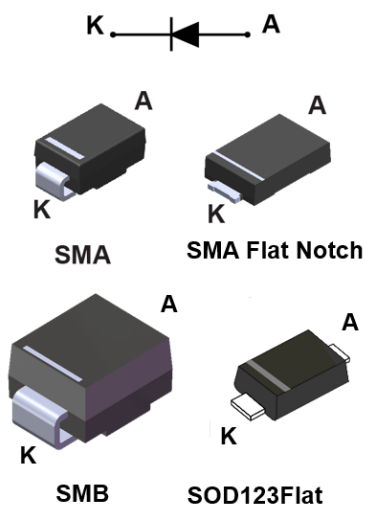


## 40 V, 1 A low drop power Schottky rectifier



### Features

- Very small conduction losses
- Negligible switching losses
- Low forward voltage drop
- Surface mount miniature packages
- Avalanche rated
- ECOPACK2 compliant

### Applications

- Reverse polarity protection
- Set-top box power supply
- TV power supply
- Battery charger

### Description

Single chip Schottky rectifiers suited to switched mode power supplies and high frequency DC to DC converters.

Packaged in SMA, SMA Flat Notch, SMB and SOD123Flat, the **STPS1L40** is ideal for use in surface mounting and used in low voltage, high frequency inverters, free-wheeling and polarity protection applications.

| Product status  |        |
|-----------------|--------|
| STPS1L40        |        |
| Product summary |        |
| Symbol          | Value  |
| $I_{F(AV)}$     | 1 A    |
| $V_{RRM}$       | 40 V   |
| $T_{j(max.)}$   | 175 °C |
| $V_{F(typ.)}$   | 0.37 V |

# 1 Characteristics

**Table 1. Absolute ratings (limiting values at 25 °C, unless otherwise specified)**

| Symbol       | Parameter  |  | Value       | Unit |
|--------------|--|--|-------------|------|
| $V_{RRM}$    | Repetitive peak reverse voltage                      |  | 40          | V    |
| $I_{F(RMS)}$ | Forward rms current                                  | SMA/SMB  | 8           | A    |
| $I_{F(AV)}$  | Average forward current $\delta = 0.5$ , square wave | SMA/SMB $T_L = 155\text{ °C}$                      | 1           | A    |
|              |  | SMA Flat Notch $T_L = 160\text{ °C}$               |             |      |
|              |  | SOD123Flat $T_L = 160\text{ °C}$                   |             |      |
| $I_{FSM}$    | Surge non repetitive forward current                 | SMA/SMB  | 60          | A    |
|              |  | SMA Flat Notch $t_p = 10\text{ ms sinusoidal}$     | 60          |      |
|              |  | SOD123Flat   | 50          |      |
| $P_{ARM}$    | Repetitive peak avalanche power                      | $t_p = 10\text{ }\mu\text{s}, T_j = 125\text{ °C}$ | 65          | W    |
| $T_{stg}$    | Storage temperature range                            |  | -65 to +175 | °C   |
| $T_j$        | Operating junction temperature <sup>(1)</sup>        |  | +175        | °C   |

1.  $(dP_{tot}/dT_j) < (1/R_{th(j-a)})$  condition to avoid thermal runaway for a diode on its own heatsink.

**Table 2. Thermal resistance parameter**

| Symbol        | Parameter        |                | Max. value | Unit |
|---------------|------------------|----------------|------------|------|
| $R_{th(j-l)}$ | Junction to lead | SMA            | 30         | °C/W |
|               |                  | SMA Flat Notch | 20         |      |
|               |                  | SMB            | 25         |      |
|               |                  | SOD123Flat     | 20         |      |

For more information, please refer to the following application note :

- AN5088 : Rectifiers thermal management, handling and mounting recommendations

**Table 3. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions       |                    | Min. | Typ. | Max. | Unit          |
|-------------|-------------------------|-----------------------|--------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$    | -    |      | 35   | $\mu\text{A}$ |
|             |                         | $T_j = 125\text{ °C}$ |                    | -    | 6    | 10   | mA            |
| $V_F^{(1)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 1\text{ A}$ | -    |      | 0.50 | V             |
|             |                         | $T_j = 125\text{ °C}$ |                    | -    | 0.37 | 0.42 |               |
|             |                         | $T_j = 25\text{ °C}$  | $I_F = 2\text{ A}$ | -    |      | 0.63 |               |
|             |                         | $T_j = 125\text{ °C}$ |                    | -    | 0.50 | 0.61 |               |

