

## SPHV Series 200W Discrete Unidirectional TVS Diode

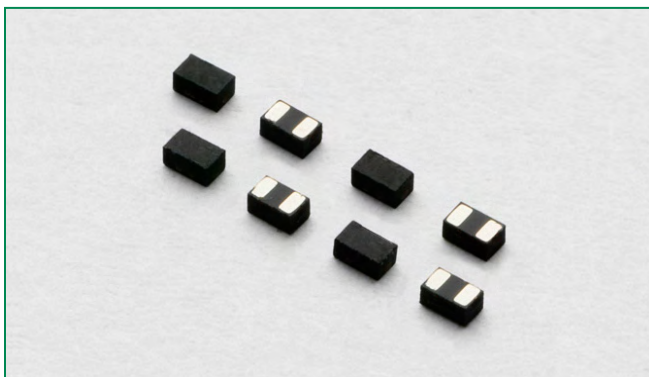


AUTOMOTIVE GRADE

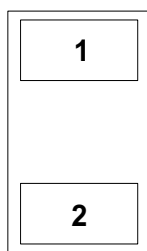
RoHS



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 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 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) 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)
- 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 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 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    |          | 0.37 |      | $\Omega$ |
| 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, $f=1MHz$        |          |      | 60   | 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 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        |
|                                    |               | $I_{PP}=5A, t_p=8/20\mu s, Fwd$  |          |      | 28.0 | V        |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$     | TLP, $t_p=100ns$ , I/O to GND    |          | 0.40 |      | $\Omega$ |
| 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, $f=1MHz$        |          |      | 46   | 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 Electrical Characteristics (T<sub>OP</sub>=25°C)

| Parameter                          | Symbol               | Test Conditions                                      | Min  | Typ  | Max  | Units |
|------------------------------------|----------------------|------------------------------------------------------|------|------|------|-------|
| Reverse Standoff Voltage           | V <sub>RWM</sub>     | I <sub>R</sub> ≤ 1 μA                                |      |      | 24.0 | V     |
| Reverse Breakdown Voltage          | V <sub>BR</sub>      | I <sub>R</sub> = 1 mA                                | 26.7 |      |      | V     |
| Leakage Current                    | I <sub>LEAK</sub>    | V <sub>R</sub> = 24 V                                |      |      | 1.0  | μA    |
| Clamp Voltage <sup>1</sup>         | V <sub>C</sub>       | I <sub>PP</sub> = 1 A, t <sub>p</sub> = 8/20 μs, Fwd |      |      | 36.0 | V     |
|                                    |                      | I <sub>PP</sub> = 3 A, t <sub>p</sub> = 8/20 μs, Fwd |      |      | 50.0 | V     |
| Dynamic Resistance <sup>2</sup>    | R <sub>DYN</sub>     | TLP, t <sub>p</sub> = 100 ns, I/O to GND             |      | 0.56 |      | Ω     |
| Peak Pulse Current                 | I <sub>PP</sub>      | t <sub>p</sub> = 8/20 μs                             |      |      | 3.0  | A     |
| ESD Withstand Voltage <sup>1</sup> | V <sub>ESD</sub>     | IEC61000-4-2 (Contact Discharge)                     | ±24  |      |      | kV    |
|                                    |                      | IEC61000-4-2 (Air Discharge)                         | ±30  |      |      | kV    |
| Diode Capacitance <sup>1</sup>     | C <sub>I/O-GND</sub> | Reverse Bias = 0 V, f = 1 MHz                        |      |      | 32   | pF    |

Note:

