

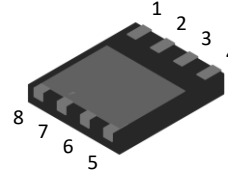
# Silicon Carbide Merged PN-Schottky Diode

## 650V SiC MPS High Speed Rectifier – Cheetah Series

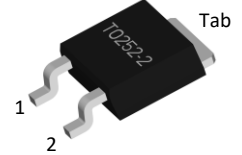


### Product Information:

Cathode  Anode



**PQFN 5 x 6**



**TO-252-2L**

### Features

- Low Capacitive Charge ( $Q_C$ )
- Low Profile & Low Parasitic Inductance Packaging
- Zero Reverse Recovery and zero Forward Recovery
- Ultra-Low Switching Loss
- Optimized for High Speed Applications
- Compact MSL-1 SMT Package
- RoHS Compliant and Halogen Free

| Terminal | Packaging Type |            |
|----------|----------------|------------|
|          | TO-252-2L      | PQFN 5x6   |
| Anode    | 2              | 1, 2, 3    |
| Cathode  | 1, Tab         | 5, 6, 7, 8 |
| N.C.     | --             | 4          |

### Benefits

- Higher System Efficiency
- Increase Parallel Device Convenience
- Enable High Temperature Application
- Allow High Frequency Operation
- Realize Compact and Lightweight Systems
- High Reliability

### Potential Applications

- Switching Mode Power Supply
- Power Factor Correction
- Portable Adaptor
- Renewable Energy

### Key Performance Parameters

| Parameter                      | Symbol             | Value      | Unit             |
|--------------------------------|--------------------|------------|------------------|
| DC Blocking Voltage            | $V_R$              | 650        | V                |
| Nominal Forward Current        | $I_{F,NOM}$        | 6          | A                |
| Total Capacitive Charge        | $Q_C$              | 10         | nC               |
| Capacitance Stored Energy      | $E_C$              | 1.5        | $\mu$ J          |
| Junction & Storage Temperature | $T_J, T_{stg}$     | -55 to 175 | $^{\circ}$ C     |
| <b>TO-252-2L</b>               |                    |            |                  |
| Continuous Forward Current     | $I_{F,max(cont.)}$ | 11.8       | A                |
| $I^2t$ Value                   | $\int i^2 dt$      | 1.4        | A <sup>2</sup> s |
| Power Dissipation              | $P_{tot}$          | 36         | W                |
| <b>PQFN 5x6</b>                |                    |            |                  |
| Continuous Forward Current     | $I_{F,max(cont.)}$ | 11.7       | A                |
| $I^2t$ Value                   | $\int i^2 dt$      | 1.2        | A <sup>2</sup> s |
| Power Dissipation              | $P_{tot}$          | 33         | W                |

| Part Number | Package    | Marking |
|-------------|------------|---------|
| FC06006A    | TO-252-2L  | FC06006 |
| FC06006B    | PQFN 5 x 6 | FC06006 |
| --          | --         | --      |

For further information about comparable products, please contact ([www.fastsic.com](http://www.fastsic.com)).