1. Pulse test:  $t_p = 380\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

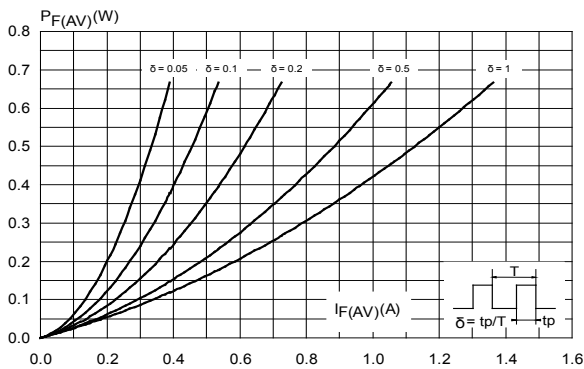
$$P = 0.23 \times I_{F(AV)} + 0.19 \times I_{F(RMS)}^2$$

For more information, please refer to the following application notes related to the power losses :

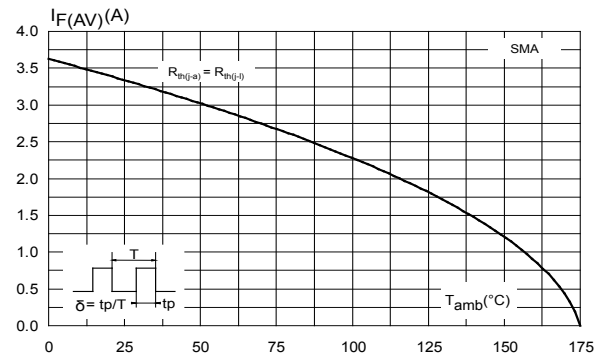
- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode

## 1.1 Characteristics (curves)

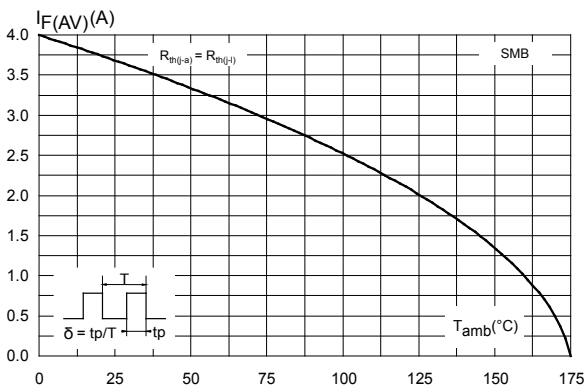
**Figure 1. Average forward power dissipation versus average forward current**



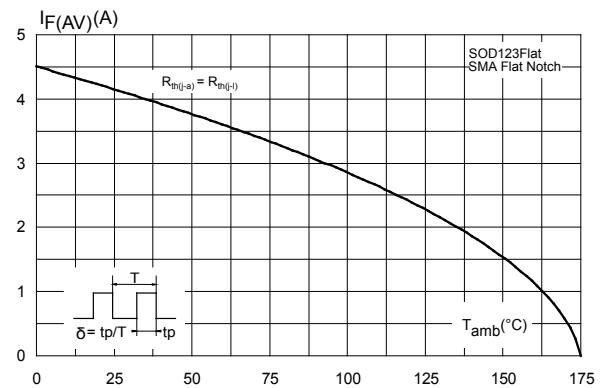
**Figure 2. Average forward current versus ambient temperature (SMA,  $\delta = 0.5$ )**



