

## SPHV-C Series 200W Discrete Bidirectional TVS Diode

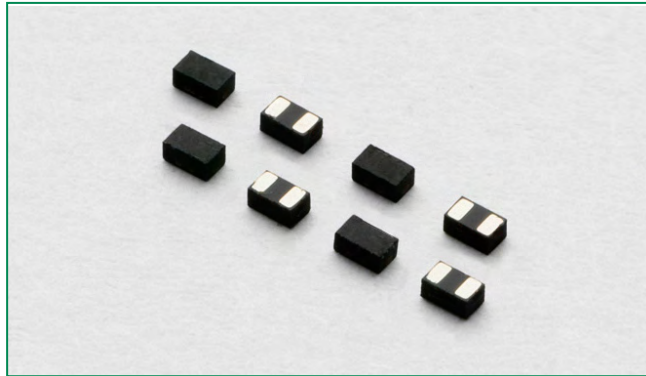


**AUTOMOTIVE GRADE**

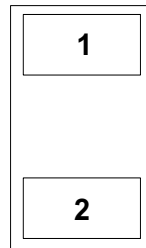
**RoHS**



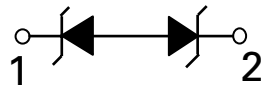
**GREEN**



### Pinout



### Functional Block Diagram



Life Support Note:

**Not Intended for Use in Life Support or Life Saving Applications**

The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

### Description

The SPHV-C series is designed to replace multilayer varistors (MLVs) in portable applications, LED lighting modules, and low speed I/Os. It will protect sensitive equipment from damage due to electrostatic discharge (ESD) and other overvoltage transients.

The SPHV-C series can safely absorb repetitive ESD strikes above the maximum level of the IEC61000-4-2 international standard (Level 4,  $\pm 8\text{kV}$  contact discharge) without performance degradation and safely dissipate up to 8A (SPHV12-C) of induced surge current (IEC61000-4-5,  $t_p=8/20\mu\text{s}$ ) with very low clamping voltages.

### Features

- ESD, IEC61000-4-2,  $\pm 30\text{kV}$  contact,  $\pm 30\text{kV}$  air
- EFT, IEC61000-4-4, 40A (5/50ns)
- Lightning, IEC61000-4-5, 8A ( $t_p=8/20\mu\text{s}$ , SPHV12-C)
- Low clamping voltage
- Low leakage current
- Small SOD882 packaging helps save board space
- AEC-Q101 qualified
- Side exposed leadframe helps to verify solderability (SPHVxx-KTG-C series)

### Applications

- LED Lighting Modules
- Portable Instrumentation
- General Purpose I/O
- Mobile & Handhelds
- RS232 / RS485
- CAN and LIN Bus

### Additional Information



**Datasheet**



**Resources**



**Samples**

### Absolute Maximum Ratings

| Symbol     | Parameter                            | Value      | Units |
|------------|--------------------------------------|------------|-------|
| $P_{pk}$   | Peak Pulse Power ( $t_p=8/20\mu s$ ) | 200        | W     |
| $T_{OP}$   | Operating Temperature                | -40 to 125 | °C    |
| $T_{STOR}$ | Storage Temperature                  | -55 to 150 | °C    |

Notes:

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### Thermal Information

| Parameter                                   | Rating     | Units |
|---------------------------------------------|------------|-------|
| Storage Temperature Range                   | -55 to 150 | °C    |
| Maximum Junction Temperature                | 150        | °C    |
| Maximum Lead Temperature (Soldering 20-40s) | 260        | °C    |