## Maximum Ratings:

| Parameter                                                 | Symbol        | Min. | Typ. | Max.             | Unit             | Test Conditions                                                                                                                |
|-----------------------------------------------------------|---------------|------|------|------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>TO-252-2L</b>                                          |               |      |      |                  |                  |                                                                                                                                |
| Continuous Forward Current                                | $I_F$         | --   | --   | 6<br>9.5<br>11.8 | A                | $T_c \leq 128^\circ\text{C}$ , Duty=100%<br>$T_c \leq 75^\circ\text{C}$ , Duty=100%<br>$T_c \leq 25^\circ\text{C}$ , Duty=100% |
| Non-Repetitive Forward Surge Current, Sinusoidal Halfwave | $I_{F,SM}$    | --   | --   | 17               |                  | $T_c = 25^\circ\text{C}$ , $t_p = 10\text{ms}$                                                                                 |
| Non-Repetitive Peak Forward Surge Current                 | $I_{F,max}$   | --   | --   | 173              |                  | $T_c = 25^\circ\text{C}$ , $t_p = 10\mu\text{s}$                                                                               |
| $I^2t$ Value                                              | $\int i^2 dt$ | --   | --   | 1.4              | A <sup>2</sup> s | $T_c = 25^\circ\text{C}$ , $t_p = 10\text{ms}$                                                                                 |
| <b>PQFN 5x6</b>                                           |               |      |      |                  |                  |                                                                                                                                |
| Continuous Forward Current                                | $I_F$         | --   | --   | 6<br>9<br>11.7   | A                | $T_c \leq 126^\circ\text{C}$ , Duty=100%<br>$T_c \leq 75^\circ\text{C}$ , Duty=100%<br>$T_c \leq 25^\circ\text{C}$ , Duty=100% |
| Non-Repetitive Forward Surge Current, Sinusoidal Halfwave | $I_{F,SM}$    | --   | --   | 16               |                  | $T_c = 25^\circ\text{C}$ , $t_p = 10\text{ms}$                                                                                 |
| Non-Repetitive Peak Forward Surge Current                 | $I_{F,max}$   | --   | --   | 158              |                  | $T_c = 25^\circ\text{C}$ , $t_p = 10\mu\text{s}$                                                                               |
| $I^2t$ Value                                              | $\int i^2 dt$ | --   | --   | 1.2              | A <sup>2</sup> s | $T_c = 25^\circ\text{C}$ , $t_p = 10\text{ms}$                                                                                 |
| Repetitive Peak Reverse Voltage                           | $V_{RRM}$     | --   | --   | 650              | V                | $T_c = 25^\circ\text{C}$                                                                                                       |
| Power Dissipation                                         | $P_{tot}$     | --   | --   | 36               | W                | $T_c = 25^\circ\text{C}$ (TO-252-2L)                                                                                           |
|                                                           |               | --   | --   | 33               |                  | $T_c = 25^\circ\text{C}$ (PQFN 5x6)                                                                                            |
| Junction Temperature                                      | $T_j$         | -55  | --   | 175              | °C               | --                                                                                                                             |
| Storage Temperature                                       | $T_{stg}$     | -55  | --   | 175              |                  |                                                                                                                                |
| Soldering Temperature                                     | $T_L$         | --   | --   | 260              |                  |                                                                                                                                |

## Electrical Characteristics:

| Parameter                 | Symbol   | Min. | Typ.         | Max.       | Unit          | Test Conditions                                                                                   |
|---------------------------|----------|------|--------------|------------|---------------|---------------------------------------------------------------------------------------------------|
| <b>DC Characteristics</b> |          |      |              |            |               |                                                                                                   |
| DC Blocking Voltage       | $V_{DC}$ | 650  | --           | --         | V             | $T_j = 25^\circ\text{C}$                                                                          |
| Forward Voltage           | $V_F$    | --   | 1.50<br>1.90 | 1.85<br>-- |               | $I_F = 6\text{A}$ , $T_j = 25^\circ\text{C}$<br>$I_F = 6\text{A}$ , $T_j = 175^\circ\text{C}$     |
|                           |          |      | 0.8<br>9     | 36<br>--   |               | $V_R = 520\text{V}$ , $T_j = 25^\circ\text{C}$<br>$V_R = 520\text{V}$ , $T_j = 175^\circ\text{C}$ |
| Reverse Current           | $I_R$    | --   | 0.8<br>9     | 36<br>--   | $\mu\text{A}$ | $V_R = 520\text{V}$ , $T_j = 25^\circ\text{C}$<br>$V_R = 520\text{V}$ , $T_j = 175^\circ\text{C}$ |
| <b>AC Characteristics</b> |          |      |              |            |               |                                                                                                   |
| Total Capacitive Charge   | $Q_C$    | --   | 10           | --         | nC            | $V_R = 400\text{V}$ , $T_j = 25^\circ\text{C}$                                                    |
| Total Capacitance         | $C_j$    | --   | 173          | --         | pF            | $V_R = 1\text{V}$ , $f = 1\text{MHz}$ , $T_j = 25^\circ\text{C}$                                  |
|                           |          |      | 19           |            |               | $V_R = 200\text{V}$ , $f = 1\text{MHz}$ , $T_j = 25^\circ\text{C}$                                |
|                           |          |      | 15           |            |               | $V_R = 400\text{V}$ , $f = 1\text{MHz}$ , $T_j = 25^\circ\text{C}$                                |
| Capacitance Stored Energy | $E_C$    | --   | 1.5          | --         | $\mu\text{J}$ | $V_R = 400\text{V}$ , $T_j = 25^\circ\text{C}$                                                    |