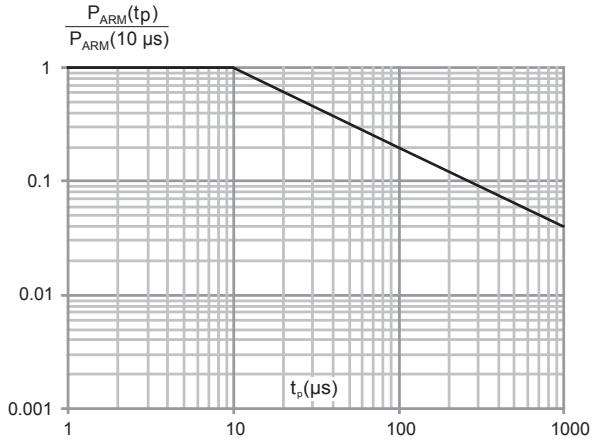
**Figure 3. Average forward current versus ambient temperature (SMB,  $\delta = 0.5$ )**



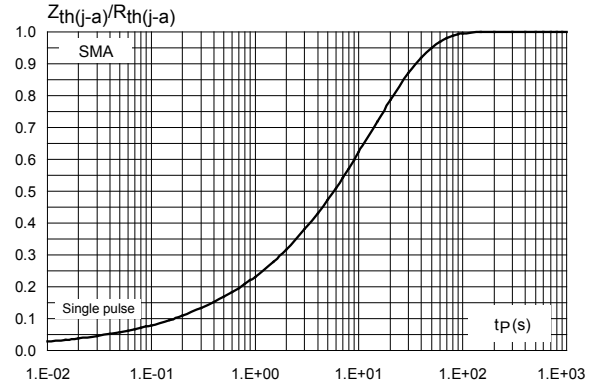
**Figure 4. Average forward current versus ambient temperature (SOD123Flat, SMA Flat Notch,  $\delta = 0.5$ )**



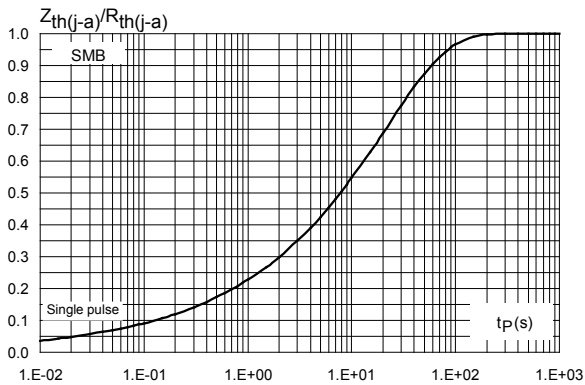
**Figure 5. Normalized avalanche power derating versus pulse duration ( $T_j = 125\text{ }^\circ\text{C}$ )**



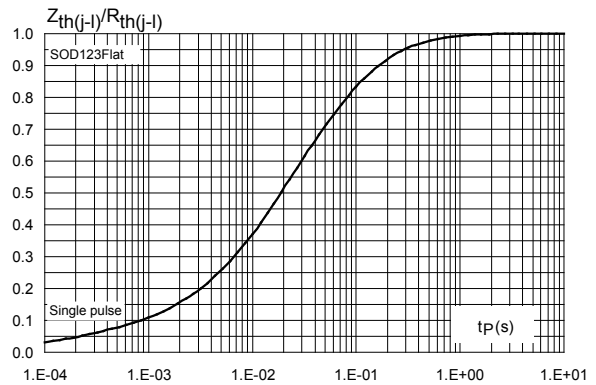
**Figure 6. Relative variation of thermal impedance junction to ambient versus pulse duration (SMA)**



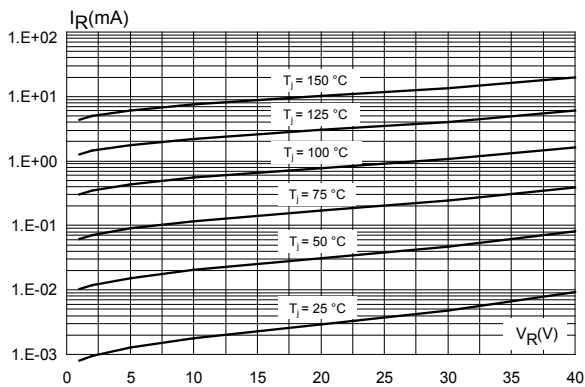
**Figure 7. Relative variation of thermal impedance junction to ambient versus pulse duration (SMB)**