### SPHV12-C Electrical Characteristics ( $T_{OP}=25^{\circ}C$ )

| Parameter                          | Symbol      | Test Conditions                  | Min      | Typ  | Max  | Units    |
|------------------------------------|-------------|----------------------------------|----------|------|------|----------|
| Reverse Standoff Voltage           | $V_{RWM}$   | $I_R \leq 1\mu A$                |          |      | 12.0 | V        |
| Reverse Breakdown Voltage          | $V_{BR}$    | $I_R = 1mA$                      | 13.3     |      |      | V        |
| Leakage Current                    | $I_{LEAK}$  | $V_R = 12V$                      |          |      | 1.0  | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$       | $I_{PP}=1A, t_p=8/20\mu s, Fwd$  |          |      | 19.0 | V        |
|                                    |             | $I_{PP}=8A, t_p=8/20\mu s, Fwd$  |          |      | 25.0 | V        |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$   | TLP, $t_p=100ns$ , I/O to GND    |          | 0.48 |      | $\Omega$ |
| Peak Pulse Current                 | $I_{PP}$    | $t_p=8/20\mu s$                  |          |      | 8.0  | A        |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$   | IEC61000-4-2 (Contact Discharge) | $\pm 30$ |      |      | kV       |
|                                    |             | IEC61000-4-2 (Air Discharge)     | $\pm 30$ |      |      | kV       |
| Diode Capacitance <sup>1</sup>     | $C_{D-GND}$ | Reverse Bias=0V, $f=1MHz$        |          |      | 30   | pF       |

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

### SPHV15-C Electrical Characteristics ( $T_{OP}=25^{\circ}C$ )

| Parameter                          | Symbol        | Test Conditions                  | Min      | Typ  | Max  | Units    |
|------------------------------------|---------------|----------------------------------|----------|------|------|----------|
| Reverse Standoff Voltage           | $V_{RWM}$     | $I_R \leq 1\mu A$                |          |      | 15.0 | V        |
| Reverse Breakdown Voltage          | $V_{BR}$      | $I_R = 1mA$                      | 16.7     |      |      | V        |
| Leakage Current                    | $I_{LEAK}$    | $V_R = 15V$                      |          |      | 1.0  | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$         | $I_{PP}=1A, t_p=8/20\mu s, Fwd$  |          |      | 22.0 | V        |
|                                    |               | $I_{PP}=5A, t_p=8/20\mu s, Fwd$  |          |      | 30.0 | V        |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$     | TLP, $t_p=100ns$ , I/O to GND    |          | 0.43 |      | $\Omega$ |
| Peak Pulse Current                 | $I_{PP}$      | $t_p=8/20\mu s$                  |          |      | 5.0  | A        |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$     | IEC61000-4-2 (Contact Discharge) | $\pm 30$ |      |      | kV       |
|                                    |               | IEC61000-4-2 (Air Discharge)     | $\pm 30$ |      |      | kV       |
| Diode Capacitance <sup>1</sup>     | $C_{I/O-GND}$ | Reverse Bias=0V, $f=1MHz$        |          |      | 24   | pF       |

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

**SPHV24-C Electrical Characteristics ( $T_{OP}=25^{\circ}\text{C}$ )**

| Parameter                          | Symbol        | Test Conditions                                      | Min      | Typ  | Max  | Units         |
|------------------------------------|---------------|------------------------------------------------------|----------|------|------|---------------|
| Reverse Standoff Voltage           | $V_{RWM}$     | $I_R \leq 1\mu\text{A}$                              |          |      | 24.0 | V             |
| Reverse Breakdown Voltage          | $V_{BR}$      | $I_R = 1\text{mA}$                                   | 26.7     |      |      | V             |
| Leakage Current                    | $I_{LEAK}$    | $V_R = 24\text{V}$                                   |          |      | 1.0  | $\mu\text{A}$ |
| Clamp Voltage <sup>1</sup>         | $V_C$         | $I_{PP} = 1\text{A}$ , $t_p = 8/20\mu\text{s}$ , Fwd |          |      | 36.0 | V             |
|                                    |               | $I_{PP} = 3\text{A}$ , $t_p = 8/20\mu\text{s}$ , Fwd |          |      | 50.0 | V             |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$     | TLP, $t_p = 100\text{ns}$ , I/O to GND               |          | 0.65 |      | $\Omega$      |
| Peak Pulse Current                 | $I_{PP}$      | $t_p = 8/20\mu\text{s}$                              |          |      | 3.0  | A             |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$     | IEC61000-4-2 (Contact Discharge)                     | $\pm 24$ |      |      | kV            |
|                                    |               | IEC61000-4-2 (Air Discharge)                         | $\pm 30$ |      |      | kV            |
| Diode Capacitance <sup>1</sup>     | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz                              |          |      | 17   | pF            |

