

## Small signal Schottky diodes

### Main product characteristics

|             |        |
|-------------|--------|
| $I_F$       | 300 mA |
| $V_{RRM}$   | 40 V   |
| C (typ)     | 7 pF   |
| $T_j$ (max) | 150° C |

### Features and benefits

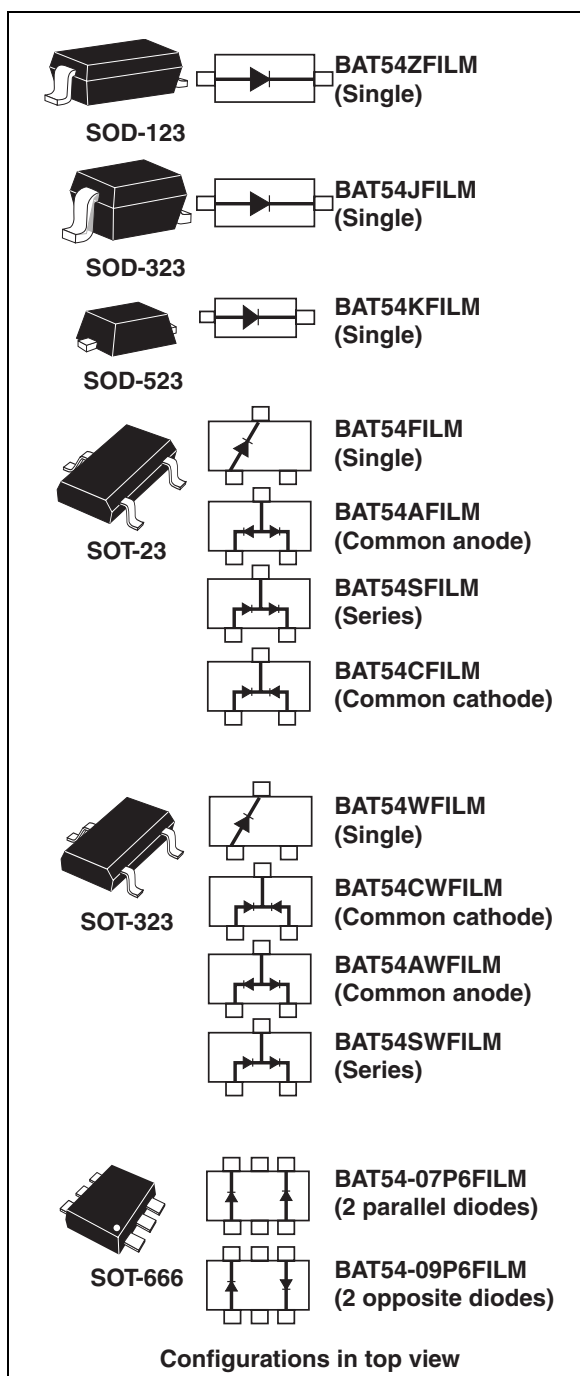
- Low conduction and reverse losses
- Negligible switching losses
- Low forward and reverse recovery times
- Extremely fast switching
- Surface mount device
- Low capacitance diode

### Description

The BAT54 series uses 40 V Schottky barrier diodes packaged in SOD- 23, SOD-323, SOD-523, SOT-23, SOT-323, or SOT-666.

### Order codes

| Part Number    | Marking |
|----------------|---------|
| BAT54FILM      | D86     |
| BAT54SFILM     | D88     |
| BAT54CFILM     | D87     |
| BAT54AFILM     | D84     |
| BAT54WFILM     | D73     |
| BAT54SWFILM    | D78     |
| BAT54CWFILM    | D77     |
| BAT54AWFILM    | D74     |
| BAT54JFILM     | 86      |
| BAT54KFILM     | 86      |
| BAT54-07P6FILM | P4      |
| BAT54-09P6FILM | Q4      |
| BAT54ZFILM     | D72     |



# 1 Characteristics

**Table 1. Absolute ratings (limiting values at  $T_j = 25^\circ\text{C}$ , unless otherwise specified)**

| Symbol    | Parameter                            | Value                           | Unit             |
|-----------|--------------------------------------|---------------------------------|------------------|
| $V_{RRM}$ | Repetitive peak reverse voltage      | 40                              | V                |
| $I_F$     | Continuous forward current           | 300                             | mA               |
| $I_{FSM}$ | Surge non repetitive forward current | $t_p = 10\text{ ms}$ Sinusoidal | A                |
| $T_{stg}$ | Storage temperature range            | -65 to +150                     | $^\circ\text{C}$ |
| $T_j$     | Operating junction temperature range | -40 to +150                     | $^\circ\text{C}$ |
| $T_L$     | Maximum soldering temperature        | 260                             | $^\circ\text{C}$ |

