When selecting the inductor, make sure it is able to handle the peak current without saturation even at the highest operating temperature.

The inductor takes the highest current in a buck circuit. The conduction loss on inductor needs to be checked for thermal and efficiency requirements.

Surface mount inductors in different shape and styles are available from Coilcraft, Elytone and Murata. Shielded inductors are small and radiate less EMI noise. But they cost more than unshielded inductors. The choice depends on EMI requirement, price and size.

Output Capacitor

The output capacitor is selected based on the DC output voltage rating, output ripple voltage specification and ripple current rating.

The selected output capacitor must have a higher rated voltage specification than the maximum desired output voltage including ripple. De-rating needs to be considered for long term reliability.

Output ripple voltage specification is another important factor for selecting the output capacitor. In a buck converter circuit, output ripple voltage is determined by inductor value, switching frequency, output capacitor value and ESR. It can be calculated by the equation below:

$$\Delta V_O = \Delta I_L \times \left(ESR_{CO} + \frac{1}{8 \times f \times C_O}\right)$$

where,

C_O is output capacitor value, and

ESR_{CO} is the equivalent series resistance of the output capacitor.

When low ESR ceramic capacitor is used as output capacitor, the impedance of the capacitor at the switching frequency dominates. Output ripple is mainly caused by capacitor value and inductor ripple current. The output ripple voltage calculation can be simplified to:

$$\Delta V_O = \Delta I_L \times \left(\frac{1}{8 \times f \times C_O}\right)$$

If the impedance of ESR at switching frequency dominates, the output ripple voltage is mainly decided by capacitor ESR and inductor ripple current. The output ripple voltage calculation can be further simplified to:

$$\Delta V_O = \Delta I_L \times ESR_{CO}$$

For lower output ripple voltage across the entire operating temperature range, X5R or X7R dielectric type of ceramic, or other low ESR tantalum capacitor or aluminum electrolytic capacitor may also be used as output capacitors.

In a buck converter, output capacitor current is continuous. The RMS current of output capacitor is decided by the peak to peak inductor ripple current. It can be calculated by:

$$I_{CO\_RMS} = \frac{\Delta I_L}{\sqrt{12}}$$

Usually, the ripple current rating of the output capacitor is a smaller issue because of the low current stress. When the buck inductor is selected to be very small and inductor ripple current is high, output capacitor could be overstressed.

Schottky Diode Selection

The external freewheeling diode supplies the current to the inductor when the high side NMOS switch is off. To reduce the losses due to the forward voltage drop and recovery of diode, Schottky diode is recommended to use. The maximum reverse voltage rating of the chosen Schottky diode should be greater than the maximum input voltage, and the current rating should be greater than the maximum load current.

Thermal Management and Layout Consideration

In the AOZ1282CI-1 buck regulator circuit, high pulsing current flows through two circuit loops. The first loop starts from the input capacitors, to the VIN pin, to the LX pins, to the filter inductor, to the output capacitor and load, and then return to the input capacitor through ground. Current flows in the first loop when the high side switch is on. The second loop starts from inductor, to the output capacitors and load, to the anode of Schottky diode, to the cathode of Schottky diode. Current flows in the second loop when the low side diode is on.

In PCB layout, minimizing the two loops area reduces the noise of this circuit and improves efficiency. A ground plane is strongly recommended to connect input capacitor, output capacitor, and PGND pin of the AOZ1282CI-1.

In the AOZ1282CI-1 buck regulator circuit, the major power dissipating components are the AOZ1282CI-1, the Schottky diode and output inductor. The total power dissipation of converter circuit can be measured by input power minus output power.

$$P_{total\_loss} = (V_{IN} \times I_{IN}) - (V_O \times V_{IN})$$

The power dissipation in Schottky can be approximated as:

$$P_{diode\_loss} = I_O \times (1 - D) \times V_{FW\_Schottky}$$

where,

$V_{FW\_Schottky}$ is the Schottky diode forward voltage drop.

