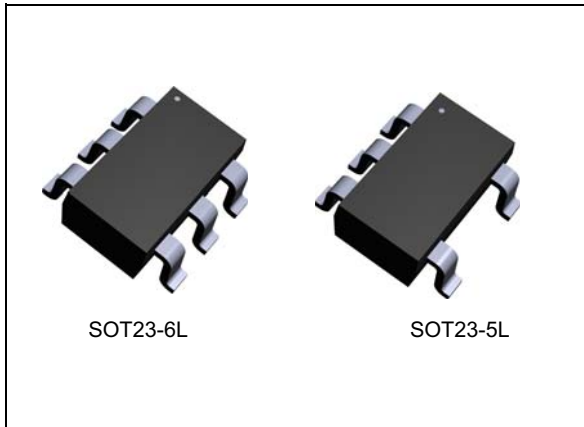


## Automotive quad-line Transil™ transient voltage suppressor (TVS) for ESD protection

Datasheet - production data



### Features

- 4 unidirectional Transil functions
- 400 W peak pulse power (8/20  $\mu$ s)

### Benefits

- High EOS and ESD protection levels
- Suitable for high density boards
- AEC-Q101 qualified

### Complies with the following standards:

- ISO 10605: C = 150 pF, R = 330  $\Omega$ 
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO 10605: C = 330 pF, R = 330  $\Omega$ 
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO 7637-2
  - Pulse 1:  $V_S = -100$  V
  - Pulse 2a:  $V_S = +50$  V
  - Pulse 3a:  $V_S = -150$  V
  - Pulse 3b:  $V_S = +100$  V

### Applications

Where ESD and EOS transient overvoltage protection in susceptible equipment is required, such as:

- Information - entertainment
- Signal communications
- Connectivity
- Comfort and convenience

### Description

The ESDAxxSCxY devices are monolithic voltage suppressors designed to protect components which are connected to data and transmission lines against ESD.

They clamp the voltage just above the logic level supply for positive transients, and to a diode drop below ground for negative transient.

Figure 1. Pin configuration

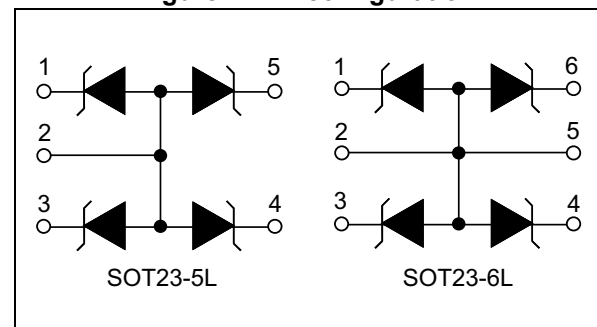


Table 1. Device summary

| Order code   | $V_{BR}(min.)$ | Package  |
|--------------|----------------|----------|
| ESDA5V3SC6Y  | 5.3            | SOT23-6L |
| ESDA6V1SC6Y  | 6.1            | SOT23-6L |
| ESDA14V2SC5Y | 14.2           | SOT23-5L |
| ESDA14V2SC6Y | 14.2           | SOT23-6L |
| ESDA25SC6Y   | 25             | SOT23-6L |

# 1 Characteristics

Table 2. Absolute ratings ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

| Symbol    | Parameter  |  | Value       | Unit               |
|-----------|--|--|-------------|--------------------|
| $V_{PP}$  | Peak pulse voltage                                 | ISO10605 (C = 150 pF, R = 330 $\Omega$ ) |             | kV                 |
|           |  | Contact discharge                        | 30          |                    |
|           |  | Air discharge                            | 30          |                    |
|           |  | ISO10605 (C = 330 pF, R = 330 $\Omega$ ) |             |                    |
| $P_{PP}$  | Peak pulse power (8/20 $\mu$ s)                    | ESDA5V3SC6Y, ESDA6V1SC6Y                 | 300         | W                  |
|           |  | ESDA14V2SC5Y, ESDA14V2SC6Y, ESDA25SC6Y   | 400         |                    |
| $I_{PP}$  | Peak pulse current (8/20 $\mu$ s)                  | ESDA5V3SC6Y                              | 22          | A                  |
|           |  | ESDA6V1SC6Y                              | 18          |                    |
|           |  | ESDA14V2SC5Y, ESDA14V2SC6Y               | 14          |                    |
|           |  | ESDA25SC6Y                               | 9           |                    |
| $T_j$     | Operating junction temperature range               |  | -40 to +150 | $^{\circ}\text{C}$ |
| $T_{stg}$ | Storage temperature range                          |  | -65 to +150 | $^{\circ}\text{C}$ |
| $T_L$     | Maximum lead temperature for soldering during 10 s |  | 260         | $^{\circ}\text{C}$ |

Figure 2. Electrical characteristics (definitions)