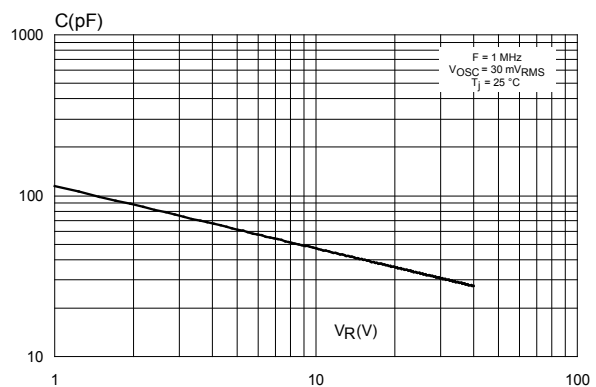
**Figure 8. Relative variation of thermal impedance junction to lead versus pulse duration (SOD123Flat)**



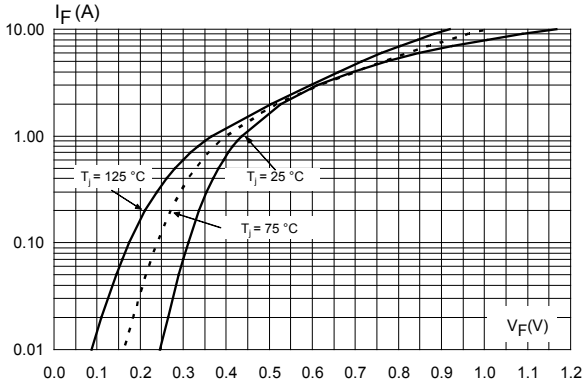
**Figure 9. Reverse leakage current versus reverse voltage applied (typical values)**



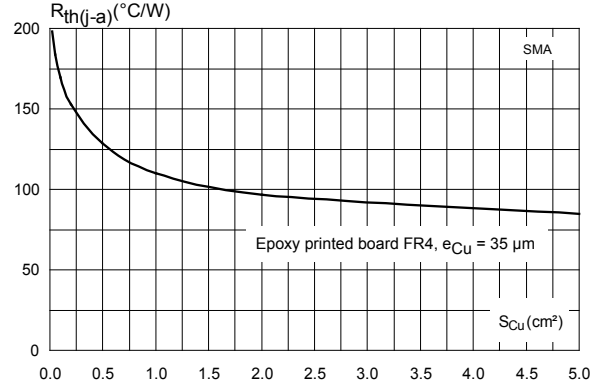
**Figure 10. Junction capacitance versus reverse voltage applied (typical values)**



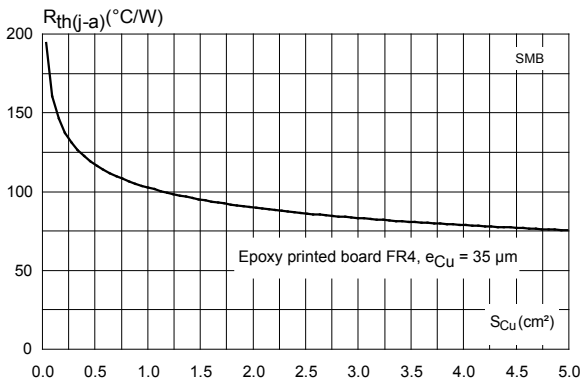
**Figure 11. Forward voltage drop versus forward current (typical values)**



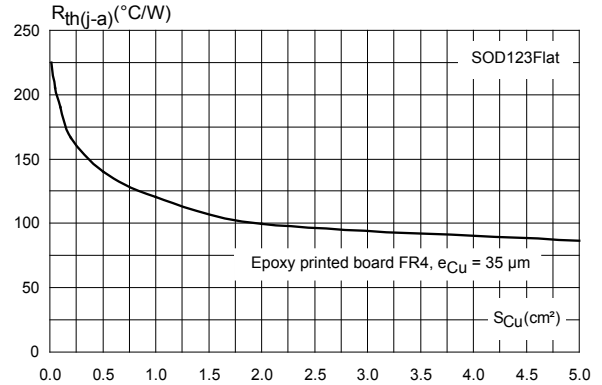
**Figure 12. Thermal resistance junction to ambient versus copper surface under each lead (typical values)**