## Thermal Characteristics:

| Parameter                                      | Symbol      | Min. | Typ. | Max. | Unit | Test Conditions                                       |
|------------------------------------------------|-------------|------|------|------|------|-------------------------------------------------------|
| Thermal Impedance, junction – case (TO-252-2L) | $R_{th-jc}$ | --   | 4.2  | --   | K/W  | --                                                    |
| Thermal Impedance, junction – case (PQFN 5x6)  | $R_{th-jc}$ | --   | 4.3  | --   |      | --                                                    |
| Thermal Impedance, junction – ambient          | $R_{th-ja}$ | --   |      |      |      | Device on PCB, with 6 cm <sup>2</sup> of cooling area |

## Electrical Characteristics Diagrams

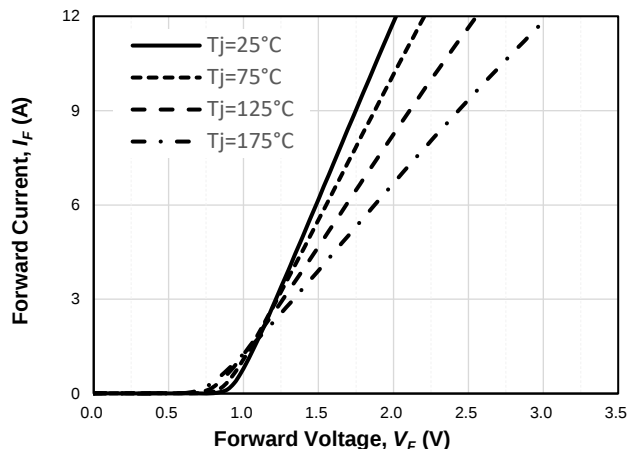


Fig. 1 Forward Characteristics

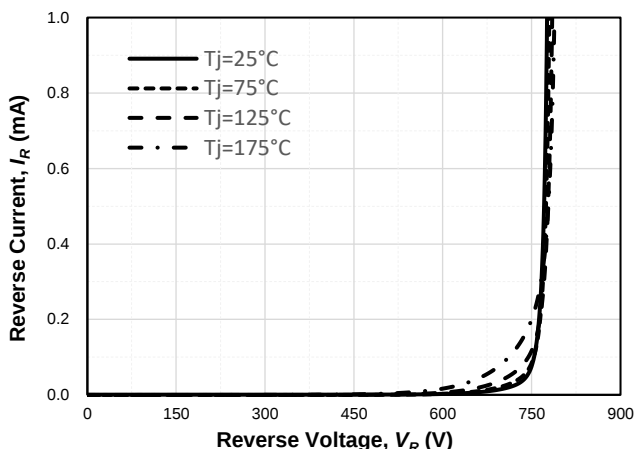


Fig. 2 Reverse Characteristics

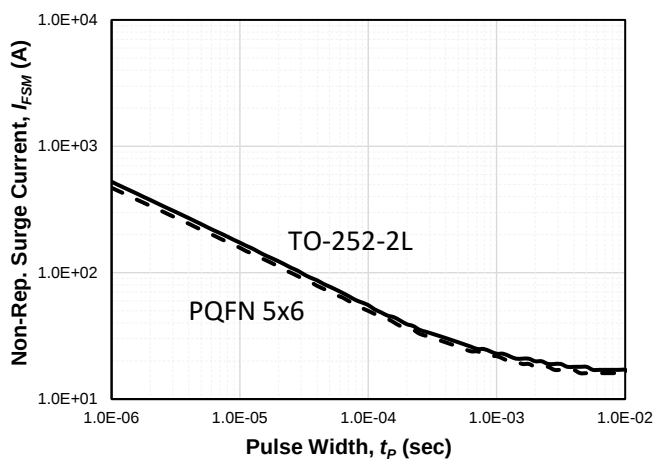


Fig. 3 Non-repetitive Peak Forward Surge Current vs. Pulse Width

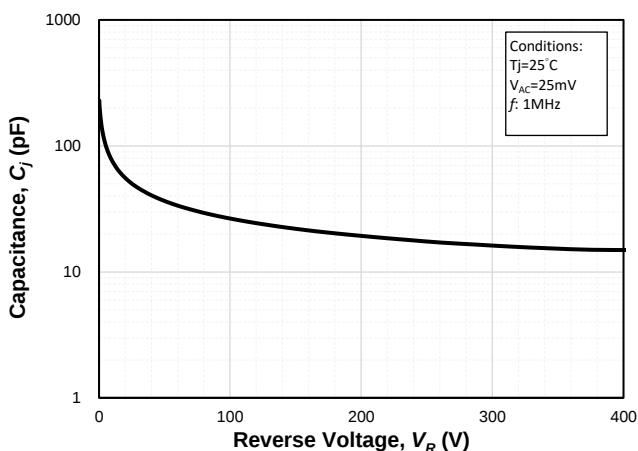


Fig. 4 Capacitance vs. Reverse Voltage

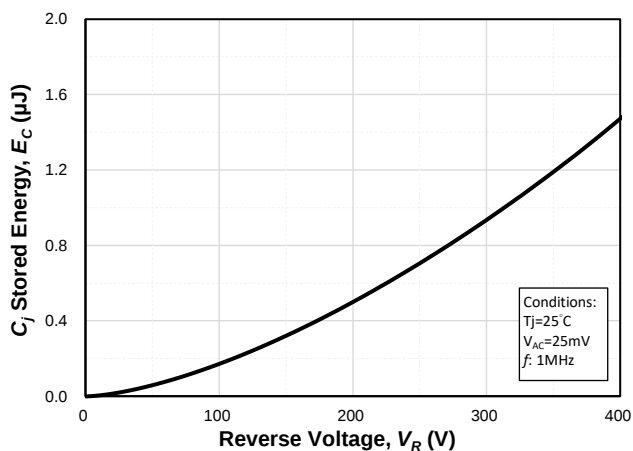


Fig. 5 Capacitance Stored Energy vs. Reverse Voltage

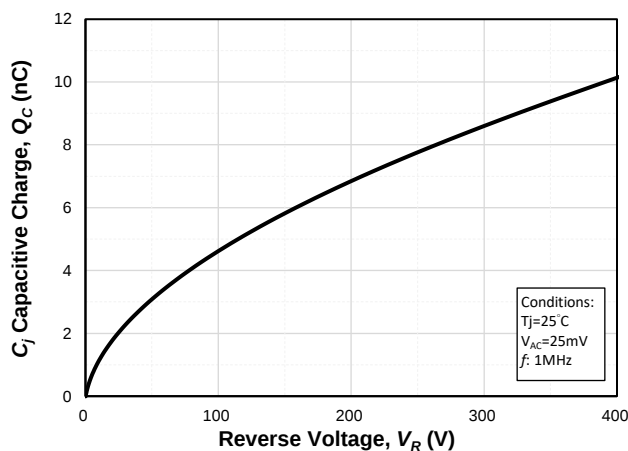


Fig. 6 Capacitive Charge vs. Reverse Voltage

## Electrical Characteristics Diagrams

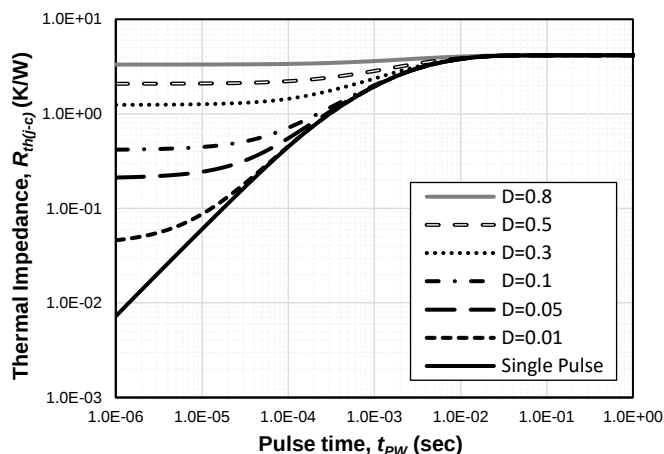


Fig. 7 Typ. Transient Thermal Impedance  $R_{th-jc}$  (TO-252-2L)