**Table 2. Thermal parameters**

| Symbol        | Parameter                          | Value             | Unit               |
|---------------|------------------------------------|-------------------|--------------------|
| $R_{th(j-a)}$ | Junction to ambient <sup>(1)</sup> | SOT-23, SOD-123   | 500                |
|               |                                    | SOT-323, SOD-323, | 550                |
|               |                                    | SOD-523, SOT-666  | 600                |
|               |                                    |                   | $^\circ\text{C/W}$ |

1. Epoxy printed circuit board with recommended pad layout

**Table 3. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions           | Min.                  | Typ | Max. | Unit          |
|-------------|-------------------------|---------------------------|-----------------------|-----|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25^\circ\text{C}$  | $V_R = 30\text{ V}$   |     | 1    | $\mu\text{A}$ |
|             |                         | $T_j = 100^\circ\text{C}$ |                       |     | 100  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25^\circ\text{C}$  | $I_F = 0.1\text{ mA}$ |     | 240  | mV            |
|             |                         |                           | $I_F = 1\text{ mA}$   |     | 320  |               |
|             |                         |                           | $I_F = 10\text{ mA}$  |     | 400  |               |
|             |                         |                           | $I_F = 30\text{ mA}$  |     | 500  |               |
|             |                         |                           | $I_F = 100\text{ mA}$ |     | 900  |               |

1. Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$

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

**Table 4. Dynamic characteristics**

| Symbol   | Parameter             | Test conditions  | Min. | Typ | Max. | Unit |
|----------|-----------------------|--|------|-----|------|------|
| C        | Diode capacitance     | $V_R = 1\text{ V}$ , $F = 1\text{ MHz}$  |      | 7   | 10   | pF   |
| $t_{rr}$ | Reverse recovery time | $I_F = 10\text{ mA}$ , $I_R = 10\text{ mA}$ , $T_j = 25^\circ\text{C}$<br>$I_{rr} = 1\text{ mA}$ , $R_L = 100\text{ }\Omega$ |      |     | 5    | ns   |

Figure 1. Average forward power dissipation versus average forward current

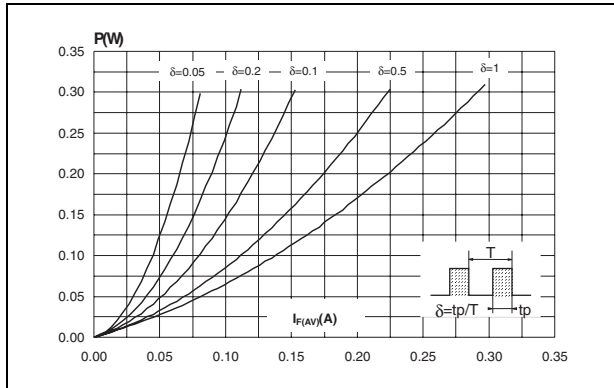


Figure 2. Average forward current versus ambient temperature ( $\delta = 1$ )

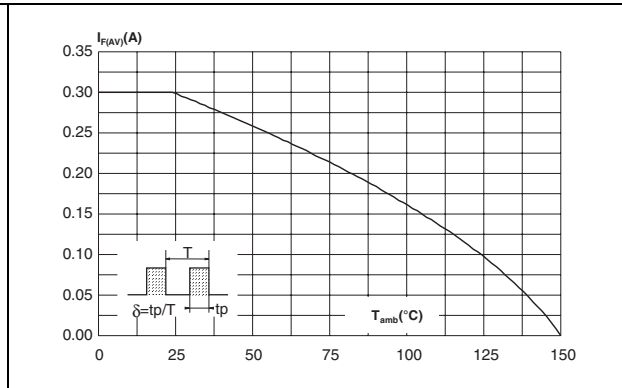


Figure 3. Reverse leakage current versus reverse applied voltage (typical values)