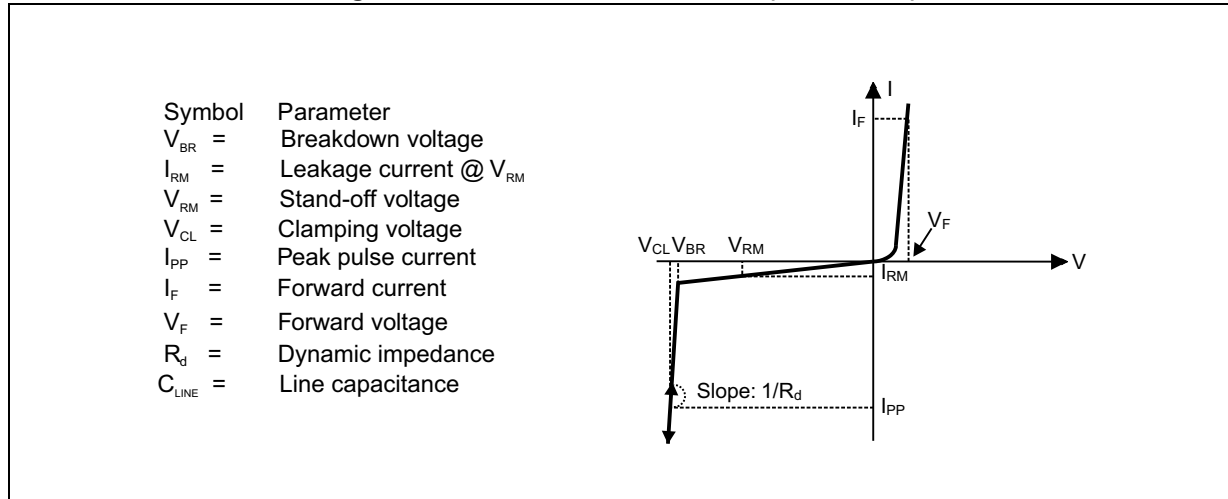
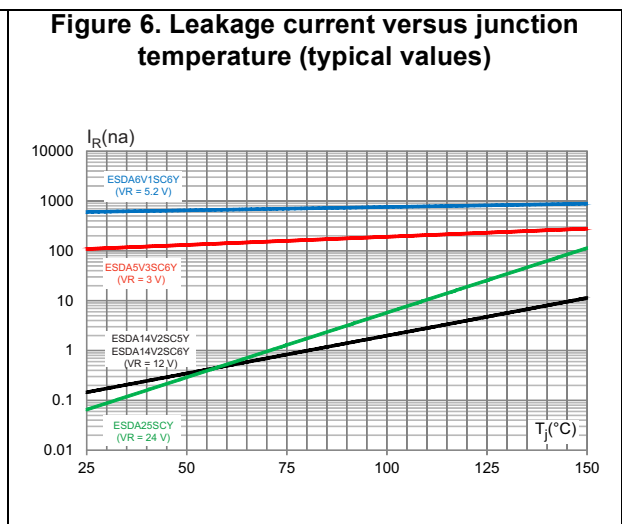
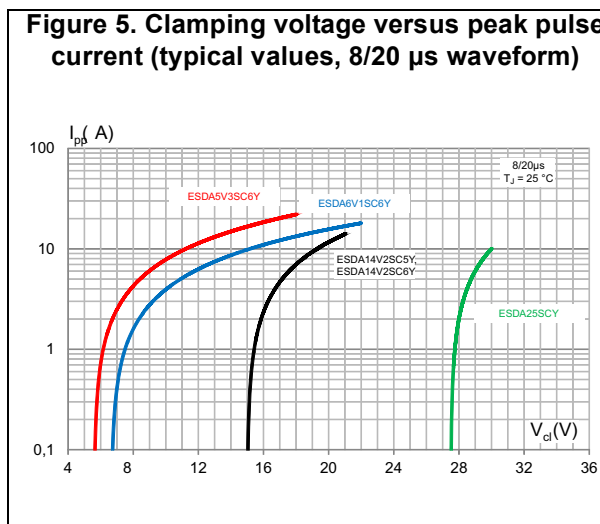
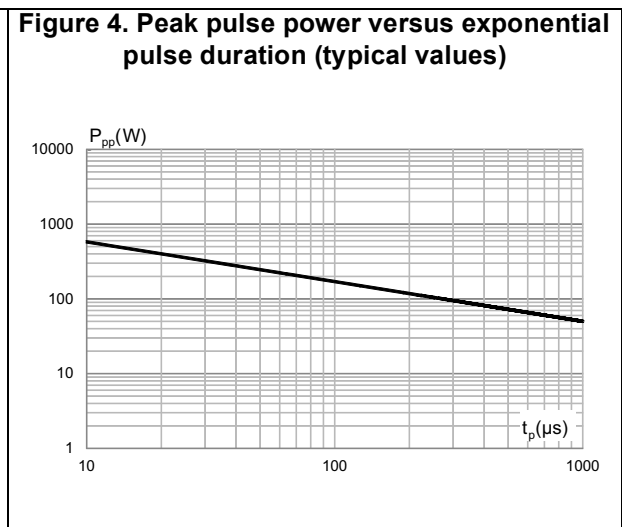
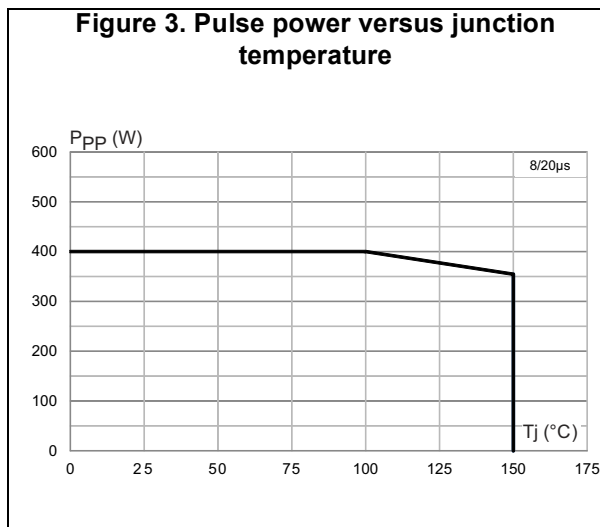


