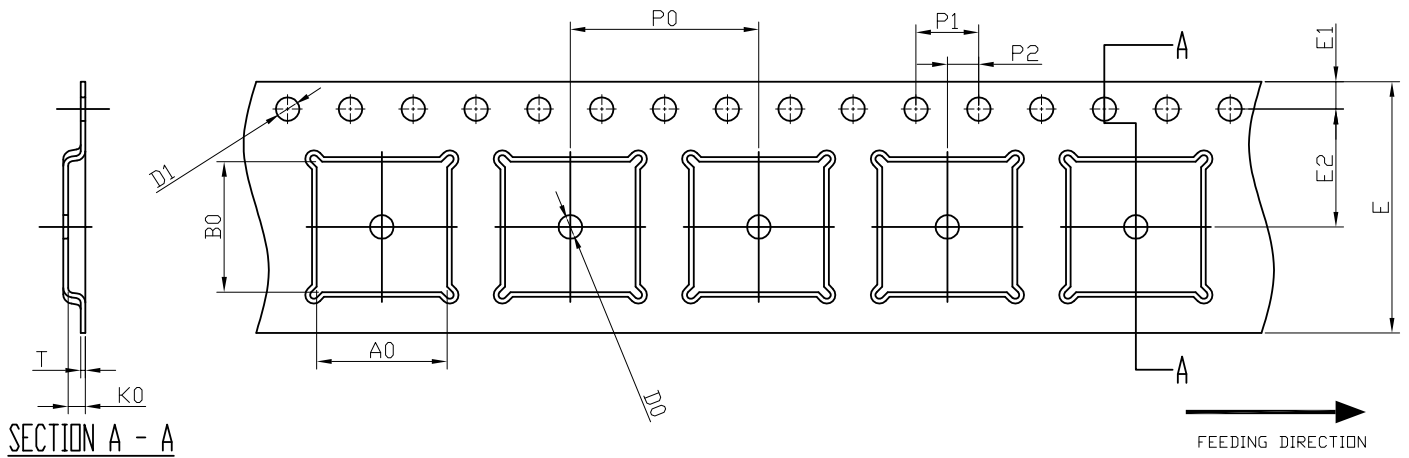
UNIT: mm

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	---	1.10	0.031	---	0.043
A1	0.00	---	0.05	0.000	---	0.002
D	7.90	8.00	8.10	0.311	0.315	0.319
D1	7.10	7.20	7.30	0.279	0.283	0.287
E	7.90	8.00	8.10	0.311	0.315	0.319
E1	4.65	4.75	4.85	0.183	0.187	0.191
E2	2.65	2.75	2.85	0.104	0.108	0.112
E3	0.30	0.40	0.50	0.012	0.016	0.020
b	0.90	1.00	1.10	0.035	0.039	0.043
e	2.00 (BSC)			0.079 (BSC)		
c	0.15	0.25	0.35	0.006	0.010	0.014
L	0.40	0.50	0.60	0.016	0.020	0.024

NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
2. CONTROLLING DIMENSION IS MILLIMETER.
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