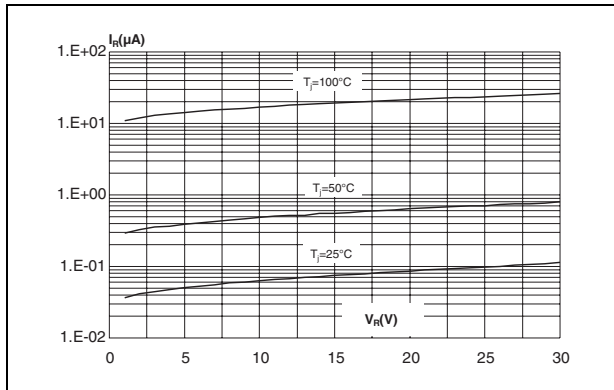


Figure 4. Reverse leakage current versus junction temperature

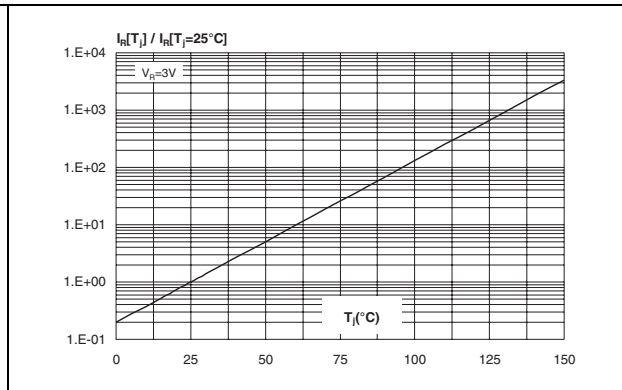


Figure 5. Junction capacitance versus reverse applied voltage (typical values)

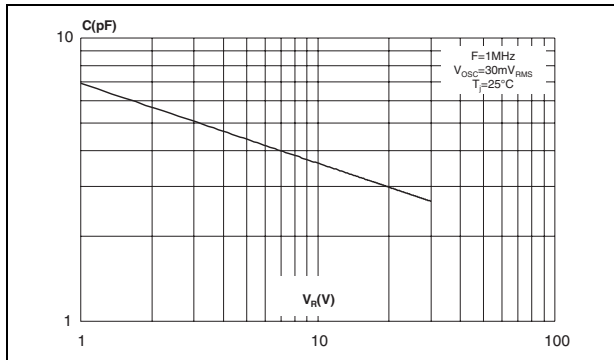
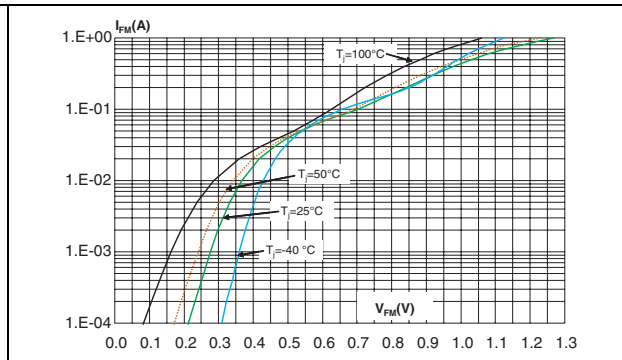
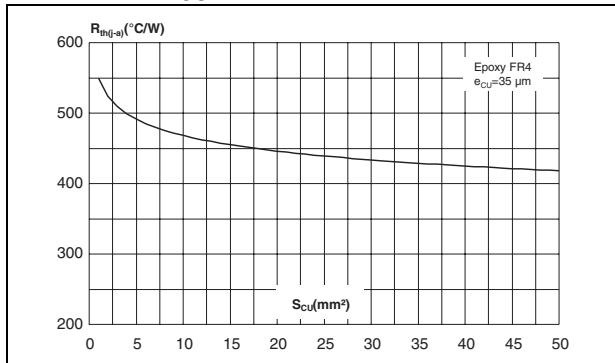


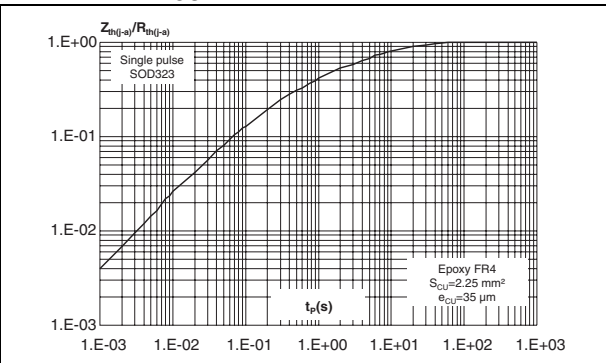
Figure 6. Forward voltage drop versus forward current (typical values)



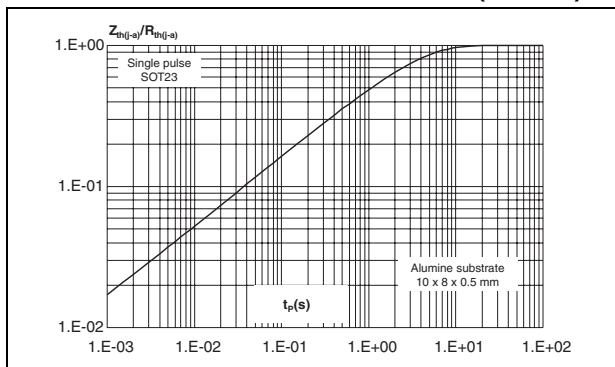
**Figure 7. Thermal resistance junction to ambient versus copper surface under each lead - epoxy FR4 with recommended pad layout,  $e_{CU} = 35 \mu\text{m}$  (SOD-323)**