Table 3. Electrical characteristics - values ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

| Order code                    | $V_{BR}$ at $I_R$ |      |    | $I_{RM}$ at $V_{RM}$ |     | $V_{CL}$ at $I_{pp}^{(1)}$ |    | $V_F$ at $I_F$ |     | $\alpha T^{(2)}$   | $C_{line}$ |
|-------------------------------|-------------------|------|----|----------------------|-----|----------------------------|----|----------------|-----|--------------------|------------|
|                               | min.              | max. |    | max.                 |     | max.                       |    | max.           |     | max.               | typ.       |
|                               | V                 | V    | mA | $\mu\text{A}$        | V   | V                          | A  | V              | mA  | $10^{-4}/\text{C}$ | pF         |
| ESDA5V3SC6Y                   | 5.3               | 5.9  | 1  | 2                    | 3   | 21                         | 22 | 1.25           | 200 | 5                  | 320        |
| ESDA6V1SC6Y                   | 6.1               | 7.2  | 1  | 2                    | 5.2 | 19                         | 18 | 1.25           | 200 | 6                  | 190        |
| ESDA14V2SC5Y,<br>ESDA14V2SC6Y | 14.2              | 15.8 | 1  | 5                    | 12  | 35                         | 14 | 1.25           | 200 | 10                 | 100        |
| ESDA25SC6Y                    | 25                | 30   | 1  | 1                    | 24  | 51                         | 9  | 1.2            | 10  | 10                 | 60         |

1. 8/20  $\mu\text{s}$  waveform

2.  $\Delta V_{BR} = \alpha T * (T_{amb} - 25\text{ }^{\circ}\text{C}) * V_{BR}(25\text{ }^{\circ}\text{C})$



Note: ISO7637-2 pulse responses are not applicable for products with a breakdown voltage lower than the average battery voltage (13.5 V) like ESDA6V1SC6Y.

Figure 7. ISO7637-2 pulse 1 response ( $V_S = -100\text{ V}$ )

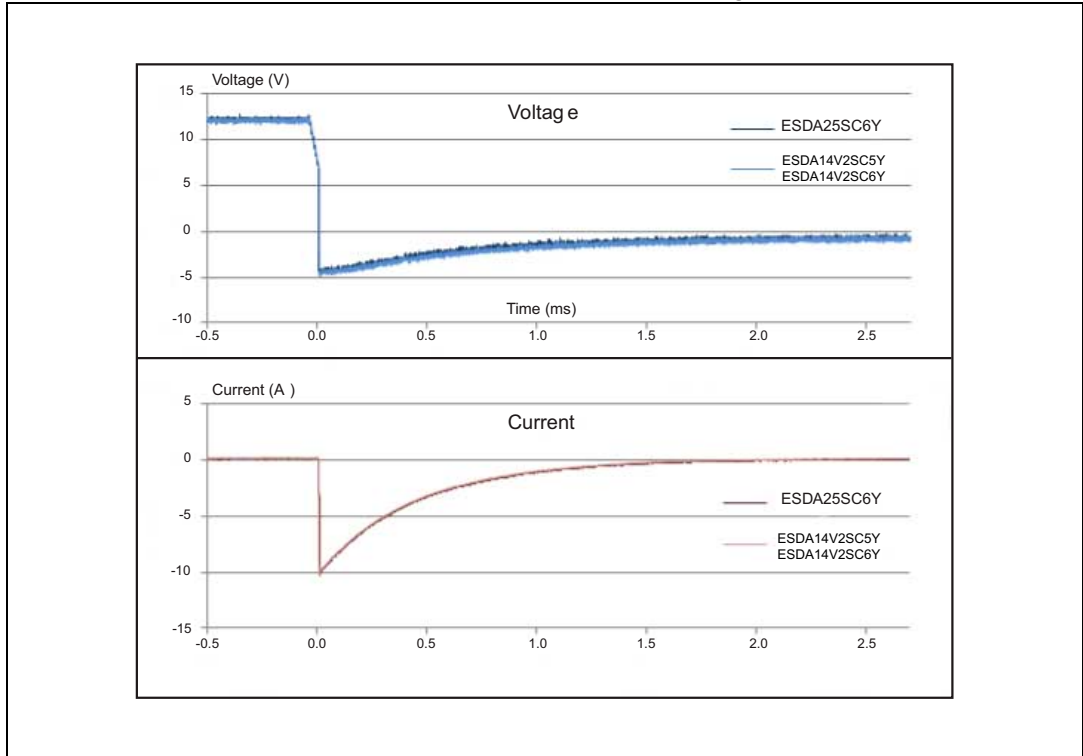


Figure 8. ISO7637-2 pulse 2a response ( $V_S = 50\text{ V}$ )