Note:

<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

**SPHV36-C Electrical Characteristics ( $T_{OP}=25^{\circ}\text{C}$ )**

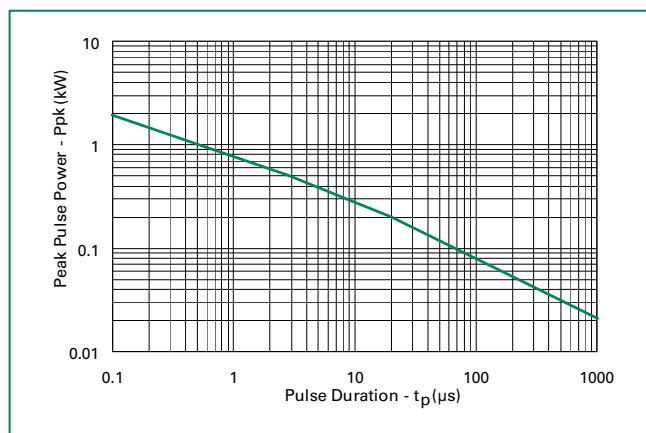
| Parameter                          | Symbol        | Test Conditions                                      | Min      | Typ  | Max  | Units         |
|------------------------------------|---------------|------------------------------------------------------|----------|------|------|---------------|
| Reverse Standoff Voltage           | $V_{RWM}$     | $I_R \leq 1\mu\text{A}$                              |          |      | 36.0 | V             |
| Reverse Breakdown Voltage          | $V_{BR}$      | $I_R = 1\text{mA}$                                   | 40.0     |      |      | V             |
| Leakage Current                    | $I_{LEAK}$    | $V_R = 36\text{V}$                                   |          |      | 1.0  | $\mu\text{A}$ |
| Clamp Voltage <sup>1</sup>         | $V_C$         | $I_{PP} = 1\text{A}$ , $t_p = 8/20\mu\text{s}$ , Fwd |          |      | 52.0 | V             |
|                                    |               | $I_{PP} = 2\text{A}$ , $t_p = 8/20\mu\text{s}$ , Fwd |          |      | 65.0 | V             |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$     | TLP, $t_p = 100\text{ns}$ , I/O to GND               |          | 1.33 |      | $\Omega$      |
| Peak Pulse Current                 | $I_{PP}$      | $t_p = 8/20\mu\text{s}$                              |          |      | 2.0  | A             |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$     | IEC61000-4-2 (Contact Discharge)                     | $\pm 15$ |      |      | kV            |
|                                    |               | IEC61000-4-2 (Air Discharge)                         | $\pm 20$ |      |      | kV            |
| Diode Capacitance <sup>1</sup>     | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz                              |          |      | 13   | pF            |

Note:

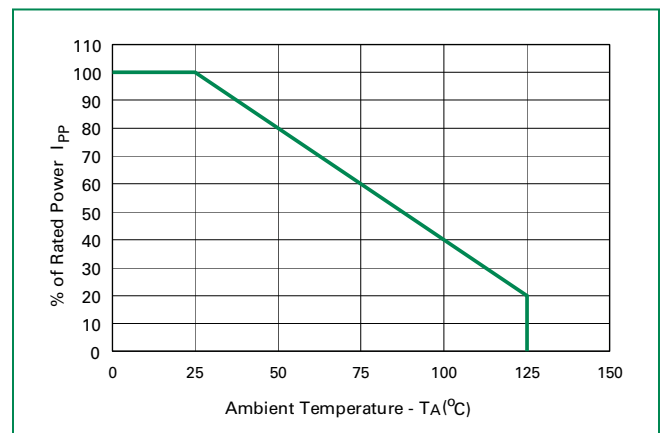
<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

<sup>2</sup> Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.