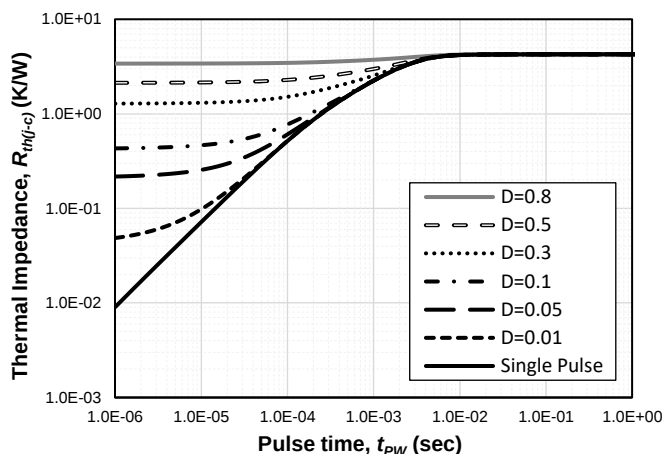


Fig. 8 Typ. Transient Thermal Impedance  $R_{th-jc}$  (PQFN 5x6)

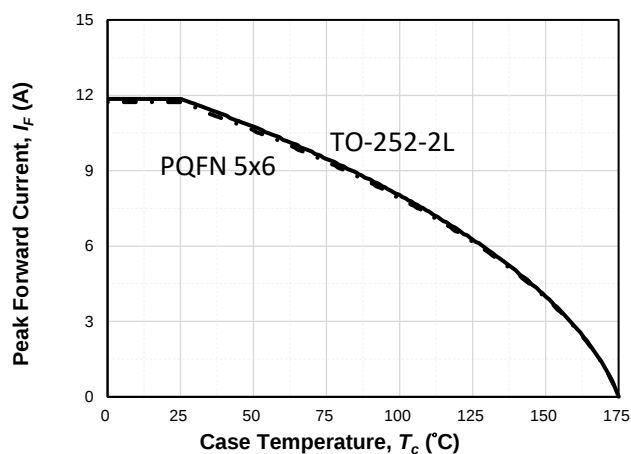


Fig. 9 Continuous  $I_F$  De-rating

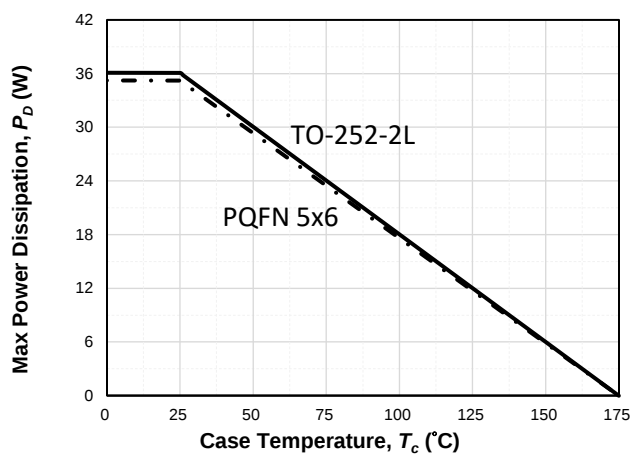
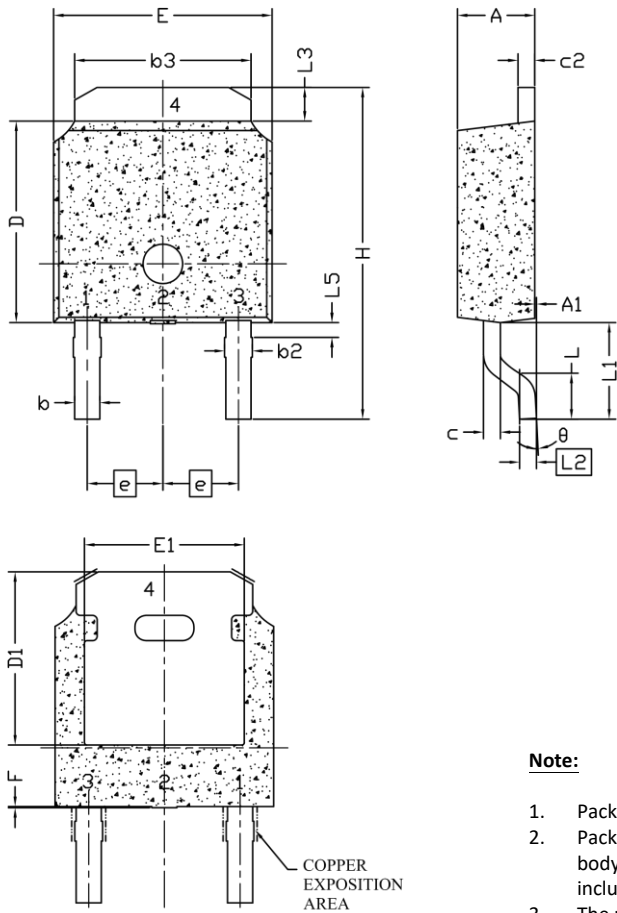