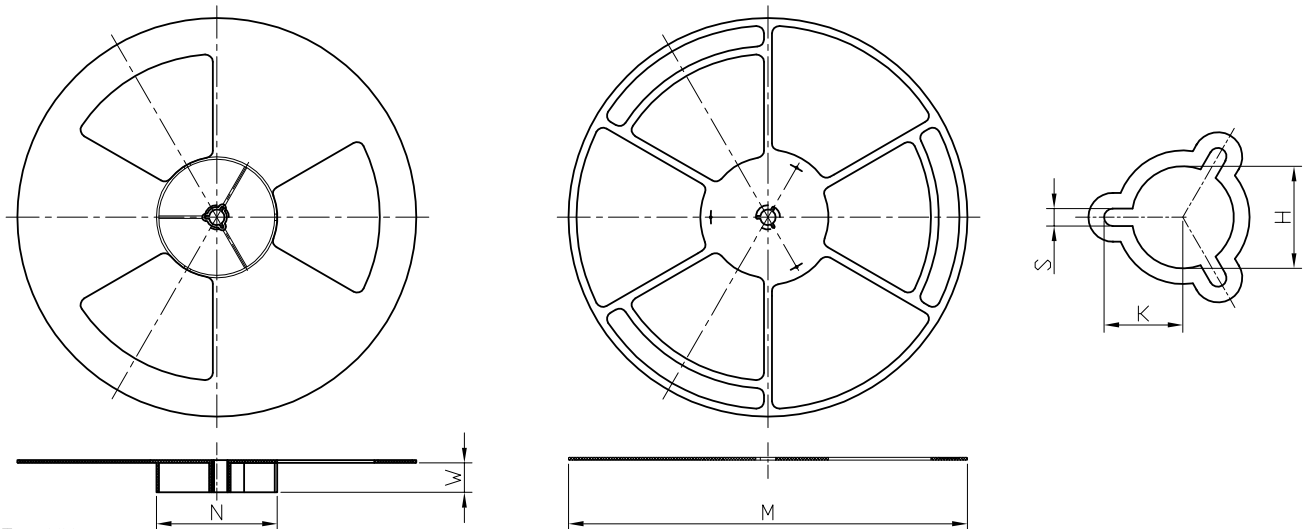
Tape and Reel Dimensions, DFN8x8-4L



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
DFN8x8 (16 mm)	8.30 ±0.10	8.30 ±0.10	1.10 ±0.10	1.50 MIN.	1.50 ^{+0.10} _{0.00}	16.00 ±0.30	1.75 ±0.10	7.50 ±0.10	12.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.30 ±0.10

DFN8x8 4L EP1 S/DFN8x8 8L EP1 S/DFN8x8A 4L EP1 S Reel



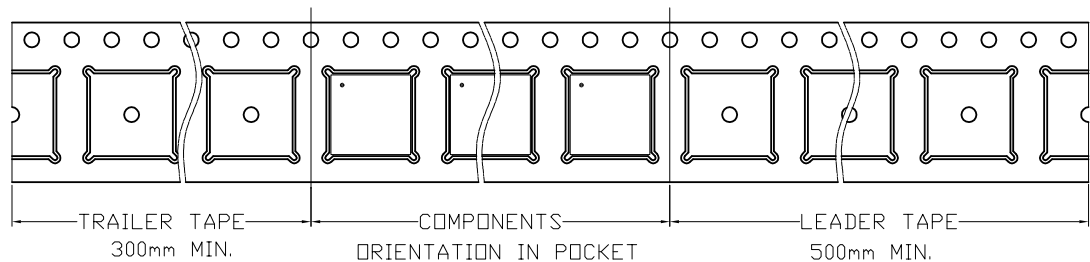
UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	H	K	S
16 mm	ø330	ø330.00 MAX.	ø100.00 MIN.	16.4 +2.0 -0.0	ø13.0 +0.5 -0.2	10.1 MIN.	1.5 MIN.

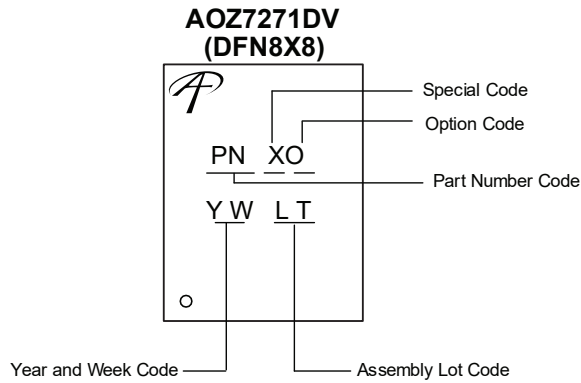
DFN8x8 4L EP1 S/DFN8x8 8L EP1 S/DFN8x8A 4L EP1 S Tape

Leader / Trailer
& Orientation

Unit Per Reel:
3500pcs



Part Marking



Part Number	Description	Code
AOZ7271DV	Green Product	AA00

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.