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

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

### SPHV36 Electrical Characteristics (T<sub>OP</sub>=25°C)

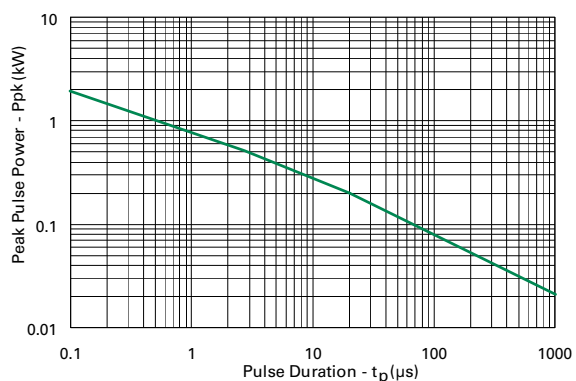
| Parameter                          | Symbol               | Test Conditions                                      | Min  | Typ  | Max  | Units |
|------------------------------------|----------------------|------------------------------------------------------|------|------|------|-------|
| Reverse Standoff Voltage           | V <sub>RWM</sub>     | I <sub>R</sub> ≤ 1 μA                                |      |      | 36.0 | V     |
| Reverse Breakdown Voltage          | V <sub>BR</sub>      | I <sub>R</sub> = 1 mA                                | 40.0 |      |      | V     |
| Leakage Current                    | I <sub>LEAK</sub>    | V <sub>R</sub> = 36 V                                |      |      | 1.0  | μA    |
| Clamp Voltage <sup>1</sup>         | V <sub>C</sub>       | I <sub>PP</sub> = 1 A, t <sub>p</sub> = 8/20 μs, Fwd |      |      | 52.0 | V     |
|                                    |                      | I <sub>PP</sub> = 2 A, t <sub>p</sub> = 8/20 μs, Fwd |      |      | 60.0 | V     |
| Dynamic Resistance <sup>2</sup>    | R <sub>DYN</sub>     | TLP, t <sub>p</sub> = 100 ns, I/O to GND             |      | 1.28 |      | Ω     |
| Peak Pulse Current                 | I <sub>PP</sub>      | t <sub>p</sub> = 8/20 μs                             |      |      | 2.0  | A     |
| ESD Withstand Voltage <sup>1</sup> | V <sub>ESD</sub>     | IEC61000-4-2 (Contact Discharge)                     | ±15  |      |      | kV    |
|                                    |                      | IEC61000-4-2 (Air Discharge)                         | ±20  |      |      | kV    |
| Diode Capacitance <sup>1</sup>     | C <sub>I/O-GND</sub> | Reverse Bias = 0 V, f = 1 MHz                        |      |      | 25   | pF    |

Note:

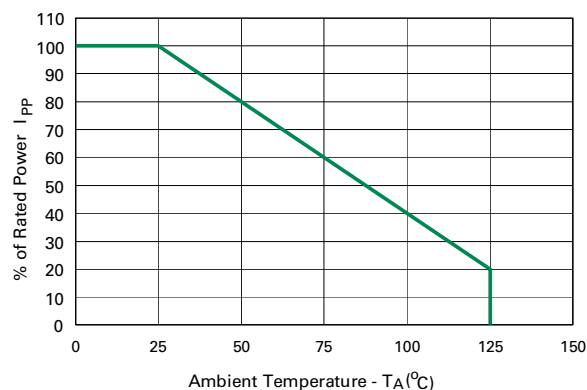
<sup>1</sup> Parameter is guaranteed by design and/or device characterization.

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

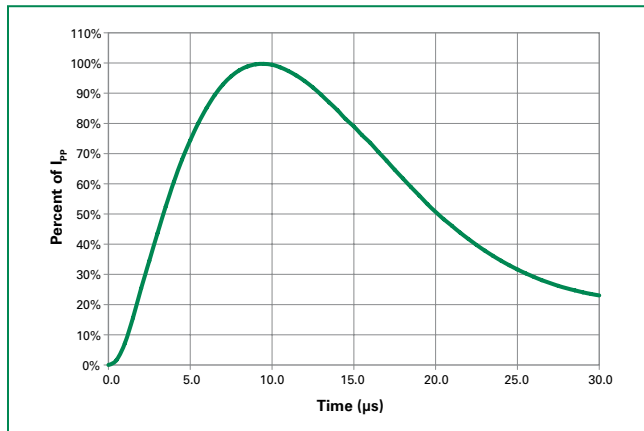
### Non-Repetitive Peak Pulse Power vs. Pulse Time