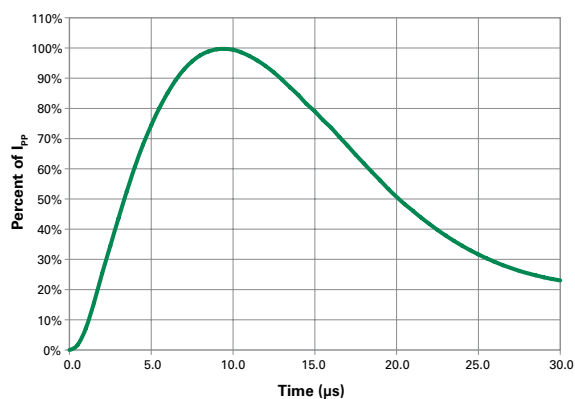
**Non-Repetitive Peak Pulse Power vs. Pulse Time**



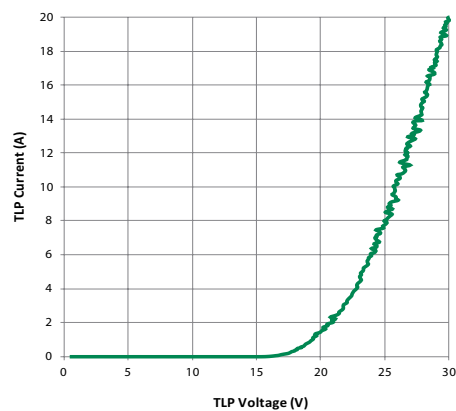
**Power Derating Curve**



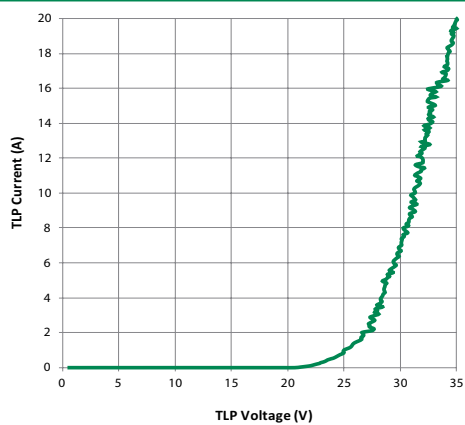
**Pulse Waveform**



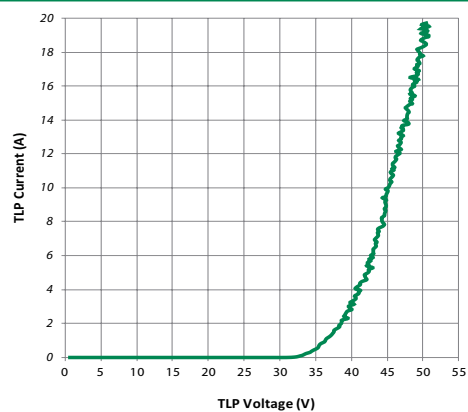
**SPHV12-C Transmission Line Pulsing(TLP) Plot**



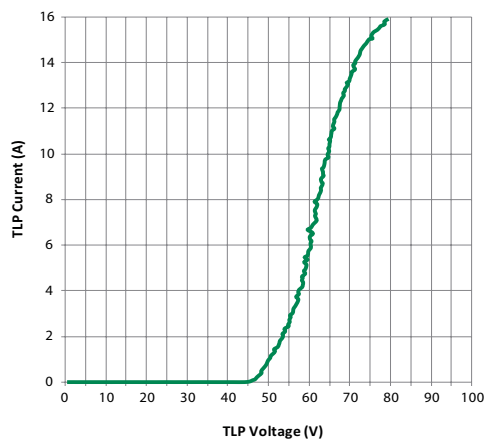
**SPHV15-C Transmission Line Pulsing(TLP) Plot**