Fig. 10 Power Dissipation

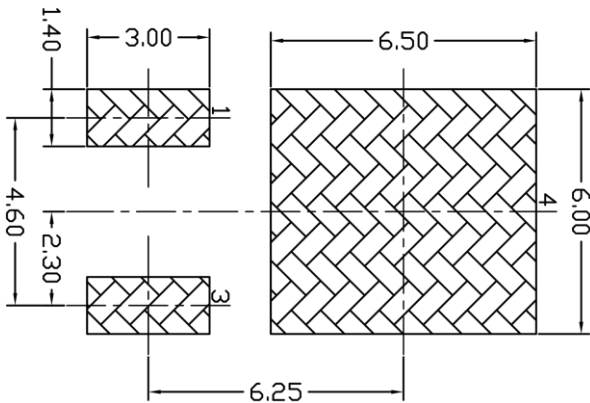
Package Outline (TO-252-2L)



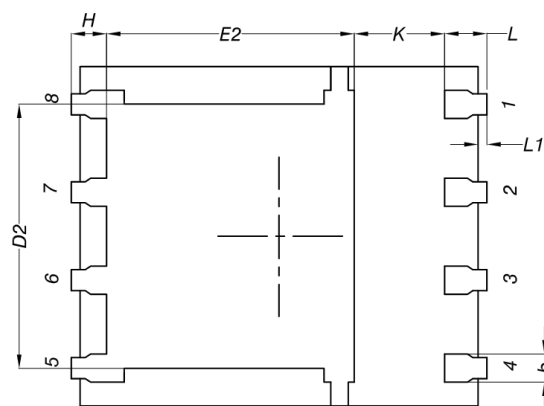
| Symbol | Dimension (Millimeters) |       |       |
|--------|-------------------------|-------|-------|
|        | Min.                    | Nom.  | Max.  |
| E      | 6.40                    | 6.60  | 6.73  |
| L      | 1.40                    | 1.52  | 1.77  |
| L1     | 2.743 REF.              |       |       |
| L2     | 0.508 BSC.              |       |       |
| L3     | 0.89                    | --    | 1.27  |
| L5     | --                      | --    | --    |
| D      | 6.00                    | 6.10  | 6.22  |
| H      | 9.40                    | 10.00 | 10.40 |
| b      | 0.64                    | 0.76  | 0.88  |
| b2     | 0.77                    | 0.84  | 1.14  |
| b3     | 5.21                    | 5.34  | 5.46  |
| e      | 2.286 BSC.              |       |       |
| A      | 2.20                    | 2.30  | 2.38  |
| A1     | 0.00                    | --    | 0.127 |
| c      | 0.46                    | 0.50  | 0.60  |
| c2     | 0.46                    | 0.50  | 0.58  |
| D1     | 5.21                    | --    | --    |
| E1     | 4.40                    | --    | --    |
| F      | --                      | --    | 0.45  |
| θ      | 0°                      | --    | 10°   |

- Note:**
1. Package body sizes exclude mold flash, protrusion, or gate burrs.
  2. Package body sizes determined at the outermost extremes of the plastic body exclusive of mold flash, gate burrs, and inter-lead flash, but including any mismatch between the top and bottom of the plastic body.
  3. The package top may be smaller than the package bottom.
  4. Dimension “b” does not include dambar protrusion. Allowable dambar protrusion shall be 0.1 mm total in excess of “b” dimension at the maximum material condition. The dambar cannot be located on the lower radius of the foot.
  5. Dimension “F” is mold flash.

