# 5-Line ESD-Protection Diode Array in LLP75-6A

## Features

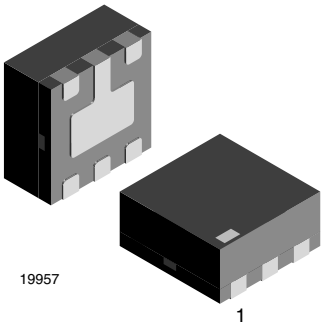
- Ultra compact LLP75-6A package
- 5-line ESD-protection
- Low leakage current $I_R$ < 0.1 µA
- Low load capacitance of typ. 43 pF at $V_R$ = 0 V
- ESD-immunity acc. IEC 61000-4-2
  ± 30 kV contact discharge
  ± 30 kV air discharge
- Working voltage range $V_{RWM}$ = 5 V
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

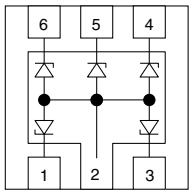
Pb-free

e3

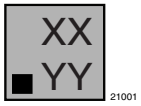
RoHS COMPLIANT

GREEN (5-2008)*




## Marking (example only)




Dot = Pin 1 marking
XX = Date code
YY = Type code (see table below)

## Ordering Information

| Device name | Ordering code | Taped units per reel (8 mm tape on 7" reel) | Minimum order quantity |
|---|---|---|---|
| GMF05LC-HS3 | GMF05LC-HS3-GS08 | 3000 | 15000 |

## Package Data

| Device name | Package name | Type code | Weight | Molding compound flammability rating | Moisture sensitivity level | Soldering conditions |
|---|---|---|---|---|---|---|
| GMF05LC-HS3 | LLP75-6A | F6 | 5.1 mg | UL 94 V-0 | MSL level 1 (according J-STD-020) | 260 °C/10 s at terminals |

## Absolute Maximum Ratings

| Rating | Test condition | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Peak pulse current | BiAs-mode: each input (pin 1; 3 - pin 6) to ground (pin 2); acc. IEC 61000-4-5; $t_p$ = 8/20 µs; single shot | | $I_{PPM}$ | 5 | A |
| Peak pulse power | BiAs-mode: each input (pin 1; 3 - pin 6) to ground (pin 2); acc. IEC 61000-4-5; $t_p$ = 8/20 µs; single shot | | $P_{PP}$ | 70 | W |
| ESD-immunity | acc. IEC61000-4-2; 10 pulses BiAs-mode: each input (pin 1; 3 - pin 6) to ground (pin 2) | contact discharge | $V_{ESD}$ | ± 30 | kV |
| | | air discharge | $V_{ESD}$ | ± 30 | kV |
| Operating temperature | Junction temperature | | $T_J$ | - 55 to + 125 | °C |
| Storage temperature | | | $T_{STG}$ | - 55 to + 150 | °C |

* Please see document “Vishay Green and Halogen-Free Definitions (5-2008)” http://www.vishay.com/doc?99902

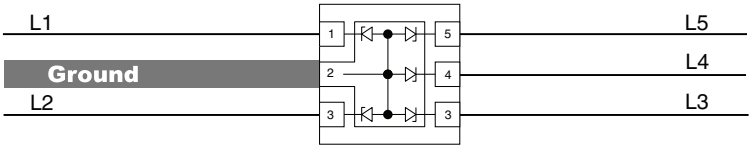
## BiAs-Mode (5-line Bidirectional Asymmetrical protection mode)

With the **GMF05LC-HS3** up to 5 signal- or data-lines (L1 - L5) can be protected against voltage transients. With pin 2 connected to ground and pin 1; 3 up tp pin 6 connected to a signal- or data-line which has to be protected. As long as the voltage level on the data- or signal-line is between 0 V (ground level) and the specified **M**aximum **R**everse **W**orking **V**oltage ($V_{RWM}$) the protection diode between data line and ground offer a high isolation to the ground line. The protection device behaves like an open switch.

As soon as any positive transient voltage signal exceeds the break through voltage level of the protection diode, the diode becomes conductive and shorts the transient current to ground. Now the protection device behaves like a closed switch. The **C**lamping **V**oltage ($V_C$) is defined by the **BR**eakthrough **V**oltage ($V_{BR}$) level plus the voltage drop at the series impedance (resistance and inductance) of the protection device.

