

## N-channel 60 V, 0.07 $\Omega$ typ., 4 A STripFET™ II Power MOSFET in a SOT-223 package

Datasheet - production data

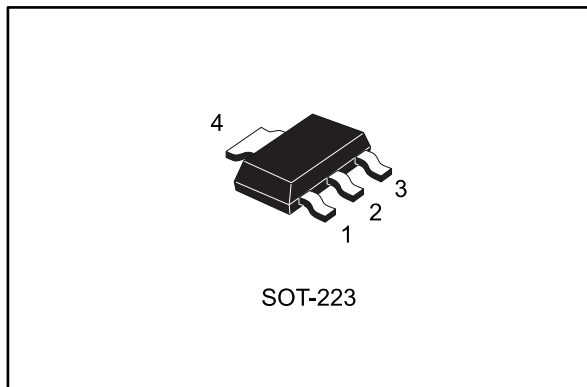
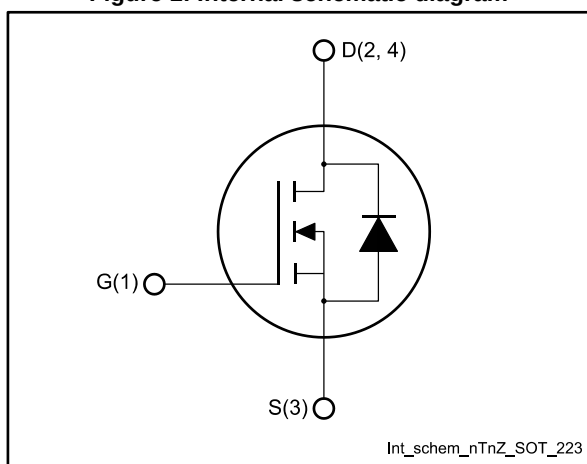


Figure 1: Internal schematic diagram



### Features

| Order code | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> |
|------------|-----------------|--------------------------|----------------|
| STN3NF06L  | 60 V            | 0.1 $\Omega$             | 4 A            |

- Exceptional dv/dt capability
- 100% avalanche tested
- Low threshold drive

### Applications

- Switching applications

### Description

This Power MOSFET series realized with STMicroelectronics unique STripFET™ process is specifically designed to minimize input capacitance and gate charge. It is therefore ideal as a primary switch in advanced high-efficiency isolated DC-DC converters for Telecom and Computer applications. It is also suitable for any application with low gate charge drive requirements.

Table 1: Device summary

| Order code | Marking | Package | Packing       |
|------------|---------|---------|---------------|
| STN3NF06L  | 3NF06L  | SOT-223 | Tape and reel |

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## Contents

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol         | Parameter                                                       | Value       | Unit             |
|----------------|-----------------------------------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain-source voltage                                            | 60          | V                |
| $V_{GS}$       | Gate-source voltage                                             | $\pm 16$    | V                |
| $I_D^{(1)}$    | Drain current (continuous) at $T_c = 25\text{ }^\circ\text{C}$  | 4           | A                |
| $I_D$          | Drain current (continuous) at $T_c = 100\text{ }^\circ\text{C}$ | 2.9         | A                |
| $I_{DM}^{(2)}$ | Drain current (pulsed)                                          | 16          | A                |
| $P_{TOT}$      | Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$       | 3.3         | W                |
| $dv/dt^{(3)}$  | Peak diode recovery voltage slope                               | 10          | V/ns             |
| $E_{AS}^{(4)}$ | Single pulse avalanche energy                                   | 200         | mJ               |
| $T_j$          | Operating junction temperature range                            | - 55 to 150 | $^\circ\text{C}$ |
| $T_{stg}$      | Storage temperature range                                       |             |                  |

**Notes:**

<sup>(1)</sup>Current limited by the package.

<sup>(2)</sup>Pulse width limited by safe operating area.