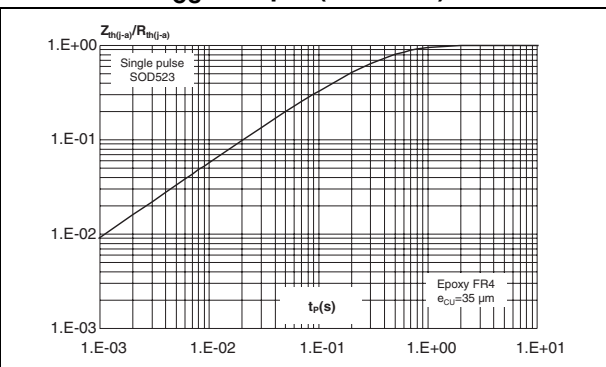
**Figure 8. Relative variation of thermal impedance junction to ambient versus pulse duration - epoxy FR4 with recommended pad layout,  $e_{CU} = 35 \mu\text{m}$  (SOD-323)**



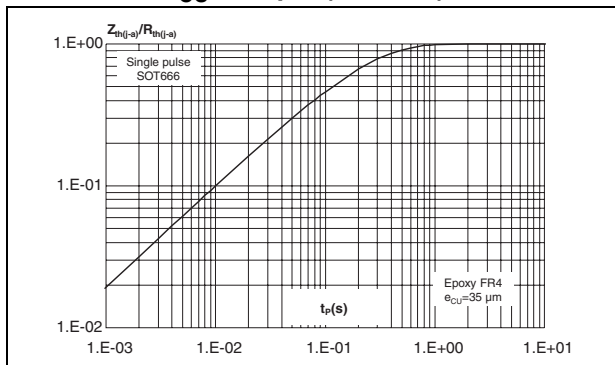
**Figure 9. Relative variation of thermal impedance junction to ambient versus pulse duration - aluminium oxide substrate 10 mm x 8 mm x 0.5 mm (SOT-23)**



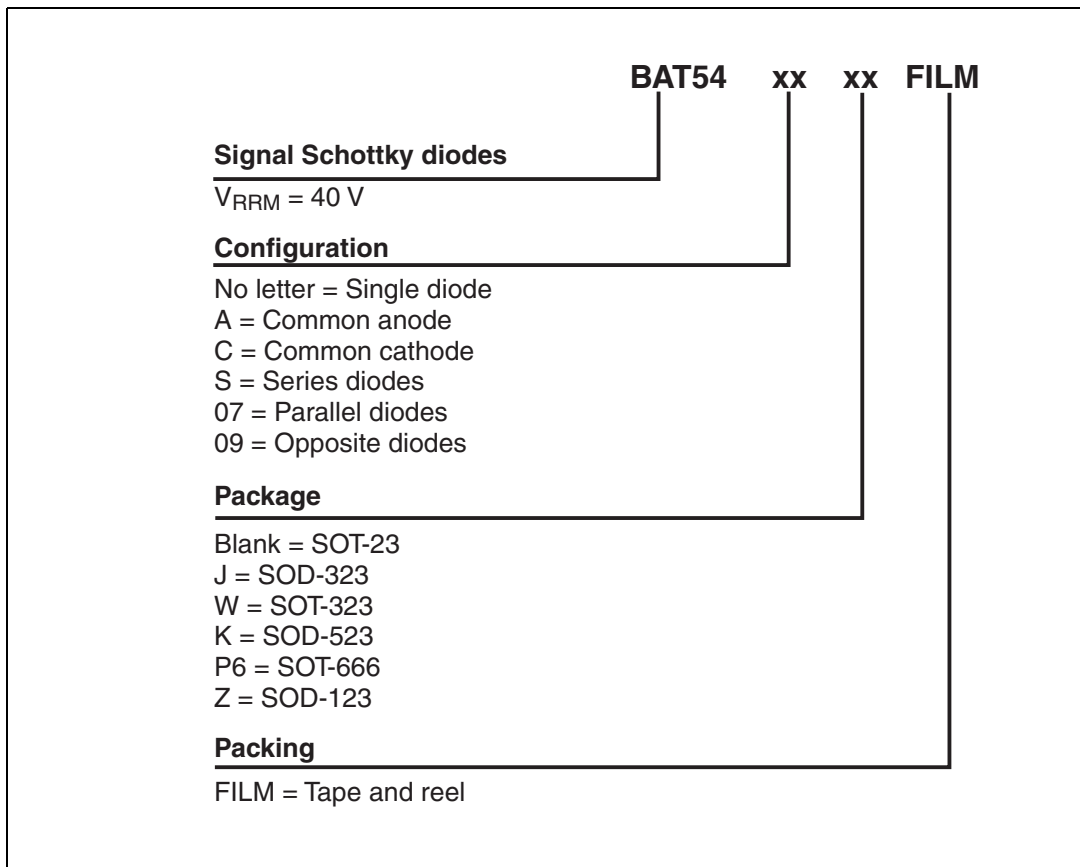
**Figure 10. Relative variation of thermal impedance junction to ambient versus pulse duration - epoxy FR4 with recommended pad layout,  $e_{CU} = 35 \mu\text{m}$  (SOD-523)**