Any negative transient signal will be clamped accordingly. The negative transient current is flowing in the forward direction of the protection diode. The low **F**orward **V**oltage ($V_F$) clamps the negative transient close to the ground level.

Due to the different clamping levels in forward and reverse direction the **GMF05LC-HS3** clamping behaviour is **Bi**directional and **As**ymmetrical (**BiAs**).

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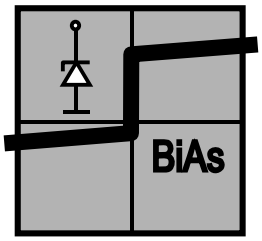



## Electrical Characteristics

Ratings at 25 °C ambient temperature, unless otherwise specified

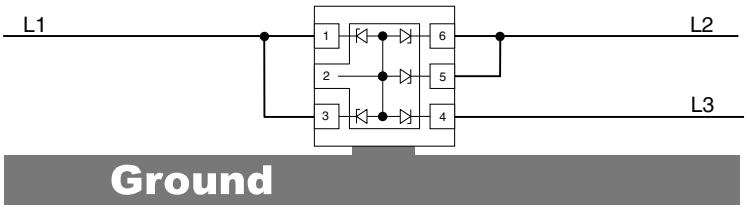
### GMF05LC-HS3

**BiAs mode: each input (pin 1, 3, 4, 5, 6) to ground (pin 2)**

| Parameter | Test conditions/remarks | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Protection paths | number of line which can be protected | N lines | | | 5 | lines |
| Reverse stand-off voltage | at $I_R$ = 1 µA | $V_{RWM}$ | 5 | | | V |
| Reverse current | at $V_R = V_{RWM}$ = 5 V | $I_R$ | | 0.01 | 0.1 | µA |
| Reverse breakdown voltage | at $I_R$ = 1 mA | $V_{BR}$ | 6 | | 8 | V |
| Reverse clamping voltage | at $I_{PP}$ = 1 A; acc. IEC 61000-4-5 | $V_C$ | | 8 | 9.5 | V |
| | at $I_{PP} = I_{PPM}$ = 5 A; acc. IEC 61000-4-5 | $V_C$ | | 11.5 | 12.5 | V |
| Forward clamping voltage | at $I_F$ = 1 A; acc. IEC 61000-4-5 | $V_F$ | | 1.5 | 2 | V |
| | at $I_{PP} = I_{PPM}$ = 5 A; acc. IEC 61000-4-5 | $V_F$ | | 3.1 | 4 | V |
| Line capacitance | at $V_R$ = 0 V; f = 1 MHz | $C_D$ | | 43 | 50 | pF |
| | at $V_R$ = 2.5 V; f = 1 MHz | $C_D$ | | 25 | | pF |

If a higher surge current or **P**eak **P**ulse **current** ($I_{PP}$) is needed, some protection diodes in the **GMF05LC-HS3** can also be used in parallel in order to "multiply" the performance.
If two diodes are switched in parallel you get

- double surge power = double peak pulse current (2 x $I_{PPM}$)
- half of the line inductance = reduced clamping voltage
- half of the line resistance = reduced clamping voltage
- double line **C**apacitance (2 x $C_D$)
- double **R**everse leakage **current** (2 x $I_R$)




## Typical Characteristics

$T_{amb}$ = 25 °C, unless otherwise specified

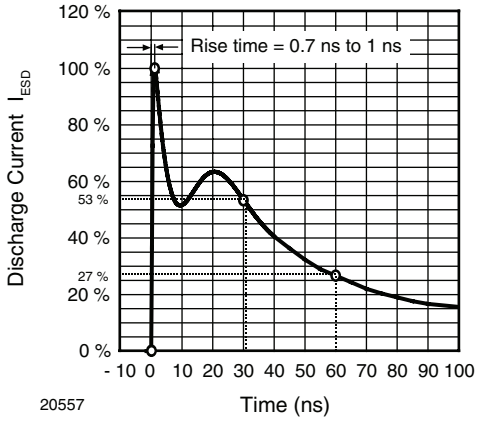



Figure 1. ESD Discharge Current Wave Form acc. IEC 61000-4-2 (330 Ω/150 pF)