<sup>(3)</sup> $I_{SD} \leq 3\text{ A}$ ,  $di/dt \leq 150\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$

<sup>(4)</sup>Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 4\text{ A}$ ,  $V_{DD} = 30\text{ V}$

Table 3: Thermal data

| Symbol        | Parameter                                      | Value | Unit                      |
|---------------|------------------------------------------------|-------|---------------------------|
| $R_{thj-pcb}$ | Thermal resistance junction-pcb <sup>(1)</sup> | 38    | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}$ | Thermal resistance junction-pcb <sup>(2)</sup> | 100   | $^\circ\text{C}/\text{W}$ |

**Notes:**

<sup>(1)</sup>When Mounted on FR-4 board 1 inch<sup>2</sup> pad, 2 oz. of Cu and  $t < 10\text{ s}$ .

<sup>(2)</sup>When mounted on minimum recommended footprint.

## 2 Electrical characteristics

$T_C = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

**Table 4: On/off-state**

| Symbol        | Parameter                         | Test conditions                                                                             | Min. | Typ.  | Max.      | Unit          |
|---------------|-----------------------------------|---------------------------------------------------------------------------------------------|------|-------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                      | 60   |       |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 60\text{ V}$                                              |      |       | 1         | $\mu\text{A}$ |
|               |                                   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 60\text{ V}$<br>$T_C = 125\text{ }^{\circ}\text{C}^{(1)}$ |      |       | 10        | $\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current         | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 16\text{ V}$                                          |      |       | $\pm 100$ | nA            |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                          | 1    |       | 2.8       | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$ , $I_D = 1.5\text{ A}$                                               |      | 0.07  | 0.10      | $\Omega$      |
|               |                                   | $V_{GS} = 5\text{ V}$ , $I_D = 1.5\text{ A}$                                                |      | 0.085 | 0.12      | $\Omega$      |

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 5: Dynamic**

| Symbol    | Parameter                    | Test conditions                                                           | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---------------------------------------------------------------------------|------|------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$       | -    | 340  |      | pF   |
| $C_{oss}$ | Output capacitance           |                                                                           | -    | 63   |      | pF   |
| $C_{rss}$ | Reverse transfer capacitance |                                                                           | -    | 30   |      | pF   |
| $Q_g$     | Total gate charge            | $V_{DD} = 48\text{ V}$ , $I_D = 3\text{ A}$                               | -    | 7    | 9    | nC   |
| $Q_{gs}$  | Gate-source charge           | $V_{GS} = 0\text{ to }5\text{ V}$                                         | -    | 1.5  |      | nC   |
| $Q_{gd}$  | Gate-drain charge            | (see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> ) | -    | 2.8  |      | nC   |

**Table 6: Switching times**

| Symbol       | Parameter           | Test conditions                                                                                                                                                                                                                                       | Min. | Typ. | Max. | Unit |
|--------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 30\text{ V}$ , $I_D = 1.5\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$<br>$V_{GS} = 5\text{ V}$<br>(see <a href="#">Figure 13: "Test circuit for resistive load switching times"</a> and <a href="#">Figure 18: "Switching time waveform"</a> ) | -    | 9    | -    | ns   |
| $t_r$        | Rise time           |                                                                                                                                                                                                                                                       | -    | 25   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time |                                                                                                                                                                                                                                                       | -    | 20   | -    | ns   |
| $t_f$        | Fall time           |                                                                                                                                                                                                                                                       | -    | 10   | -    | ns   |

Table 7: Source-drain diode

| Symbol         | Parameter                | Test conditions                                                                                                                                                                                                                      | Min. | Typ. | Max. | Unit |
|----------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $V_{SD}^{(1)}$ | Forward on voltage       | $I_{SD} = 4\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                                                                                                                                        | -    |      | 1.5  | V    |
| $t_{rr}$       | Reverse recovery time    | $I_{SD} = 4\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 25\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$<br>(see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> ) | -    | 50   |      | ns   |
| $Q_{rr}$       | Reverse recovery charge  |                                                                                                                                                                                                                                      | -    | 88   |      | nC   |
| $I_{RRM}$      | Reverse recovery current |                                                                                                                                                                                                                                      | -    | 3.5  |      | A    |