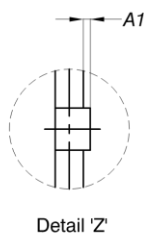
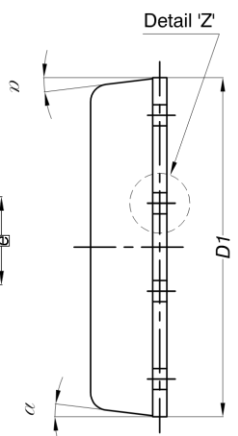
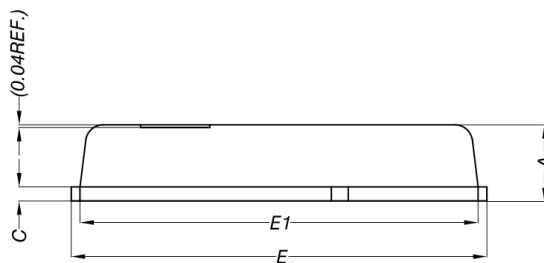
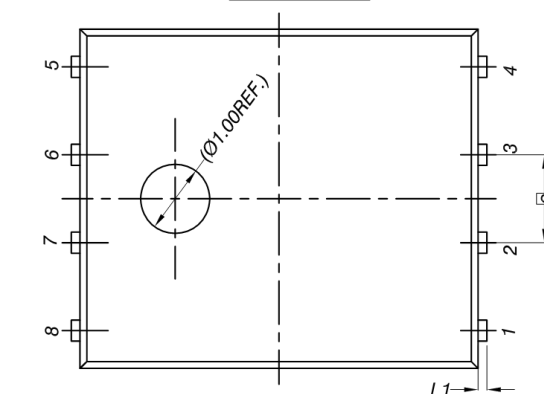
Land Pattern (Only for Reference)



## Package Outline (PQFN 5x6)



BACKSIDE VIEW

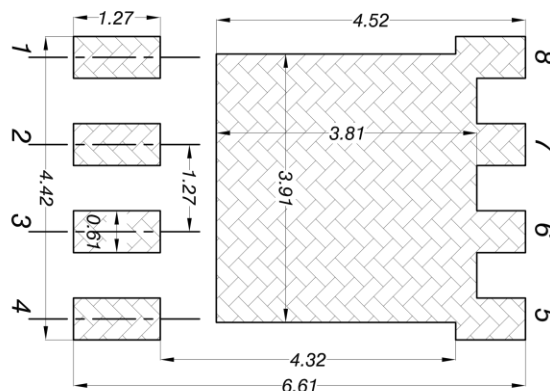


| Symbol | Dimension (Millimeters) |      |      |
|--------|-------------------------|------|------|
|        | Min.                    | Nom. | Max. |
| A      | 0.90                    | 1.00 | 1.10 |
| A1     | 0                       | --   | 0.05 |
| b      | 0.33                    | 0.41 | 0.51 |
| C      | 0.20                    | 0.25 | 0.30 |
| D1     | 4.80                    | 4.90 | 5.00 |
| D2     | 3.61                    | 3.81 | 3.96 |
| E      | 5.90                    | 6.00 | 6.10 |
| E1     | 5.70                    | 5.75 | 5.80 |
| E2     | 3.38                    | 3.58 | 3.78 |
| e      | 1.27 BSC.               |      |      |
| H      | 0.41                    | 0.51 | 0.61 |
| K      | 1.10                    | --   | --   |
| L      | 0.51                    | 0.61 | 0.71 |
| L1     | 0.06                    | 0.13 | 0.20 |
| α      | 0°                      | --   | 12°  |
|        |                         |      |      |

**Note:**

1. Package body sizes exclude mold flash, protrusion, or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 0.10 mm per side
2. Package body sizes determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar, tie bar burrs, gate burrs, and inter-lead flash, but including any mismatch between the top and bottom of the plastic body.
3. The package top may be smaller than the package bottom.

### Land Pattern (Only for Reference)



## Revision History

| Date  | Revision     | Changes               |
|-------|--------------|-----------------------|
| 21.10 | Preliminary  | 1 <sup>st</sup> issue |
| 22.07 | Revision 1.0 | Revision to 1.0       |
| 23.08 | Revision 1.1 | Minor change for typo |
|       |              |                       |

## Important Note (Disclaimer)

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