**Figure 11. Relative variation of thermal impedance junction to ambient versus pulse duration - epoxy FR4 with recommended pad layout,  $e_{CU} = 35 \mu\text{m}$  (SOT-666)**



## 2 Ordering information scheme



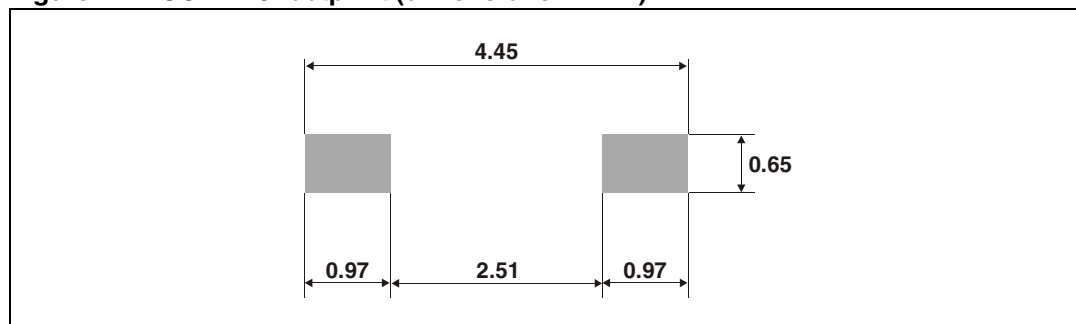
### 3 Package information

Epoxy meets UL94, V0

**Table 5. SOD-123 dimensions**

| Ref. | Dimensions  |      |            |       |
|------|-------------|------|------------|-------|
|      | Millimeters |      | Inches     |       |
|      | Min.        | Max. | Min.       | Max.  |
| A    |             | 1.45 |            | 0.057 |
| A1   | 0           | 0.1  | 0          | 0.004 |
| A2   | 0.85        | 1.35 | 0.033      | 0.053 |
| b    | 0.55 Typ.   |      | 0.022 Typ. |       |
| c    | 0.15 Typ.   |      | 0.039 Typ. |       |
| D    | 2.55        | 2.85 | 0.1        | 0.112 |
| E    | 1.4         | 1.7  | 0.055      | 0.067 |
| G    | 0.25        |      | 0.01       |       |
| H    | 3.55        | 3.95 | 0.14       | 0.156 |

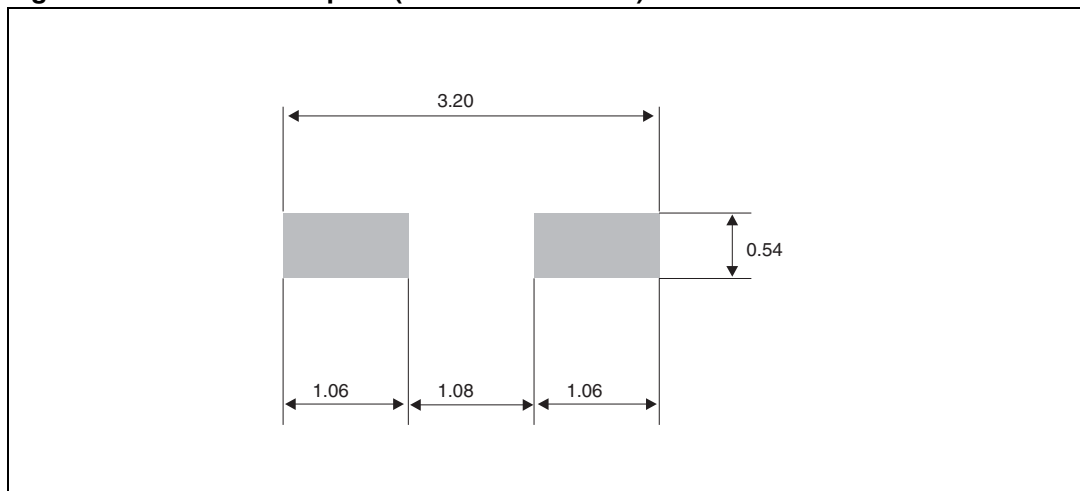
**Figure 12. SOD-123 footprint (dimensions in mm)**