The power dissipation of inductor can be approximately calculated by output current and DCR of inductor.

$$P_{inductor\_loss} = I_O^2 \times R_{inductor} \times 1.1$$

The actual junction temperature can be calculated with power dissipation in the AOZ1282CI-1 and thermal impedance from junction to ambient.

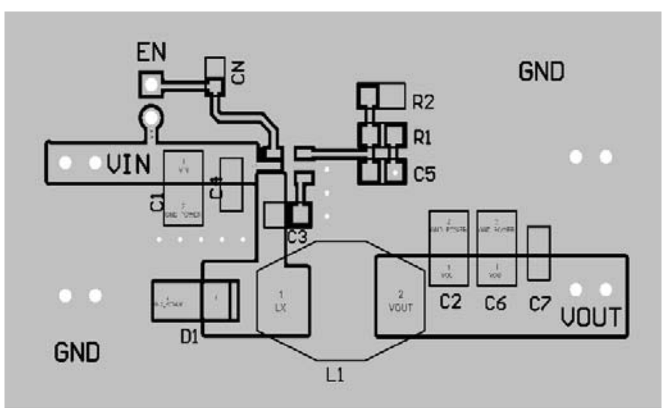
$$T_{junction} = \frac{(P_{total\_loss} - P_{diode\_loss} - P_{inductor\_loss})}{\theta_{JA} + T_{ambient}}$$

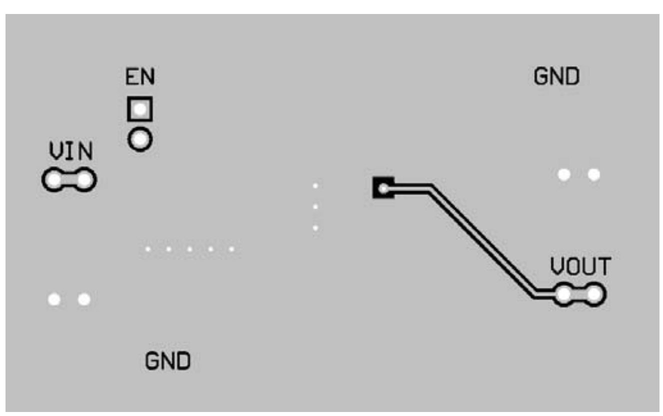
The maximum junction temperature of AOZ1282CI-1 is 150ºC, which limits the maximum load current capability.

The thermal performance of the AOZ1282CI-1 is strongly affected by the PCB layout. Extra care should be taken by users during design process to ensure that the IC will operate under the recommended environmental conditions.

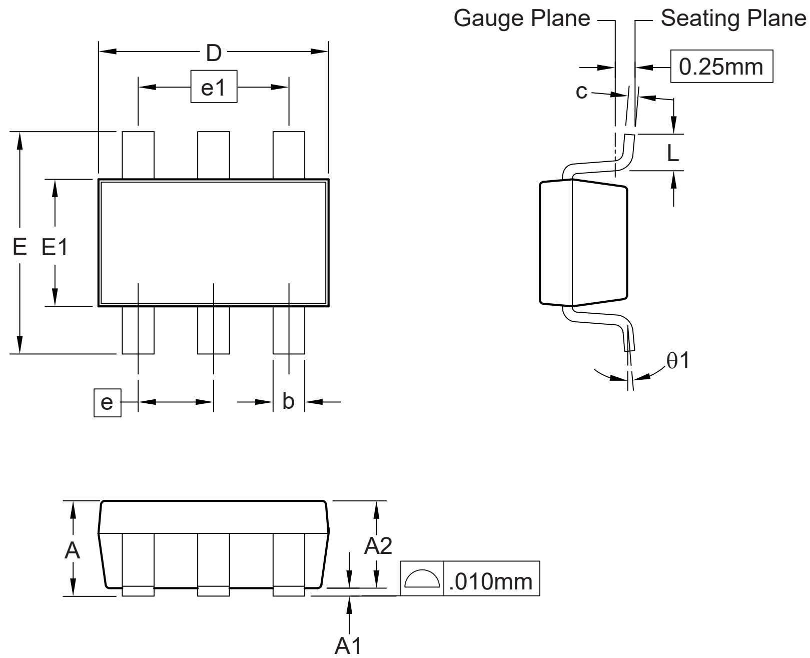
Several layout tips are listed below for the best electric and thermal performance.