**SPHV24-C Transmission Line Pulsing(TLP) Plot**

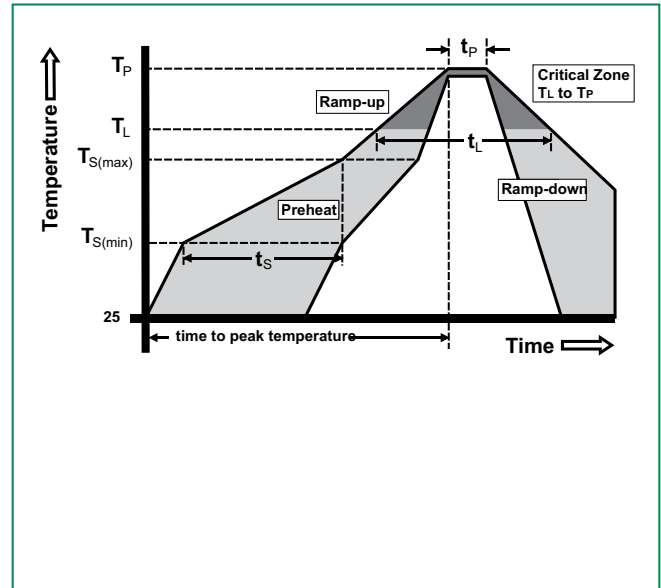


**SPHV36-C Transmission Line Pulsing(TLP) Plot**



## Soldering Parameters

|                                                        |                                    |                         |
|--------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | Pb – Free assembly      |
| Pre Heat                                               | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|                                                        | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|                                                        | - Time (min to max) ( $t_s$ )      | 60 – 180 secs           |
| Average ramp up rate (Liquidus) Temp ( $T_L$ ) to peak |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow                                                 | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                        | - Temperature ( $t_L$ )            | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                             |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 – 40 seconds         |
| Ramp-down Rate                                         |                                    | 6°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )                |                                    | 8 minutes Max.          |
| Do not exceed                                          |                                    | 260°C                   |



## Product Characteristics

|                            |                         |
|----------------------------|-------------------------|
| <b>Lead Plating</b>        | Pre-Plated Frame        |
| <b>Lead Material</b>       | Copper Alloy            |
| <b>Lead Coplanarity</b>    | 0.0004 inches (0.102mm) |
| <b>Substitute Material</b> | Silicon                 |
| <b>Body Material</b>       | Molded Epoxy            |
| <b>Flammability</b>        | UL 94 V-0               |

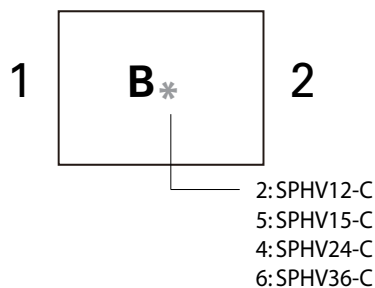
Notes :

1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
5. Package surface matte finish VDI 11-13.