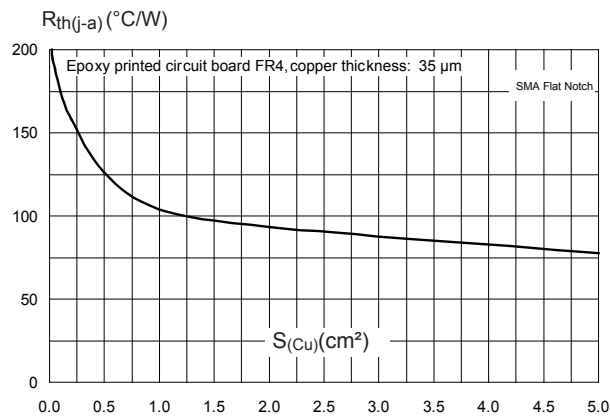
**Figure 13. Thermal resistance junction to ambient versus copper surface under each lead (typical values)**



**Figure 14. Thermal resistance junction to ambient versus copper surface under each lead (typical values)**



**Figure 15. Thermal resistance junction to ambient versus copper surface under each lead (SMA Flat Notch)**



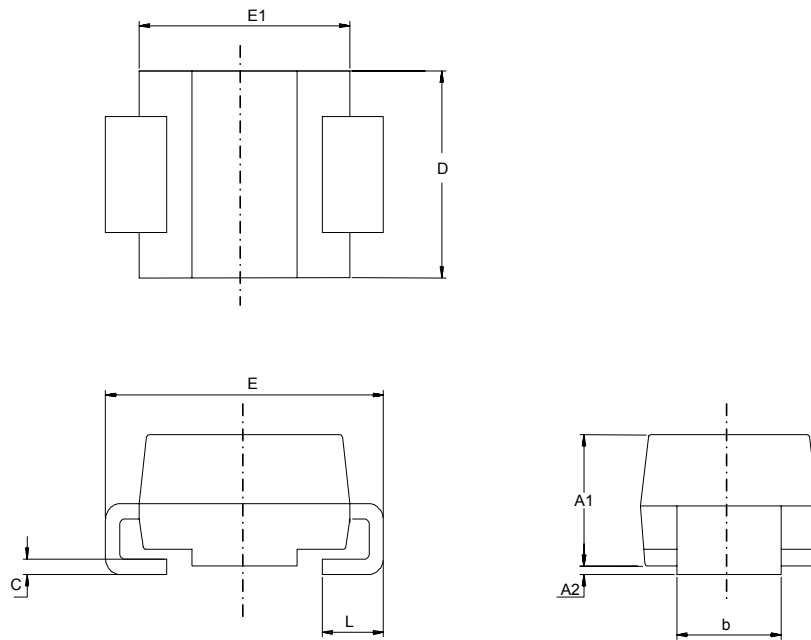
## 2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

### 2.1 SMB package information

- Epoxy meets UL94, V0
- Lead-free package

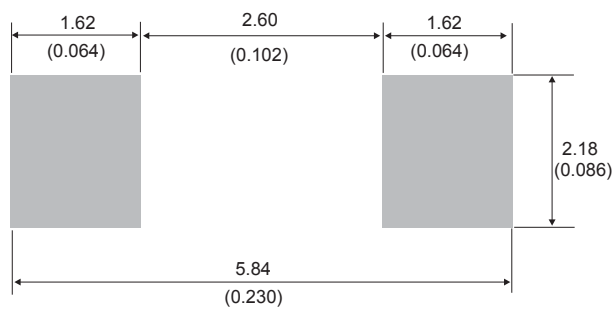
**Figure 16. SMB package outline**



**Table 4. SMB package mechanical data**

| Ref. | Dimensions  |      |                             |       |
|------|-------------|------|-----------------------------|-------|
|      | Millimeters |      | Inches (for reference only) |       |
|      | Min.        | Max. | Min.                        | Max.  |
| A1   | 1.90        | 2.45 | 0.074                       | 0.097 |
| A2   | 0.05        | 0.20 | 0.001                       | 0.008 |
| b    | 1.95        | 2.20 | 0.076                       | 0.087 |
| c    | 0.15        | 0.40 | 0.005                       | 0.016 |
| D    | 3.30        | 3.95 | 0.129                       | 0.156 |
| E    | 5.10        | 5.60 | 0.200                       | 0.221 |
| E1   | 4.05        | 4.60 | 0.159                       | 0.182 |
| L    | 0.75        | 1.50 | 0.029                       | 0.060 |