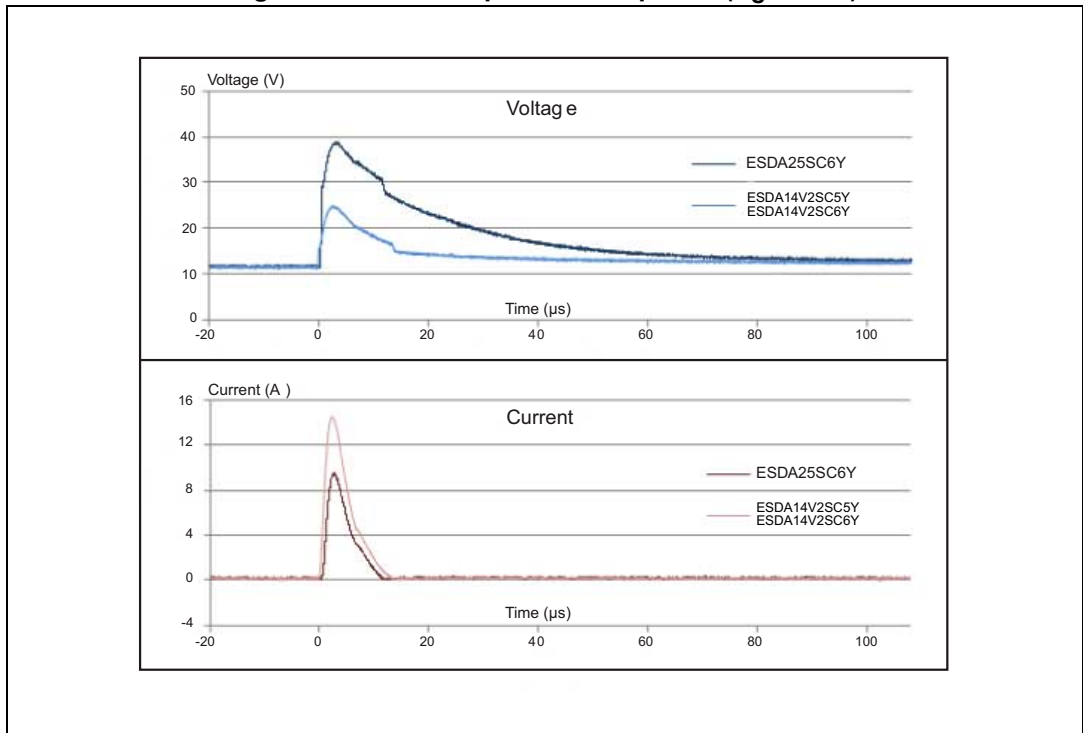


Figure 9. ISO7637-2 pulse 3a response ( $V_S = -150\text{ V}$ )

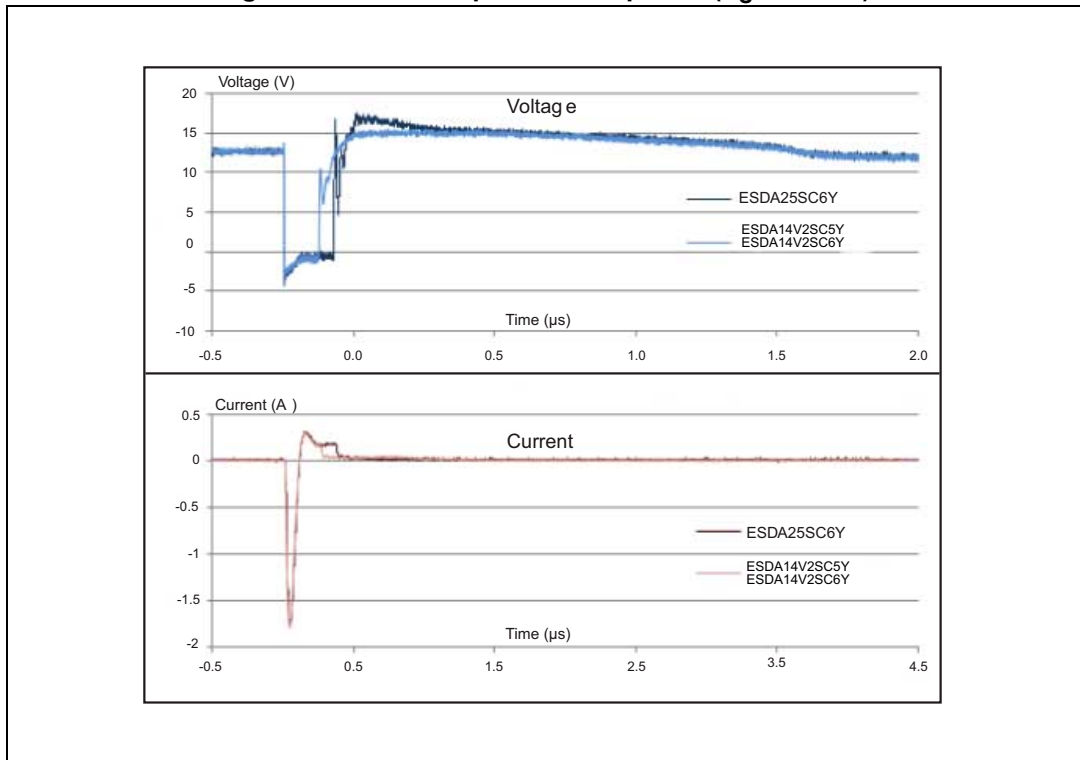
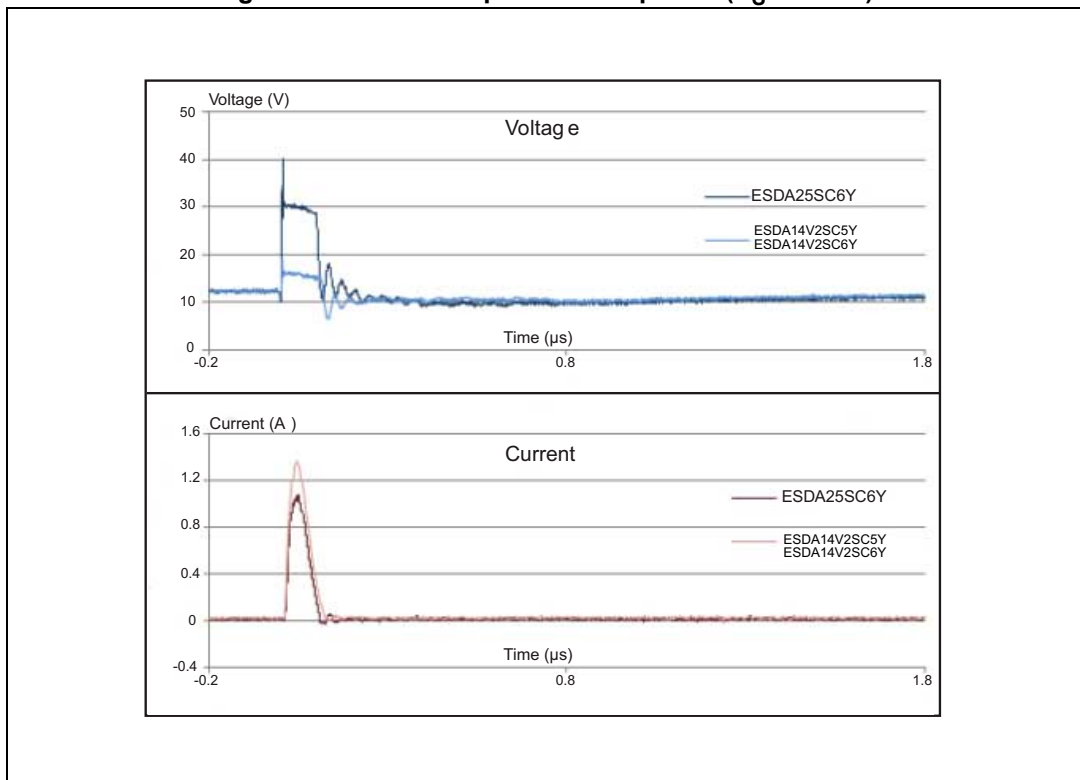