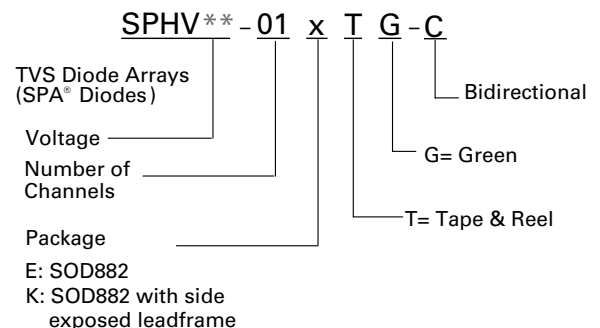
## Ordering Information

| Part Number    | Package                            | Marking | Min. Order Qty. |
|----------------|------------------------------------|---------|-----------------|
| SPHV12-01ETG-C | SOD882                             | B2      | 10000           |
| SPHV15-01ETG-C |                                    | B5      |                 |
| SPHV24-01ETG-C |                                    | B4      |                 |
| SPHV36-01ETG-C |                                    | B6      |                 |
| SPHV12-01KTG-C | SOD882 with side exposed leadframe | B2      | 10000           |
| SPHV15-01KTG-C |                                    | B5      |                 |
| SPHV24-01KTG-C |                                    | B4      |                 |
| SPHV36-01KTG-C |                                    | B6      |                 |

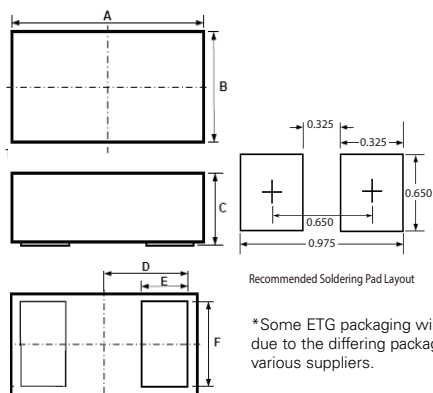
## Part Marking System



## Part Numbering System



### Package Dimensions — SOD882(SPHVxx-01ETG-C)

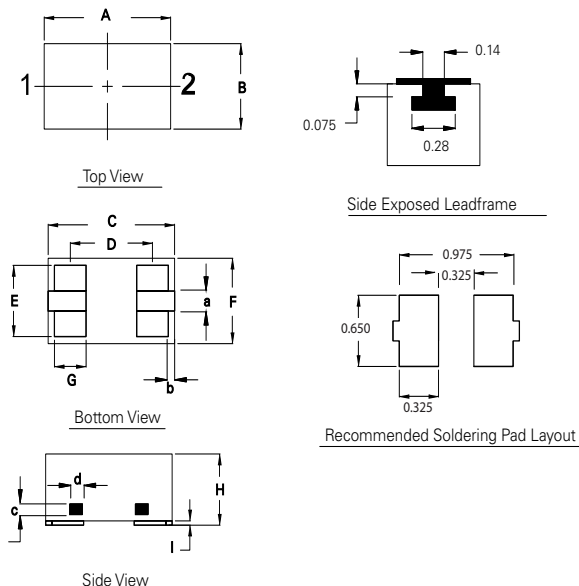


Recommended Soldering Pad Layout

\*Some ETG packaging will look like KTG packaging due to the differing package construction between various suppliers.

| Symbol   | Package     | SOD882 |      |        |       |       |  |
|----------|-------------|--------|------|--------|-------|-------|--|
|          | JEDEC       | MO-236 |      |        |       |       |  |
|          | Millimeters |        |      | Inches |       |       |  |
|          | Min         | Typ    | Max  | Min    | Typ   | Max   |  |
| <b>A</b> | 0.90        | 1.00   | 1.10 | 0.037  | 0.039 | 0.041 |  |
| <b>B</b> | 0.50        | 0.60   | 0.70 | 0.022  | 0.024 | 0.026 |  |
| <b>C</b> | 0.40        | 0.50   | 0.60 | 0.016  | 0.020 | 0.024 |  |
| <b>D</b> | 0.45        |        |      | 0.018  |       |       |  |
| <b>E</b> | 0.20        | 0.25   | 0.35 | 0.008  | 0.010 | 0.012 |  |
| <b>F</b> | 0.45        | 0.50   | 0.55 | 0.018  | 0.020 | 0.022 |  |