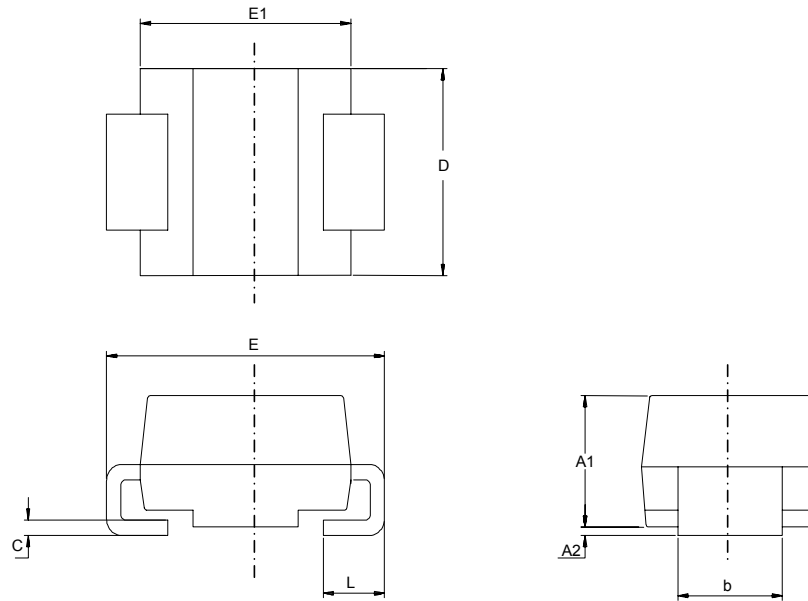
**Figure 17. SMB recommended footprint**



## 2.2 SMA package information

- Epoxy meets UL94, V0
- Cooling method : by conduction (C)

**Figure 18. SMA package outline**

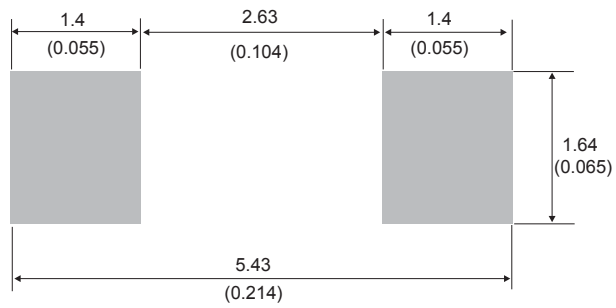


**Table 5. SMA package mechanical data**

| Ref. | Dimensions  |      |                             |       |
|------|-------------|------|-----------------------------|-------|
|      | Millimeters |      | Inches (for reference only) |       |
|      | Min.        | Max. | Min.                        | Max.  |
| A1   | 1.90        | 2.45 | 0.074                       | 0.097 |
| A2   | 0.05        | 0.20 | 0.001                       | 0.008 |
| b    | 1.25        | 1.65 | 0.049                       | 0.065 |
| c    | 0.15        | 0.40 | 0.005                       | 0.016 |
| D    | 2.25        | 2.90 | 0.088                       | 0.115 |
| E    | 4.80        | 5.35 | 0.188                       | 0.211 |
| E1   | 3.95        | 4.60 | 0.155                       | 0.182 |
| L    | 0.75        | 1.50 | 0.029                       | 0.060 |