1. The input capacitor should be connected as close as possible to the VIN pin and the GND pin.
2. The inductor should be placed as close as possible to the LX pin and the output capacitor.
3. Keep the connection of the schottky diode between the LX pin and the GND pin as short and wide as possible.
4. Place the feedback resistors and compensation components as close to the chip as possible.
5. Keep sensitive signal traces away from the LX pin.
6. Pour a maximized copper area to the VIN pin, the LX pin and especially the GND pin to help thermal dissipation.
7. Pour a copper plane on all unused board area and connect the plane to stable DC nodes, like VIN, GND or VOUT.

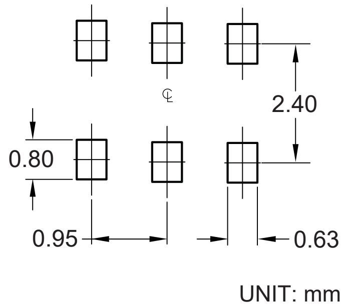




Package Dimensions, SOT23-6



RECOMMENDED LAND PATTERN



Dimensions in millimeters

Symbols	Min.	Nom.	Max.
A	0.80	—	1.25
A1	0.00	—	0.15
A2	0.70	1.10	1.20
b	0.30	0.40	0.50
c	0.08	0.13	0.20
D	2.70	2.90	3.10
E	2.50	2.80	3.10
E1	1.50	1.60	1.70
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	—	0.60
θ1	0°	—	8°

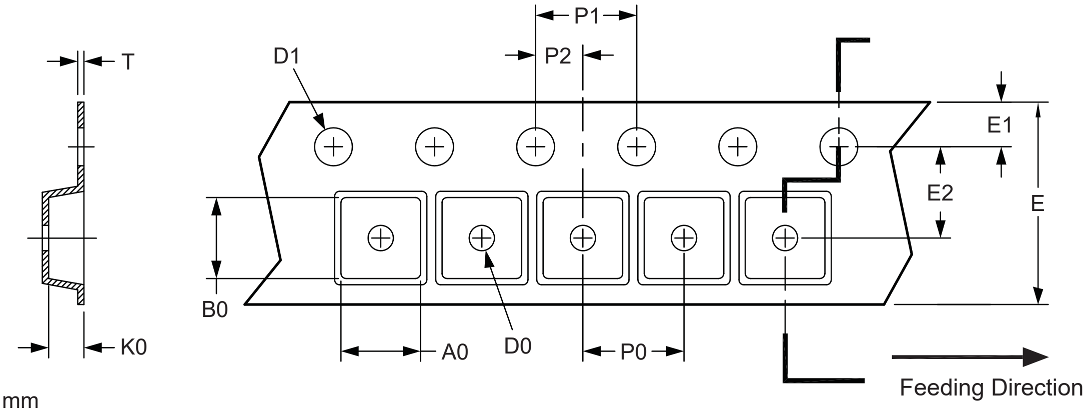
Dimensions in inches

Symbols	Min.	Nom.	Max.
A	0.031	—	0.049
A1	0.000	—	0.006
A2	0.028	0.043	0.047
b	0.012	0.016	0.020
c	0.003	0.005	0.008
D	0.106	0.114	0.122
E	0.098	0.110	0.122
E1	0.059	0.063	0.067
e	0.037 BSC		
e1	0.075 BSC		
L	0.012	—	0.024
θ1	0°	—	8°

Notes:
1. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils each.
2. Dimension “L” is measured in gauge plane.
3. Tolerance ±0.100 mm (4 mil) unless otherwise specified.
4. Followed from JEDEC MO-178C & MO-193C.
5. Controlling dimension is millimeter. Converted inch dimensions are not necessarily exact.