Figure 10. ISO7637-2 pulse 3b response ( $V_S = 100\text{ V}$ )



## 2 Application and design guidelines

More information is available in the STMicroelectronics Application note AN2689: "Protection of automotive electronics from electrical hazards, guidelines for design and component selection".

### 3 Package information

- Epoxy meets UL94, V0
- Lead-free packages

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

### 3.1 SOT23-5L package information

Figure 11. SOT23-5L package outline

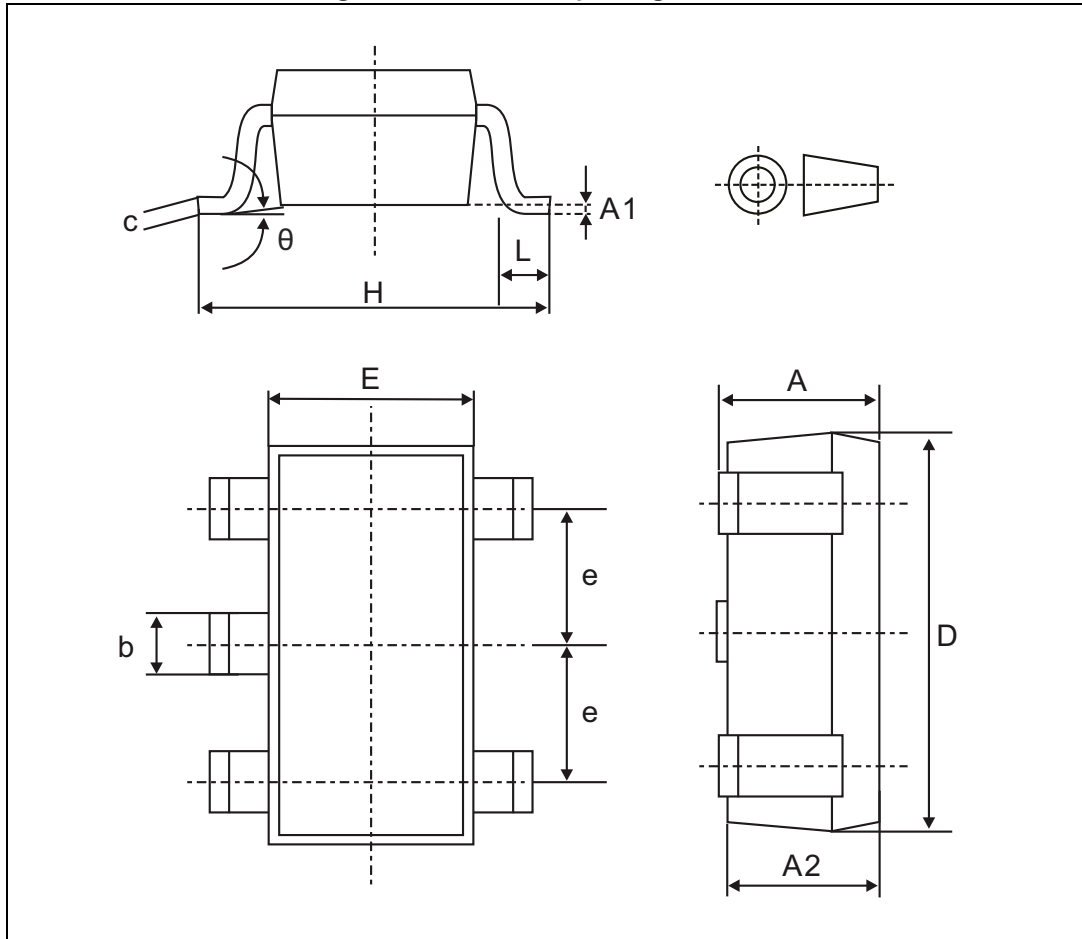
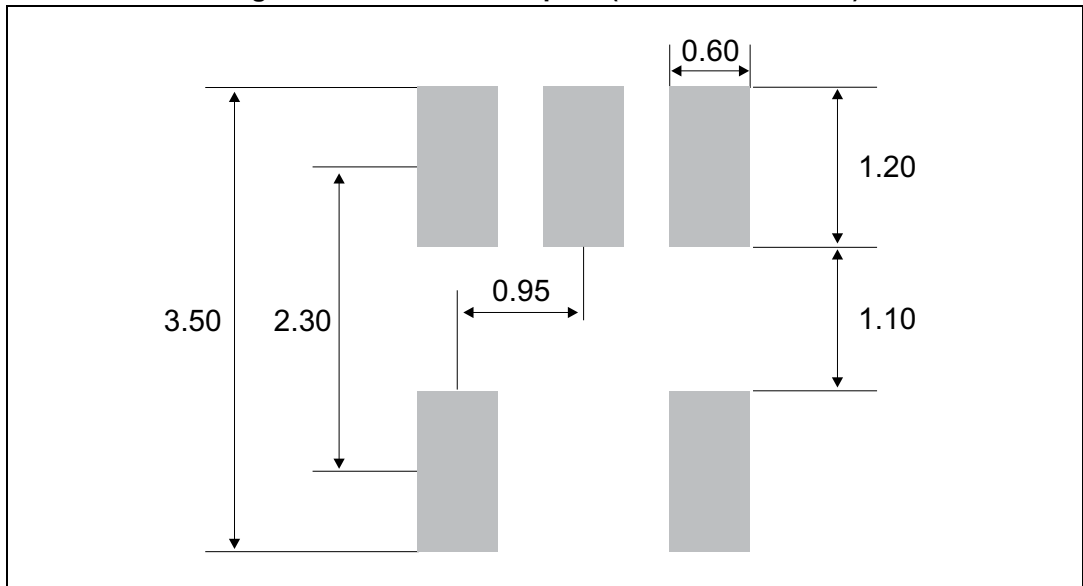