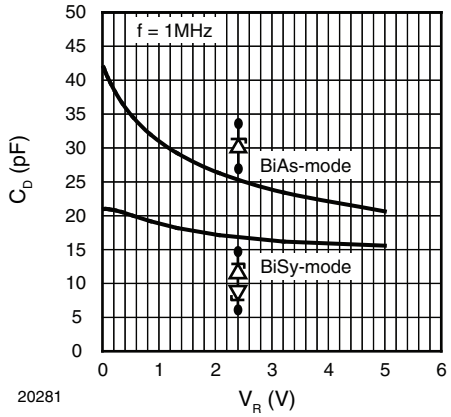



Figure 3. Typical Capacitance $C_D$ vs. Reverse Voltage $V_R$

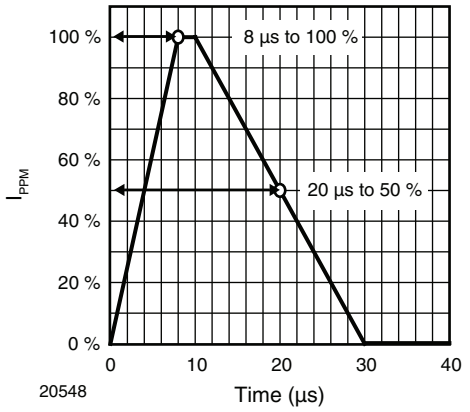



Figure 2. 8/20 µs Peak Pulse Current Wave Form acc. IEC 61000-4-5

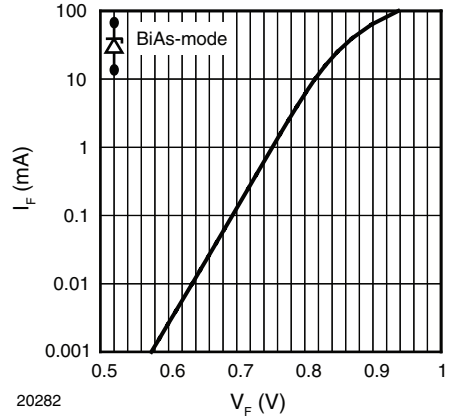



Figure 4. Typical Forward Current $I_F$ vs. Forward Voltage $V_F$

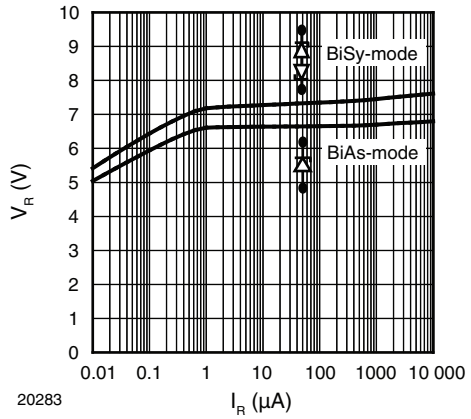



Figure 5. Typical Reverse Voltage $V_R$ vs. Reverse Current $I_R$

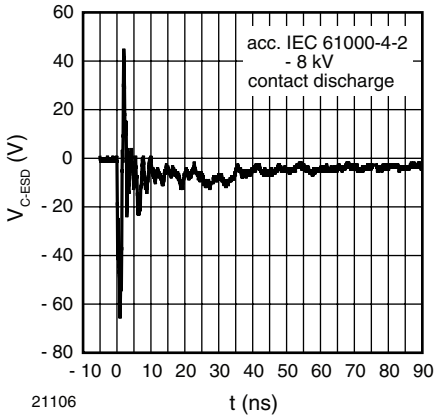



Figure 8. Typical Clamping performance at - 8 kV Contact Discharge (acc. IEC 61000-4-2)