**Table 6. SOD-323 dimensions**

| Ref. | Dimensions  |      |        |       |
|------|-------------|------|--------|-------|
|      | Millimeters |      | Inches |       |
|      | Min.        | Max. | Min.   | Max.  |
| A    |             | 1.17 |        | 0.046 |
| A1   | 0           | 0.1  | 0      | 0.004 |
| b    | 0.25        | 0.44 | 0.01   | 0.017 |
| c    | 0.1         | 0.25 | 0.004  | 0.01  |
| D    | 1.52        | 1.8  | 0.06   | 0.071 |
| E    | 1.11        | 1.45 | 0.044  | 0.057 |
| H    | 2.3         | 2.7  | 0.09   | 0.106 |
| L    | 0.1         | 0.46 | 0.004  | 0.02  |
| Q1   | 0.1         | 0.41 | 0.004  | 0.016 |

**Figure 13. SOD-323 footprint (dimensions in mm)**



**Table 7. SOD-523 dimensions**

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 0.50        | 0.60 | 0.70 | 0.020  | 0.024 | 0.028 |
| E    | 1.50        | 1.60 | 1.70 | 0.059  | 0.063 | 0.067 |
| E1   | 1.10        | 1.20 | 1.30 | 0.043  | 0.047 | 0.051 |
| D    | 0.70        | 0.80 | 0.90 | 0.028  | 0.031 | 0.035 |
| b    | 0.25        |      | 0.35 | 0.010  |       | 0.014 |
| c    | 0.07        |      | 0.20 | 0.003  |       | 0.008 |
| L    | 0.15        | 0.20 | 0.25 | 0.006  | 0.008 | 0.010 |
| L1   | 0.10        |      | 0.20 | 0.004  |       | 0.008 |

**Figure 14. SOD-523 footprint (dimensions in mm)**

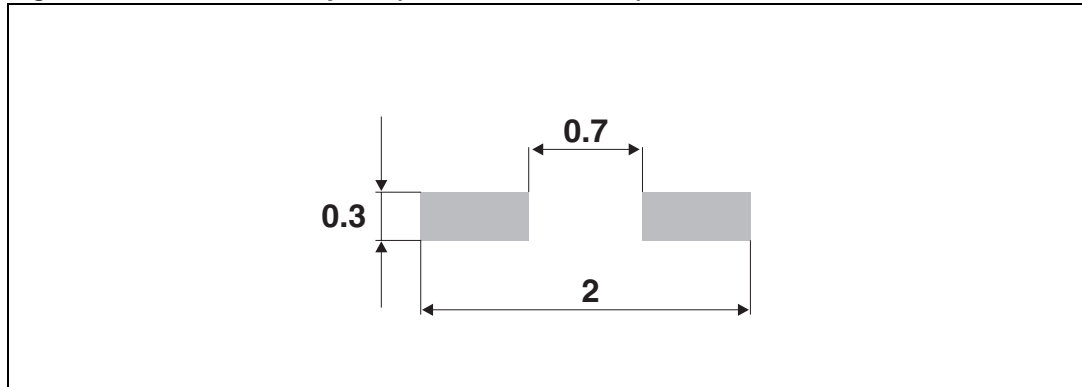
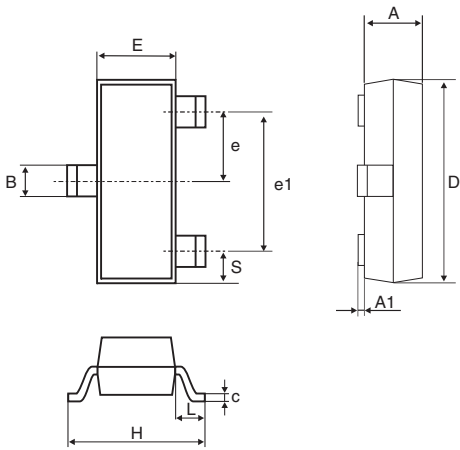