Table 4. SOT23-5L package mechanical data

| Ref. | Dimensions  |      |      |        |        |        |
|------|-------------|------|------|--------|--------|--------|
|      | Millimeters |      |      | Inches |        |        |
|      | Min.        | Typ. | Max. | Min.   | Typ.   | Max.   |
| A    | 0.90        |      | 1.45 | 0.0354 |        | 0.0570 |
| A1   | 0           |      | 0.15 | 0      |        | 0.0059 |
| A2   | 0.90        |      | 1.30 | 0.0354 |        | 0.0511 |
| b    | 0.30        |      | 0.50 | 0.0118 |        | 0.0196 |
| c    | 0.09        |      | 0.20 | 0.0035 |        | 0.0078 |
| D    | 2.80        |      | 3.05 | 0.1102 |        | 0.1200 |
| E    | 1.50        |      | 1.75 | 0.0590 |        | 0.0688 |
| e    |             | 0.95 |      |        | 0.0374 |        |
| H    | 2.60        |      | 3.00 | 0.1023 |        | 0.1181 |
| L    | 0.30        |      | 0.60 | 0.0118 |        | 0.0236 |
| θ    | 0°          |      | 10°  | 0°     |        | 10°    |



Figure 12. SOT23-5L footprint (dimensions in mm)