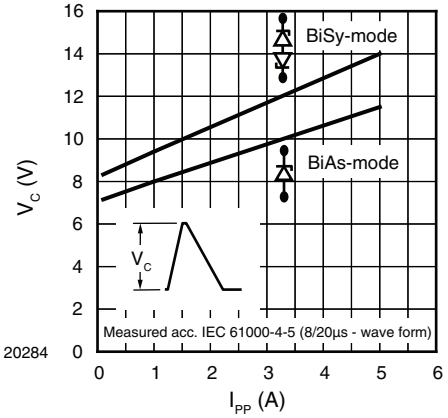



Figure 6. Typical Peak Clamping Voltage $V_C$ vs. Peak Pulse Current $I_{PP}$

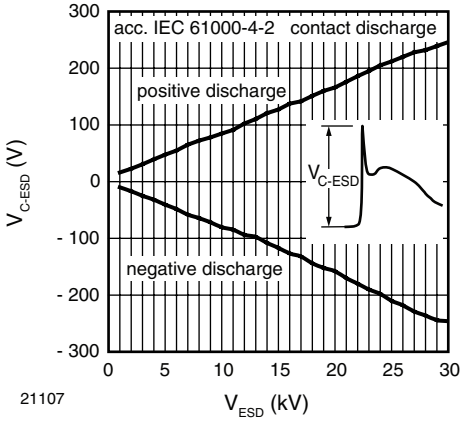



Figure 9. Typical Peak Clamping Voltage at ESD Contact Discharge (acc. IEC 61000-4-2)

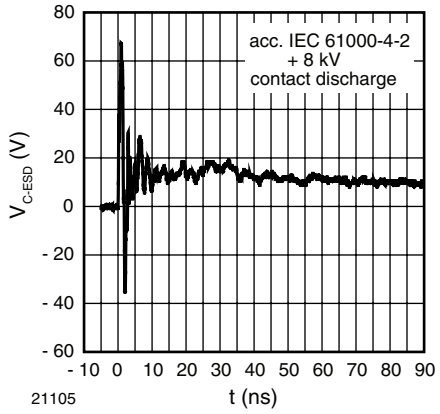
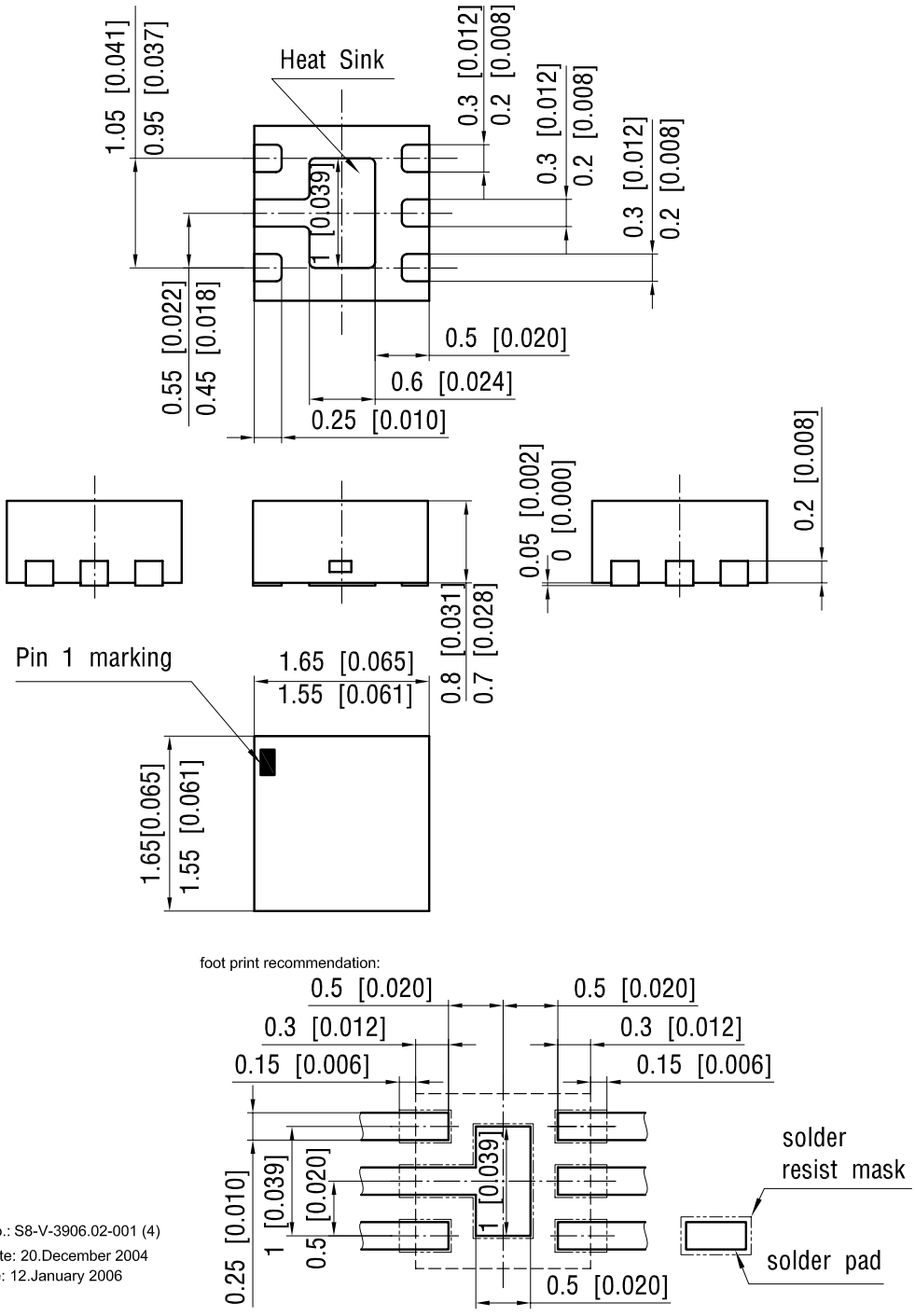