**Figure 19. SMA recommended footprint in mm (inches)**



### 2.3 SMA Flat Notch package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Band indicates cathode

Figure 20. SMA Flat Notch package outline

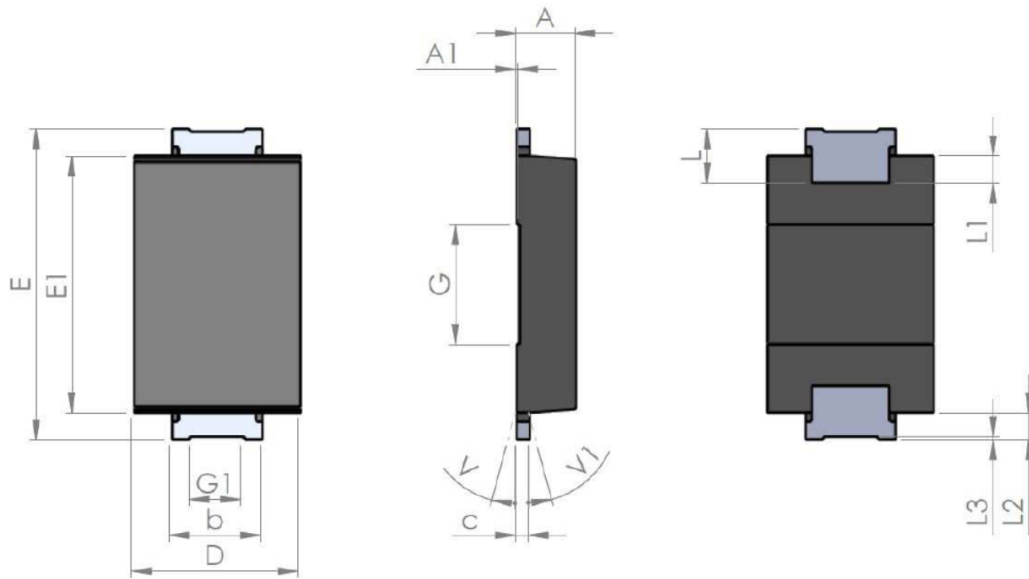
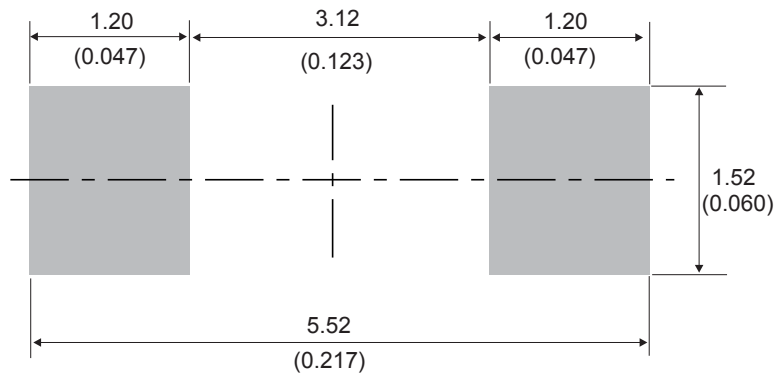


Table 6. SMA Flat Notch package mechanical data

| Ref. | Dimensions  |      |      |                             |       |       |
|------|-------------|------|------|-----------------------------|-------|-------|
|      | Millimeters |      |      | Inches (for reference only) |       |       |
|      | Min.        | Typ. | Max. | Min.                        | Typ.  | Max.  |
| A1   | 0.90        |      | 1.10 | 0.035                       |       | 0.044 |
| A1   |             | 0.05 |      |                             | 0.002 |       |
| b    | 1.25        |      | 1.65 | 0.049                       |       | 0.065 |
| C    | 0.15        |      | 0.40 | 0.005                       |       | 0.016 |
| D    | 2.25        |      | 2.90 | 0.088                       |       | 0.115 |
| E    | 5.00        |      | 5.35 | 0.196                       |       | 0.211 |
| E1   | 3.95        |      | 4.60 | 0.155                       |       | 0.182 |
| G    |             | 2.00 |      |                             | 0.079 |       |
| G1   |             | 0.85 |      |                             | 0.033 |       |
| L    | 0.75        |      | 1.20 | 0.029                       |       |       |
| L1   |             | 0.45 |      |                             | 0.018 |       |
| L2   |             | 0.45 |      |                             | 0.018 |       |
| L3   |             | 0.05 |      |                             | 0.002 |       |
| V    |             |      | 8°   |                             |       | 8°    |
| V1   |             |      | 8°   |                             |       | 8°    |

Figure 21. SMA Flat Notch recommended footprint in mm (inches)