**Notes:**

<sup>(1)</sup>Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

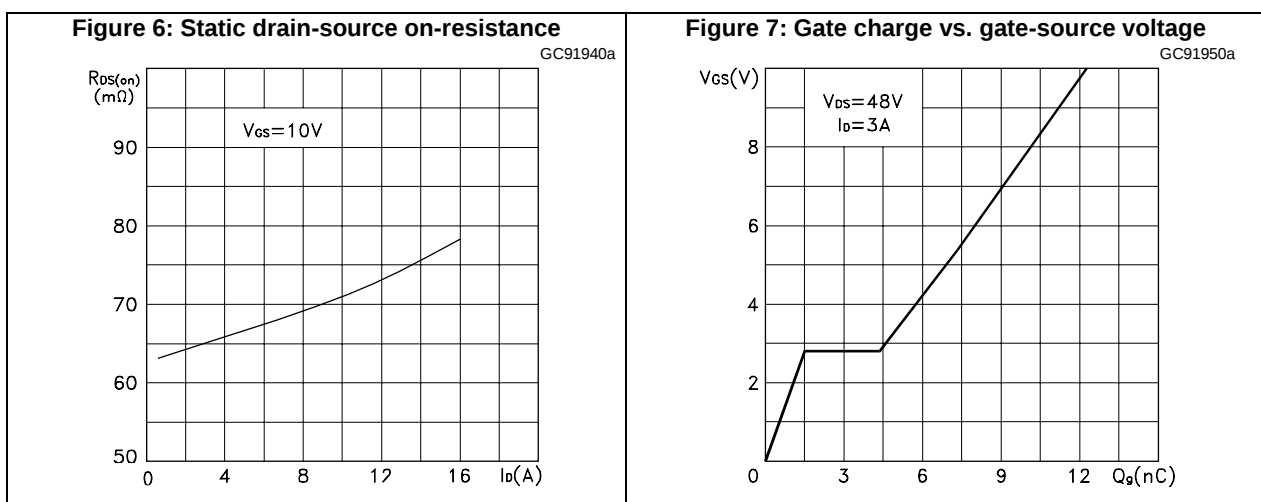