Tape and Reel Dimensions, SOT23-6

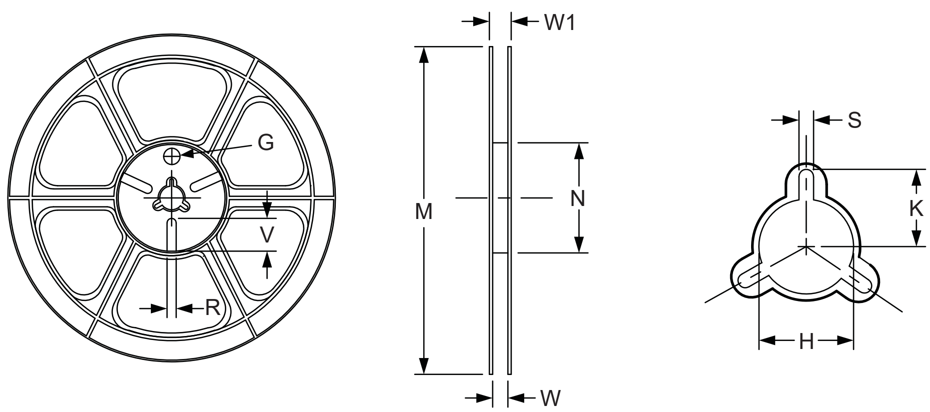
Tape



Unit: mm

Package	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SOT-23	3.15 ±0.10	3.27 ±0.10	1.34 ±0.10	1.10 ±0.01	1.50 ±0.10	8.00 ±0.20	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.25 ±0.05

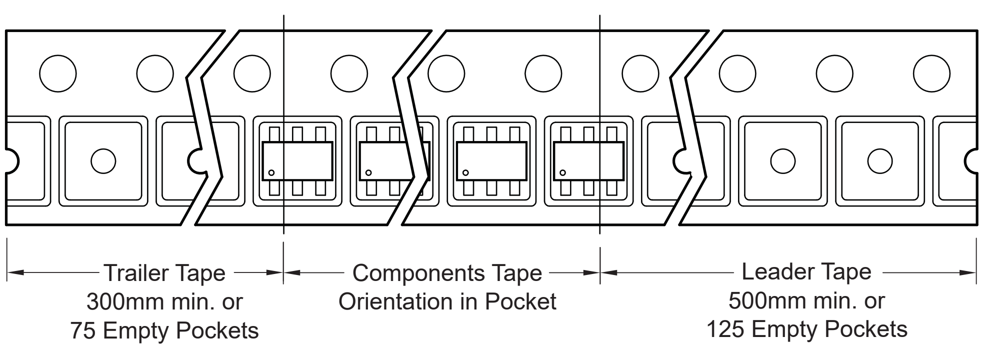
Reel



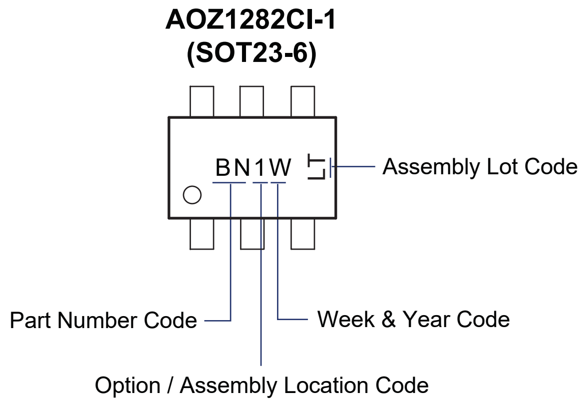
Unit: mm

Tape Size	Reel Size	M	N	W	W1	H	K	S	G	R	V
8 mm	ø180	ø180.00 ±0.50	ø60.50 Min.	9.00 ±0.30	11.40 ±1.0	ø13.00 +0.50 / -0.20	10.60	2.00 ±0.50	ø9.00	5.00	18.00

Leader/Trailer and Orientation



Part Marking



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