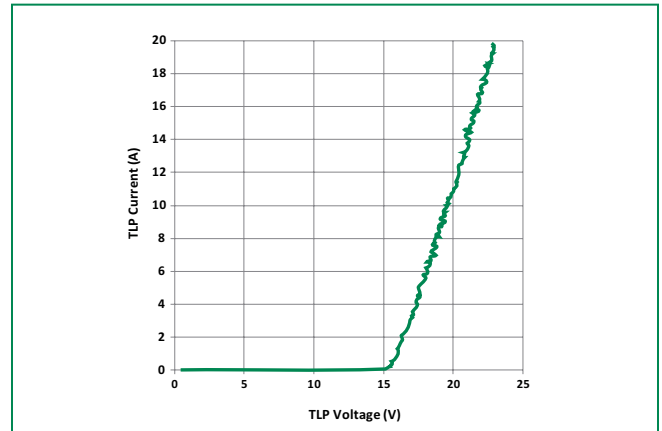
### Power Derating Curve



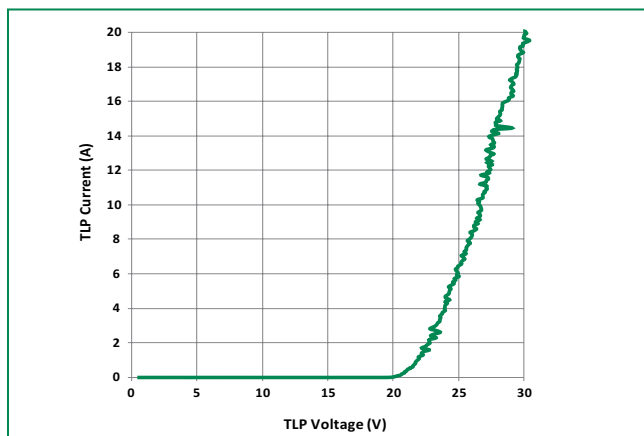
**Pulse Waveform**



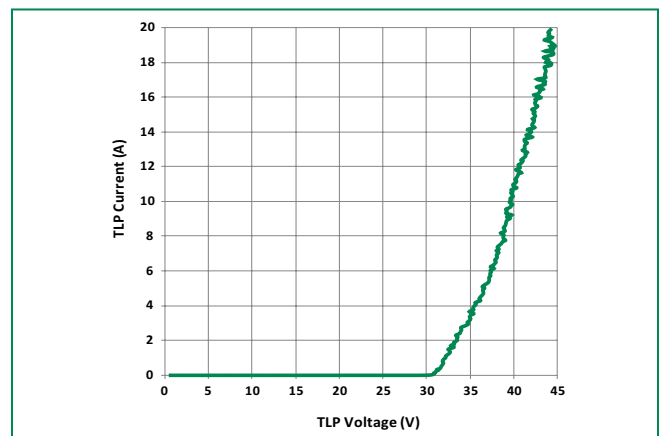
**SPHV12 Transmission Line Pulsing(TLP) Plot**



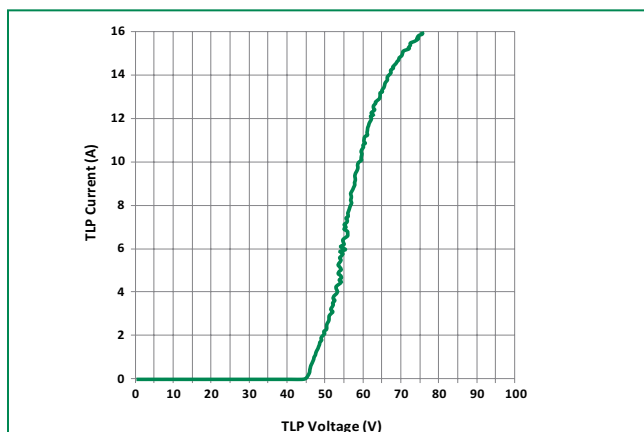
**SPHV15 Transmission Line Pulsing(TLP) Plot**



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

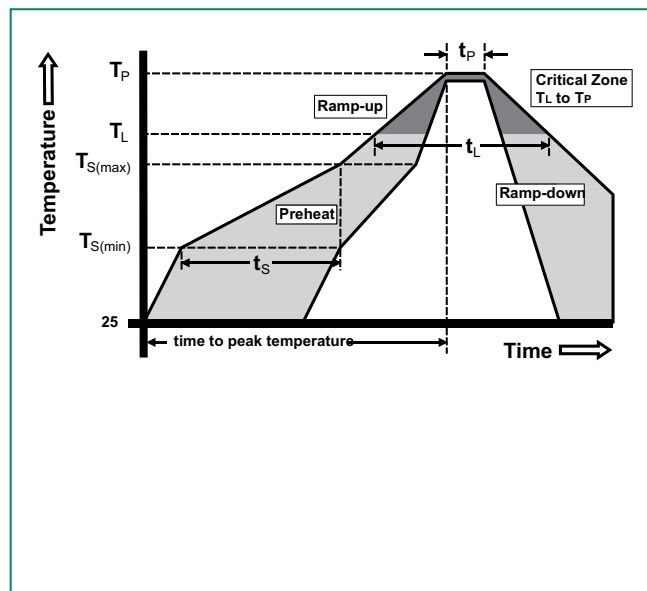


**SPHV36 Transmission Line Pulsing(TLP) Plot**



## 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

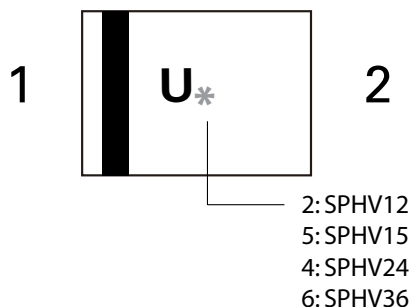
|                           |                         |
|---------------------------|-------------------------|
| <b>Lead Plating</b>       | Pre-Plated Frame        |
| <b>Lead Material</b>      | Copper Alloy            |
| <b>Lead Coplanarity</b>   | 0.0004 inches (0.102mm) |
| <b>Substrate material</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.