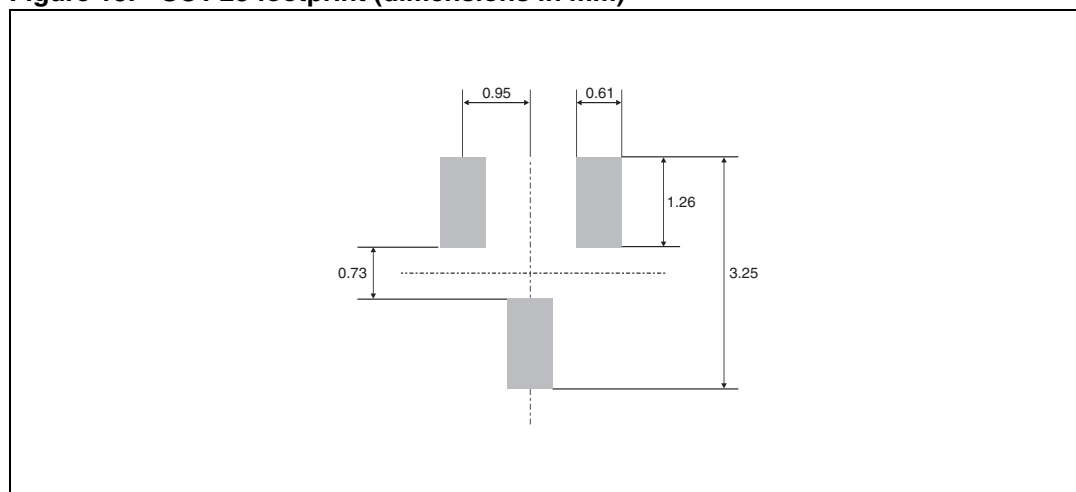


Table 8. SOT-23 dimensions



| Ref. | Dimensions  |      |            |       |
|------|-------------|------|------------|-------|
|      | Millimeters |      | Inches     |       |
|      | Min.        | Max. | Min.       | Max.  |
| A    | 0.89        | 1.4  | 0.035      | 0.055 |
| A1   | 0           | 0.1  | 0          | 0.004 |
| B    | 0.3         | 0.51 | 0.012      | 0.02  |
| c    | 0.085       | 0.18 | 0.003      | 0.007 |
| D    | 2.75        | 3.04 | 0.108      | 0.12  |
| e    | 0.85        | 1.05 | 0.033      | 0.041 |
| e1   | 1.7         | 2.1  | 0.067      | 0.083 |
| E    | 1.2         | 1.6  | 0.047      | 0.063 |
| H    | 2.1         | 2.75 | 0.083      | 0.108 |
| L    | 0.6 typ.    |      | 0.024 typ. |       |
| S    | 0.35        | 0.65 | 0.014      | 0.026 |

Figure 15. SOT-23 footprint (dimensions in mm)



**Table 9. SOT-323 dimensions**

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 0.8         |      | 1.1  | 0.031  |       | 0.043 |
| A1   | 0.0         |      | 0.1  | 0.0    |       | 0.004 |
| b    | 0.25        |      | 0.4  | 0.010  |       | 0.016 |
| c    | 0.1         |      | 0.26 | 0.004  |       | 0.010 |
| D    | 1.8         | 2.0  | 2.2  | 0.071  | 0.079 | 0.086 |
| E    | 1.15        | 1.25 | 1.35 | 0.045  | 0.049 | 0.053 |
| e    |             | 0.65 |      |        | 0.026 |       |
| H    | 1.8         | 2.1  | 2.4  | 0.071  | 0.083 | 0.094 |
| L    | 0.1         | 0.2  | 0.3  | 0.004  | 0.008 | 0.012 |
| q    | 0           |      | 30°  | 0      |       | 30°   |