Figure 7. Typical Clamping Performance at + 8 kV Contact Discharge (acc. IEC 61000-4-2)

## Package Dimensions in millimeters (inches): LLP75-6A




foot print recommendation:

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Created - Date: 20.December 2004
Rev. b - Date: 12.January 2006
18058

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It is the policy of Vishay Semiconductor GmbH to

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2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.



Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

# LLP75-6A

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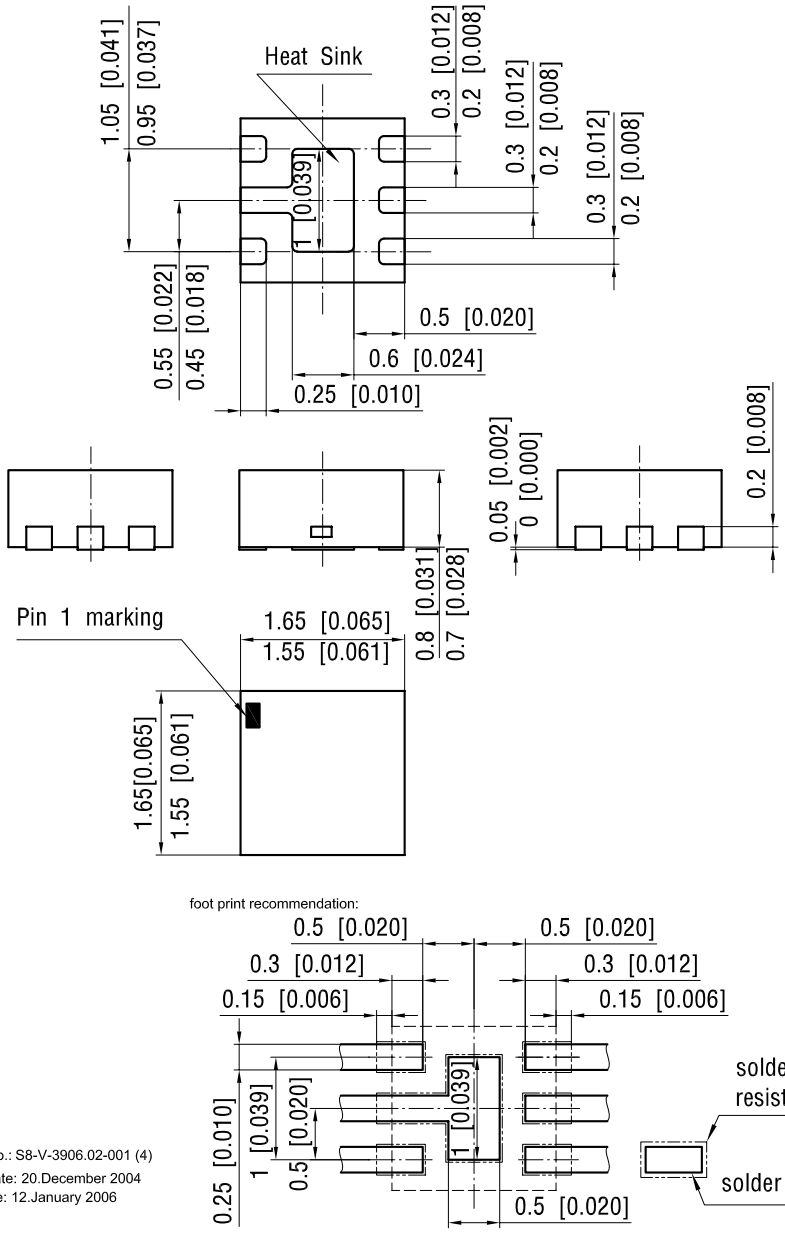