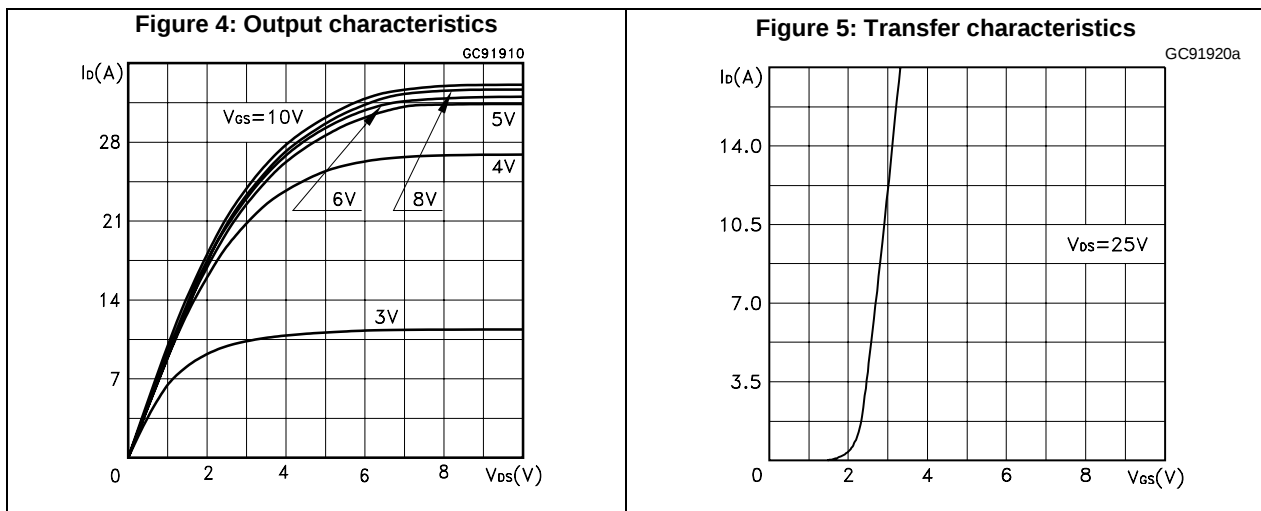
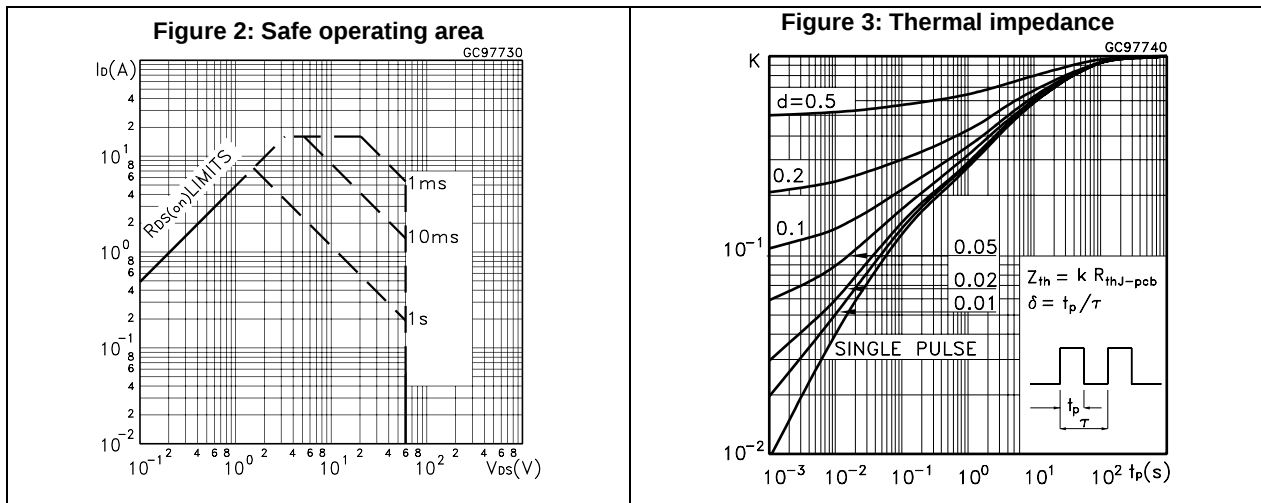