**Figure 16. SOT-323 footprint (dimensions in mm)**

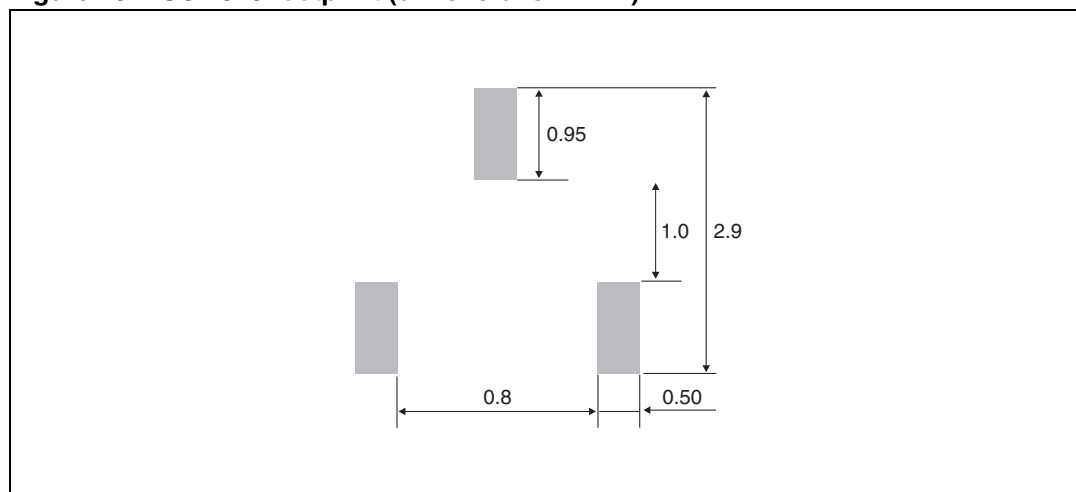
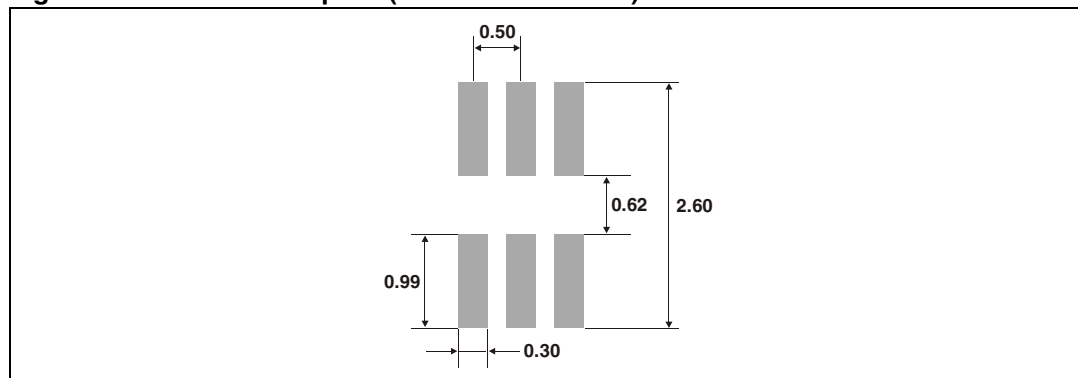


Table 10. SOT-666 dimensions

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 0.45        |      | 0.60 | 0.018  |       | 0.024 |
| A3   | 0.08        |      | 0.18 | 0.003  |       | 0.007 |
| b    | 0.17        |      | 0.34 | 0.007  |       | 0.013 |
| b1   | 0.19        | 0.27 | 0.34 | 0.007  | 0.011 | 0.013 |
| D    | 1.50        |      | 1.70 | 0.059  |       | 0.067 |
| E    | 1.50        |      | 1.70 | 0.059  |       | 0.067 |
| E1   | 1.10        |      | 1.30 | 0.043  |       | 0.051 |
| e    |             | 0.50 |      |        | 0.020 |       |
| L1   |             | 0.19 |      |        | 0.007 |       |
| L2   | 0.10        |      | 0.30 | 0.004  |       | 0.012 |
| L3   |             | 0.10 |      |        | 0.004 |       |

Figure 17. SOT-666 footprint (dimensions in mm)



In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

## 4 Ordering information

| Part Number    | Marking | Package                   | Weight | Base qty | Delivery mode |
|----------------|---------|---------------------------|--------|----------|---------------|
| BAT54FILM      | D86     | SOT-23 Single             | 10 mg  | 3000     | Tape and reel |
| BAT54SFILM     | D88     | SOT-23 Serial             | 10 mg  | 3000     | Tape and reel |
| BAT54CFILM     | D87     | SOT-23<br>Common cathode  | 10 mg  | 3000     | Tape and reel |
| BAT54AFILM     | D84     | SOT-23<br>Common anode    | 10 mg  | 3000     | Tape and reel |
| BAT54WFILM     | D73     | SOT-323 Single            | 6 mg   | 3000     | Tape and reel |
| BAT54SWFILM    | D78     | SOT-323 Serial            | 6 mg   | 3000     | Tape and reel |
| BAT54CWFILM    | D77     | SOT-323<br>Common cathode | 6 mg   | 3000     | Tape and reel |
| BAT54AWFILM    | D74     | SOT-323<br>Common anode   | 6 mg   | 3000     | Tape and reel |
| BAT54JFILM     | 86      | SOD-323                   | 5 mg   | 3000     | Tape and reel |
| BAT54KFILM     | 86      | SOD-523                   | 1.4 mg | 3000     | Tape and reel |
| BAT54-07P6FILM | P4      | SOT-666 Parallel          | 2.9 mg | 3000     | Tape and reel |
| BAT54-09P6FILM | Q4      | SOT-666 Opposite          | 2.9 mg | 3000     | Tape and reel |
| BAT54ZFILM     | D72     | SOD-123                   | 10 mg  | 3000     | Tape and reel |

## 5 Revision history

| Date        | Revision | Description of Changes   |
|-------------|----------|--|
| Jun-1999    | 8        | Last update.   |
| 24-Jul-2006 | 9        | BAT54, A, C, S and BAT54J / W / AW / CW /SW datasheets merged. ECOPACK statement added. SOD-123, SOD-523 and SOT-666 packages added. |

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