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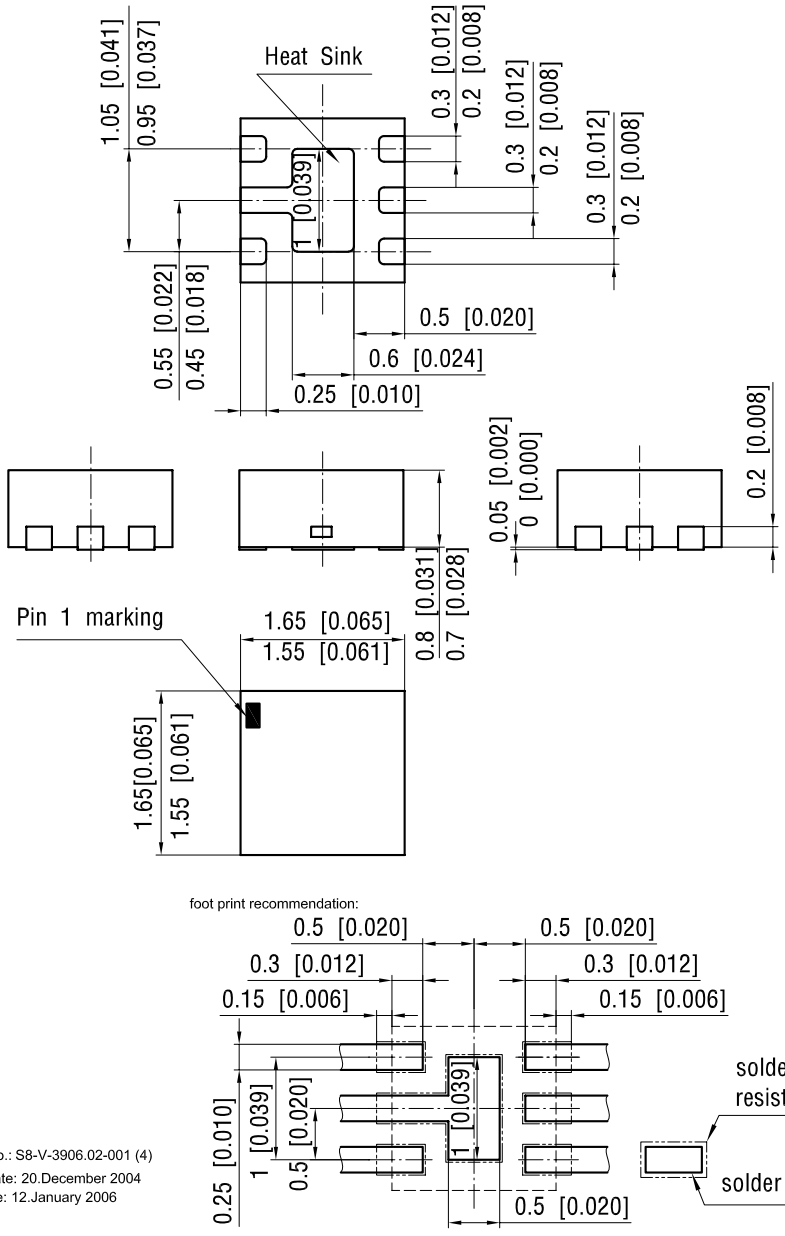


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