Figure 8: Capacitance variations

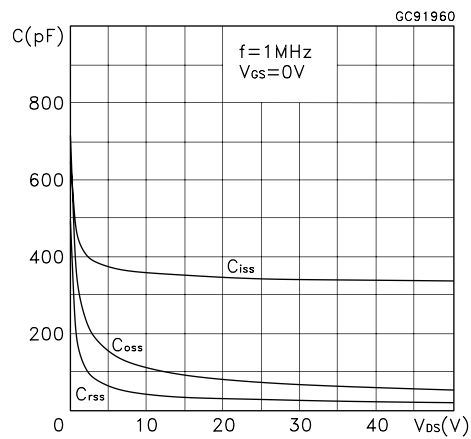


Figure 9: Normalized gate threshold voltage vs temperature

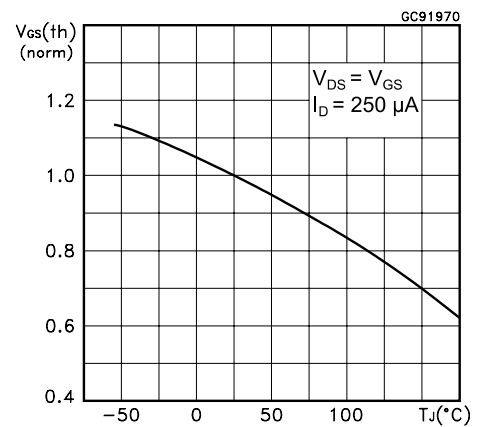


Figure 10: Normalized on-resistance vs temperature

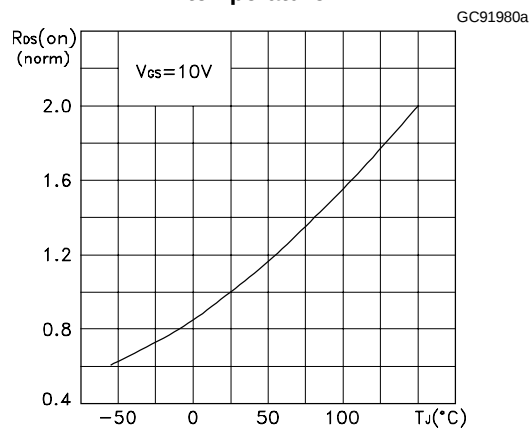
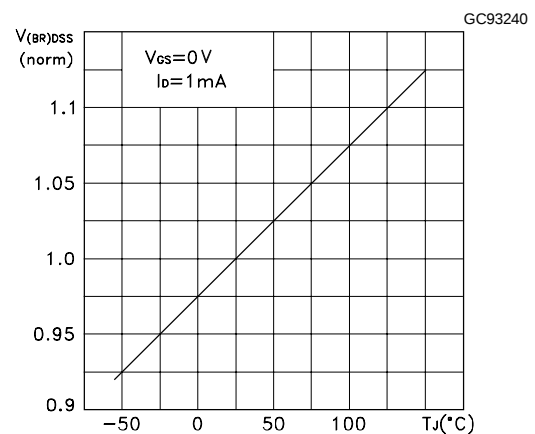
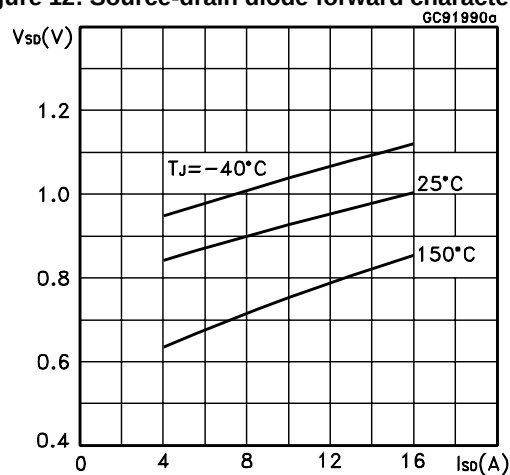
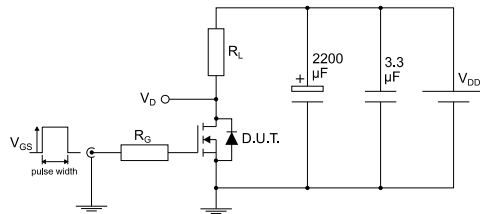
Figure 11: Normalized  $V_{(BR)DSS}$  vs temperature

Figure 12: Source-drain diode forward characteristics



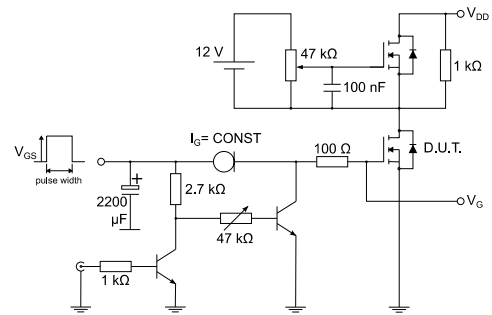
### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



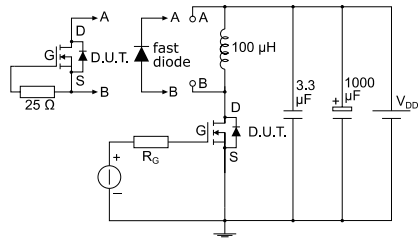
AM01468v1

**Figure 14: Test circuit for gate charge behavior**



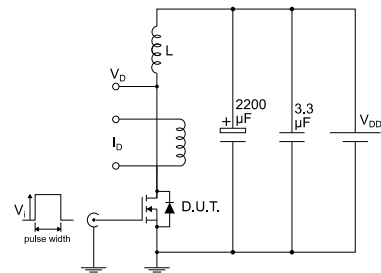
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



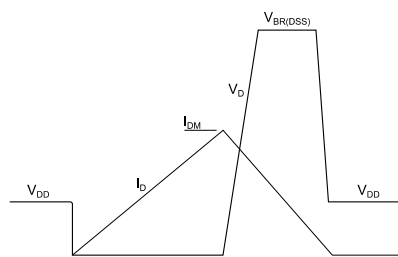
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**Figure 16: Unclamped inductive load test circuit**