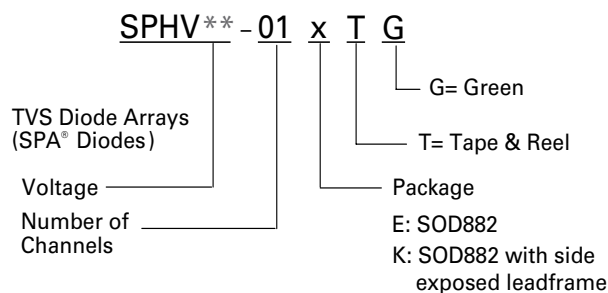
## Ordering Information

| Part Number  | Package                            | Marking | Min. Order Qty. |
|--------------|------------------------------------|---------|-----------------|
| SPHV12-01ETG | SOD882                             | U2      | 10000           |
| SPHV15-01ETG |                                    | U5      |                 |
| SPHV24-01ETG |                                    | U4      |                 |
| SPHV36-01ETG |                                    | U6      |                 |
| SPHV12-01KTG | SOD882 with side exposed leadframe | U2      | 10000           |
| SPHV15-01KTG |                                    | U5      |                 |
| SPHV24-01KTG |                                    | U4      |                 |
| SPHV36-01KTG |                                    | U6      |                 |

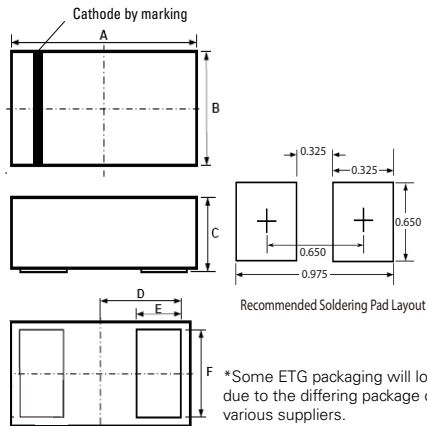
## Part Marking System



## Part Numbering System

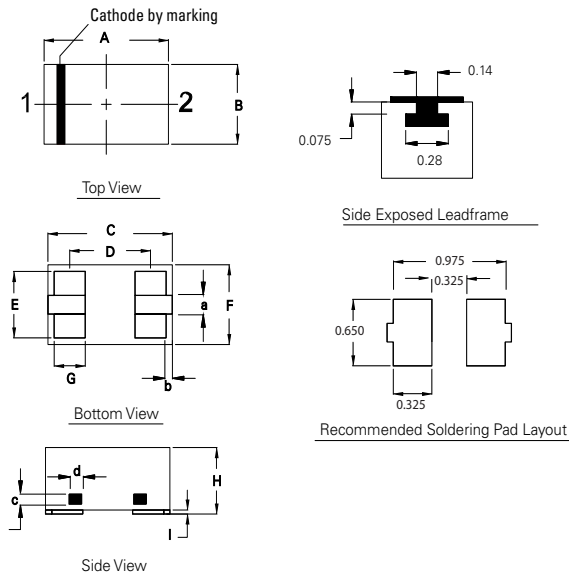


### Package Dimensions — SOD882(SPHVxx-01ETG)



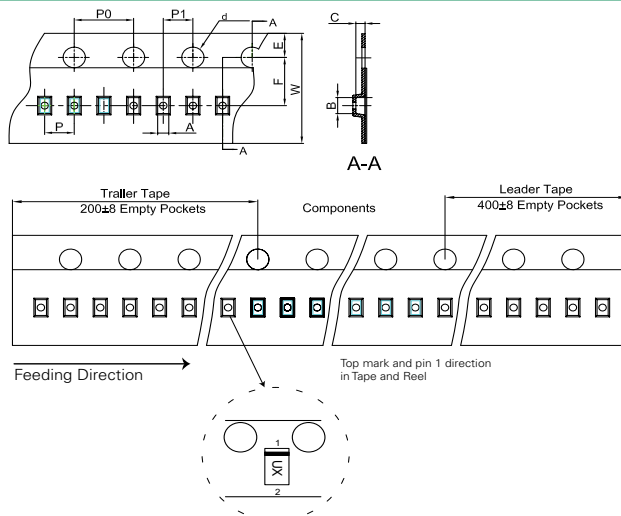
| Symbol   | Package     | SOD882 |      |        |       |       |
|----------|-------------|--------|------|--------|-------|-------|
|          | JEDEC       | MO-236 |      |        |       |       |
|          | Millimeters |        |      | Inches |       |       |
|          | Min         | Typ    | 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)



| 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 |

## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

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<http://moschip.ru/get-element>

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В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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