### 3.2 SOT23-6L package information

Figure 13. SOT23-6L package outline

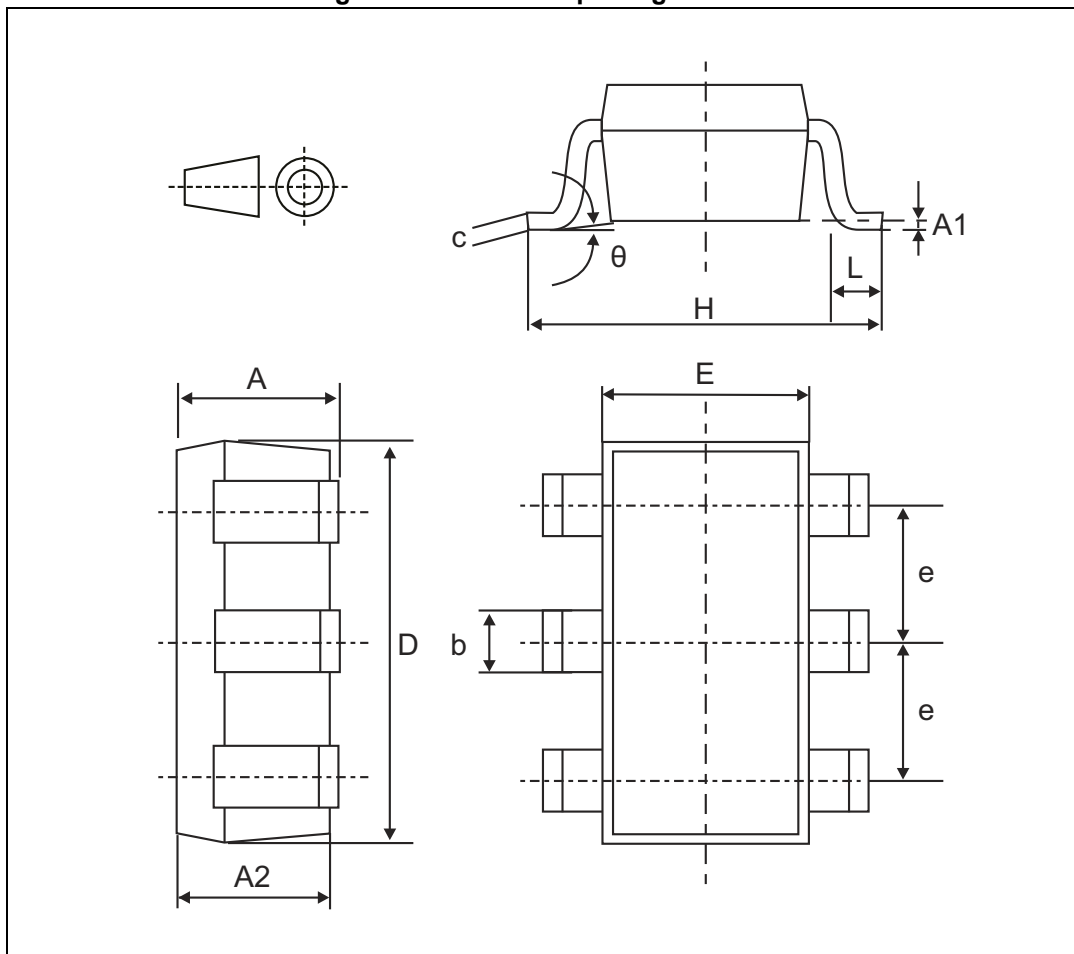
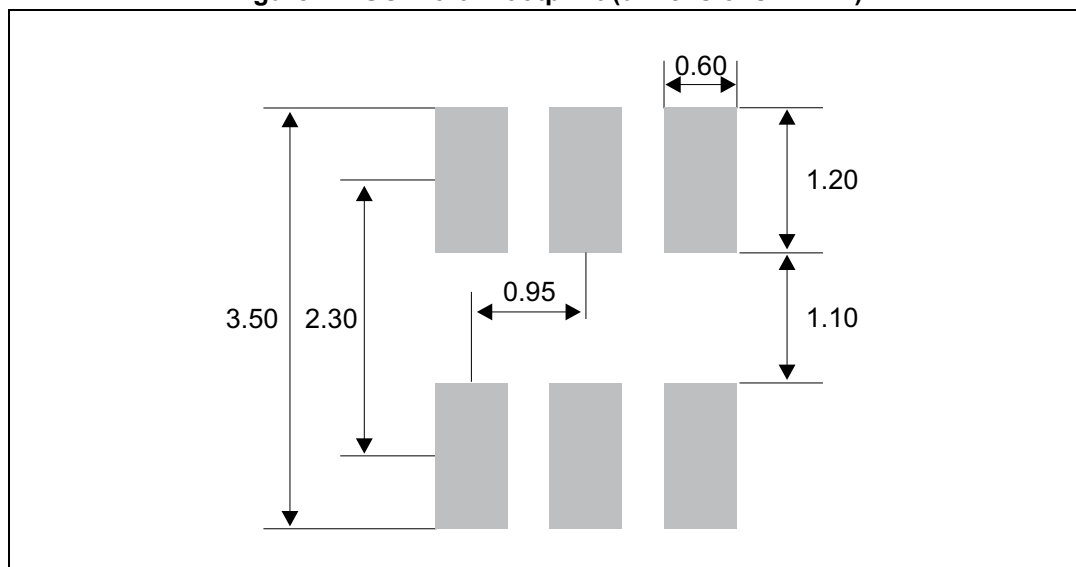


Table 5. SOT23-6L package mechanical data

| Ref.  | Dimensions  |      |      |        |        |        |
|-------|-------------|------|------|--------|--------|--------|
|       | Millimeters |      |      | Inches |        |        |
|       | Min.        | Typ. | Max. | Min.   | Typ.   | Max.   |
| A     | 0.90        |      | 1.45 | 0.0354 |        | 0.0570 |
| A1    | 0           |      | 0.15 | 0      |        | 0.0059 |
| A2    | 0.90        |      | 1.30 | 0.0354 |        | 0.0511 |
| b     | 0.30        |      | 0.50 | 0.0118 |        | 0.0196 |
| c     | 0.09        |      | 0.20 | 0.0035 |        | 0.0078 |
| D     | 2.80        |      | 3.05 | 0.1102 |        | 0.1200 |
| E     | 1.50        |      | 1.75 | 0.0590 |        | 0.0688 |
| e     |             | 0.95 |      |        | 0.0374 |        |
| H     | 2.60        |      | 3.00 | 0.1023 |        | 0.1181 |
| L     | 0.30        |      | 0.60 | 0.0118 |        | 0.0236 |
| theta | 0°          |      | 10°  | 0°     |        | 10°    |

Figure 14. SOT23-6L footprint (dimensions in mm)



## 4 Recommendation on PCB assembly

### 4.1 Solder paste

1. Use halide-free flux, qualification ROL0 according to ANSI/J-STD-004.
2. “No clean” solder paste recommended.
3. Offers a high tack force to resist component displacement during PCB movement.
4. Use solder paste with fine particles: powder particle size 20–45  $\mu\text{m}$ .