### Package Dimensions — SOD882 with side exposed leadframe(SPHVxx-01KTG-C)

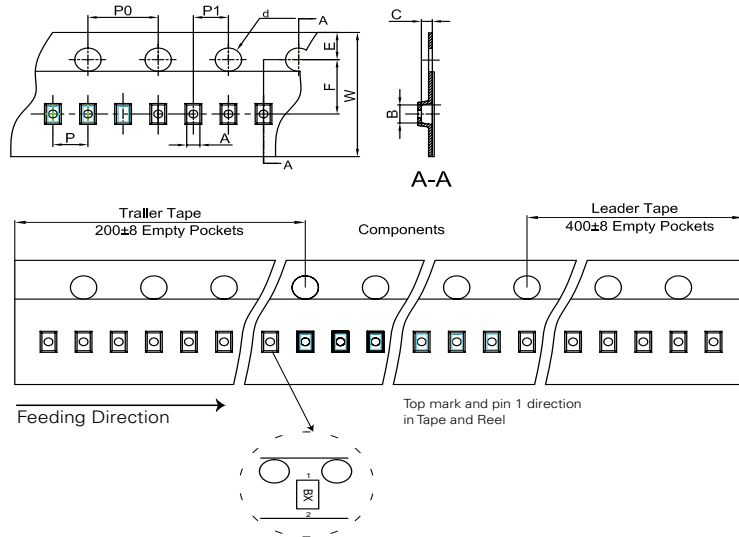


Side Exposed Leadframe

Recommended Soldering Pad Layout

| Symbol   | Package     | SOD882 with side exposed leadframe |      |           |       |       |  |
|----------|-------------|------------------------------------|------|-----------|-------|-------|--|
|          | JEDEC       | MO-236                             |      |           |       |       |  |
|          | Millimeters |                                    |      | Inches    |       |       |  |
|          | Min         | Typ                                | Max  | Min       | Typ   | Max   |  |
| <b>A</b> | 0.90        | 1.00                               | 1.10 | 0.037     | 0.039 | 0.043 |  |
| <b>B</b> | 0.50        | 0.60                               | 0.70 | 0.020     | 0.024 | 0.028 |  |
| <b>C</b> | 0.90        | 1.00                               | 1.10 | 0.037     | 0.039 | 0.043 |  |
| <b>D</b> | 0.55        | 0.65                               | 0.75 | 0.022     | 0.026 | 0.030 |  |
| <b>E</b> | 0.40        | 0.50                               | 0.60 | 0.016     | 0.020 | 0.024 |  |
| <b>F</b> | 0.50        | 0.60                               | 0.70 | 0.020     | 0.024 | 0.028 |  |
| <b>G</b> | 0.20        | 0.25                               | 0.30 | 0.008     | 0.010 | 0.012 |  |
| <b>H</b> | 0.40        | 0.50                               | 0.60 | 0.016     | 0.020 | 0.024 |  |
| <b>I</b> | 0.05 max    |                                    |      | 0.002 max |       |       |  |
| <b>a</b> | -           | 0.14                               | -    | -         | 0.006 | -     |  |
| <b>b</b> | -           | 0.04                               | -    | -         | 0.002 | -     |  |
| <b>c</b> | -           | 0.075                              | -    | -         | 0.003 | -     |  |
| <b>d</b> | -           | 0.10                               | -    | -         | 0.004 | -     |  |

### Embossed Carrier Tape & Reel Specification



| Symbol    | Millimeters       |
|-----------|-------------------|
| <b>A</b>  | 0.70+/-0.045      |
| <b>B</b>  | 1.10+/-0.045      |
| <b>C</b>  | 0.65+/-0.045      |
| <b>d</b>  | 1.55+/-0.10       |
| <b>E</b>  | 1.75+/-0.05       |
| <b>F</b>  | 3.50+/-0.05       |
| <b>P</b>  | 2.00+/-0.10       |
| <b>P0</b> | 4.00+/-0.10       |
| <b>P1</b> | 2.00+/-0.10       |
| <b>W</b>  | 8.00 + 0.30 -0.10 |



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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