## 2.4 SOD123Flat package information

Figure 22. SOD123Flat package outline

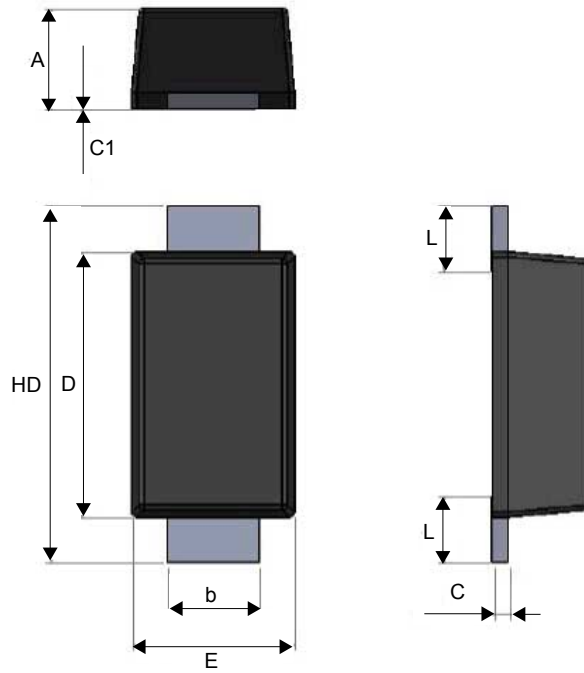
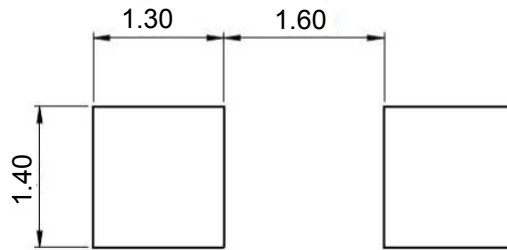


Table 7. SOD123Flat package mechanical data

| Ref. | Dimensions  |      |      |                             |       |       |
|------|-------------|------|------|-----------------------------|-------|-------|
|      | Millimeters |      |      | Inches (for reference only) |       |       |
|      | Min.        | Typ. | Max. | Min.                        | Typ.  | Max.  |
| A    | 0.86        | 0.98 | 1.10 | 0.034                       | 0.038 | 0.043 |
| b    | 0.80        | 0.90 | 1.00 | 0.031                       | 0.035 | 0.039 |
| c    | 0.08        | 0.15 | 0.25 | 0.003                       | 0.006 | 0.009 |
| c1   | 0.00        |      | 0.10 | 0.000                       |       | 0.004 |
| D    | 2.50        | 2.60 | 2.70 | 0.098                       | 0.102 | 0.106 |
| E    | 1.50        | 1.60 | 1.80 | 0.059                       | 0.063 | 0.070 |
| HD   | 3.30        | 3.50 | 3.70 | 0.130                       | 0.137 | 0.146 |
| L    | 0.45        | 0.65 | 0.85 | 0.018                       | 0.025 | 0.033 |

Figure 23. SOD123Flat footprint dimensions (mm)



### 3 Ordering information

**Table 8. Ordering information**

| Order code  | Marking | Package        | Weight  | Base qty. | Delivery mode |
|-------------|---------|----------------|---------|-----------|---------------|
| STPS1L40U   | GC4     | SMB            | 107 mg  | 2500      | Tape and reel |
| STPS1L40A   | GB4     | SMA            | 68 mg   | 5000      | Tape and reel |
| STPS1L40AFN | A14     | SMA Flat Notch | 39 mg   | 10 000    | Tape and reel |
| STPS1L40ZF  | 1L4     | SOD123Flat     | 12.5 mg | 3000      | Tape and reel |

## Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| Jul-2003    | 4A       | Last update.  |
| Aug-2004    | 5        | SMA package dimensions update. Reference A1 max. changed from 2.70 mm (0.106 inch.) to 2.03 mm (0.080).   |
| 24-Jun-2009 | 6        | Added STmite flat package.  |
| 01-Jul-2016 | 7        | STmite flat package information removed.<br>Added SOD123Flat package.   |
| 03-Dec-2018 | 8        | Updated <a href="#">Section Features</a> and <a href="#">Table 1. Absolute ratings (limiting values at 25 °C, unless otherwise specified)</a> . |
| 27-Sep-2019 | 9        | Added <a href="#">Section 2.3 SMA Flat Notch package information</a> .  |

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