### 4.2 Placement

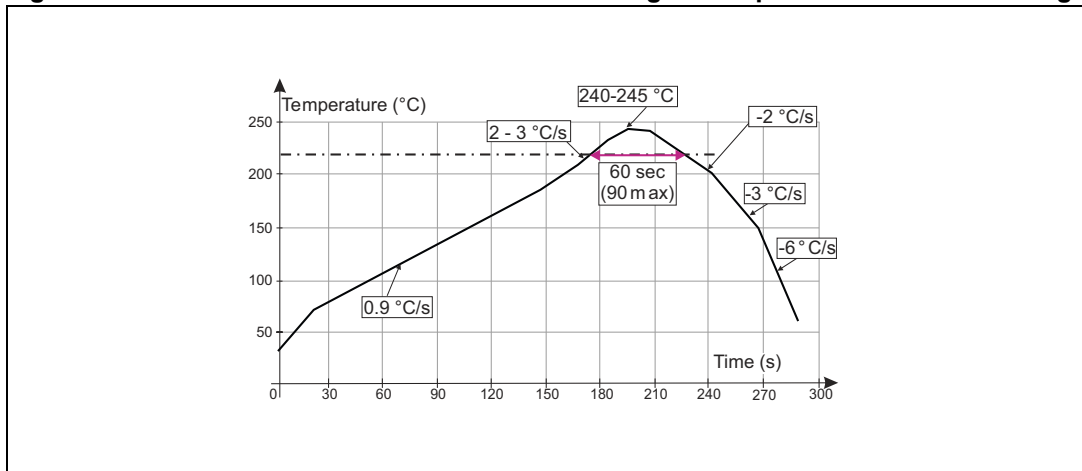
1. Manual positioning is not recommended.
2. It is recommended to use the lead recognition capabilities of the placement system, not the outline centering.
3. Standard tolerance of  $\pm 0.05$  mm is recommended.
4. 3.5 N placement force is recommended. Too much placement force can lead to squeezed out solder paste and cause solder joints to short. Too low placement force can lead to insufficient contact between package and solder paste that could cause open solder joints or badly centered packages.
5. To improve the package placement accuracy, a bottom side optical control should be performed with a high resolution tool.
6. For assembly, a perfect supporting of the PCB (all the more on flexible PCB) is recommended during solder paste printing, pick and place and reflow soldering by using optimized tools.

### 4.3 PCB design preference

1. To control the solder paste amount, the closed via is recommended instead of open vias.
2. The position of tracks and open vias in the solder area should be well balanced. The symmetrical layout is recommended, in case any tilt phenomena caused by asymmetrical solder paste amount due to the solder flow away.

## 4.4 Reflow profile

Figure 15. ST ECOPACK<sup>®</sup> recommended soldering reflow profile for PCB mounting



Note: Minimize air convection currents in the reflow oven to avoid component movement.

## 5 Ordering information

Figure 16. Ordering information scheme

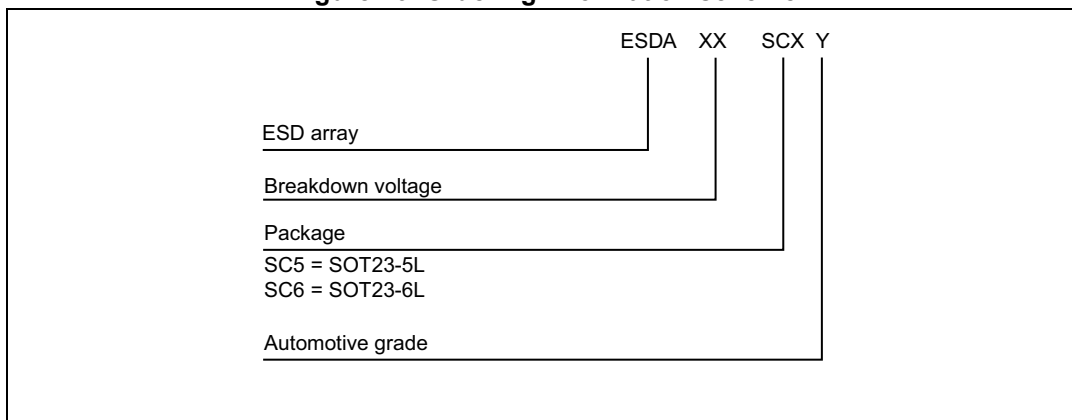


Table 6. Ordering information

| Order codes  | Marking <sup>(1)</sup> | Package  | Weight | Base qty | Delivery mode |
|--------------|------------------------|----------|--------|----------|---------------|
| ESDA5V3SC6Y  | ES5Y                   | SOT23-6L | 14 mg  | 3000     | Tape and reel |
| ESDA6V1SC6Y  | ES6Y                   | SOT23-6L |        |          |               |
| ESDA14V2SC5Y | EC1Y                   | SOT23-5L | 16 mg  |          |               |
| ESDA14V2SC6Y | ES1Y                   | SOT23-6L |        |          |               |
| ESDA25SC6Y   | ES2Y                   | SOT23-6L | 14 mg  |          |               |

1. The marking can be rotated by multiples of 90° to differentiate assembly location

## 6 Revision history

Table 7. Document revision history

| Date        | Revision | Changes          |
|-------------|----------|------------------|
| 05-Oct-2015 | 1        | Initial release. |

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