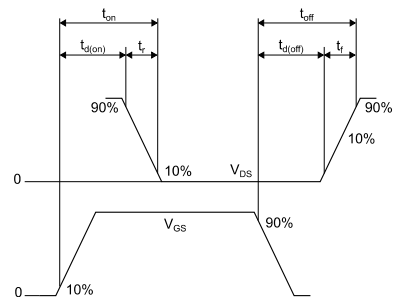
AM01471v1

**Figure 17: Unclamped inductive waveform**



AM01472v1

**Figure 18: Switching time waveform**



AM01473v1

## 4 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.

### 4.1 SOT-223 package information

Figure 19: SOT-223 package outline

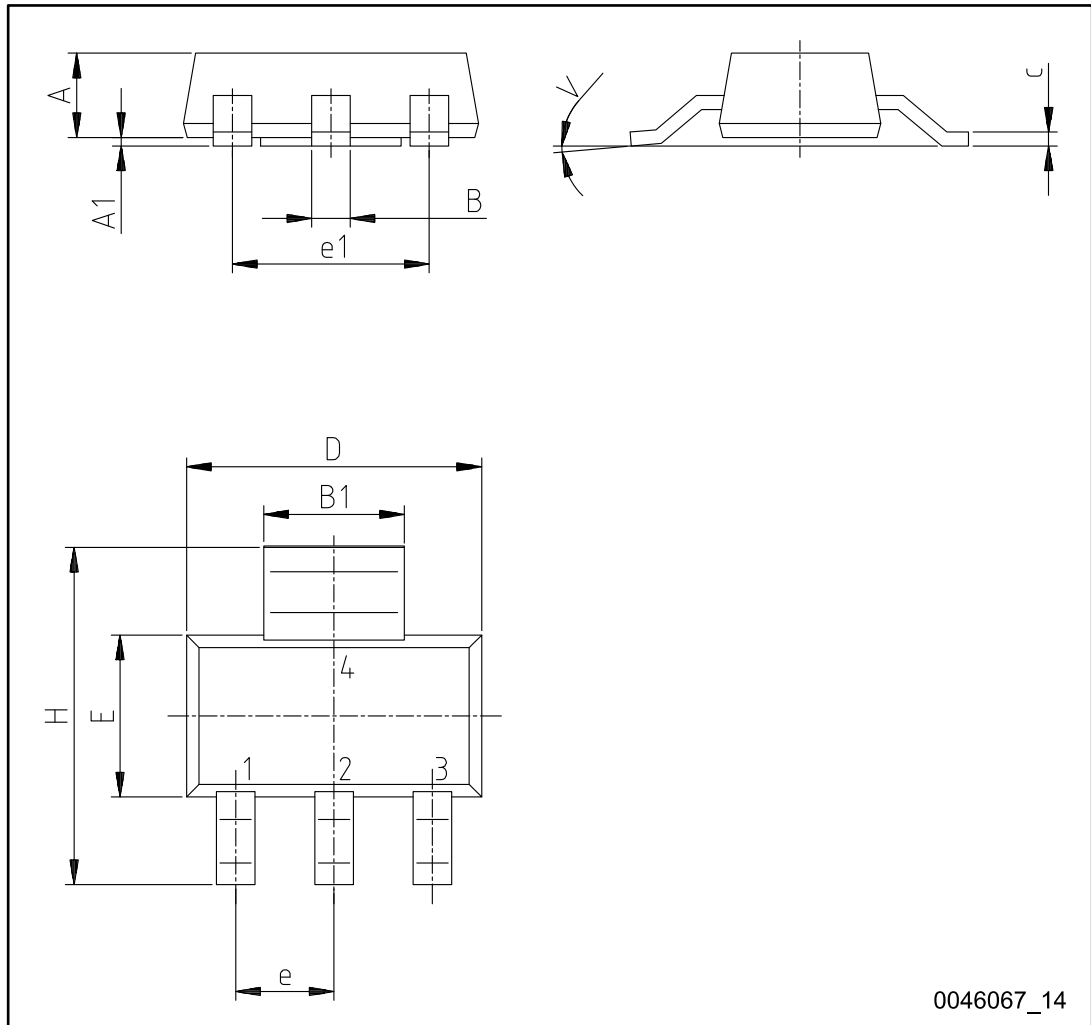
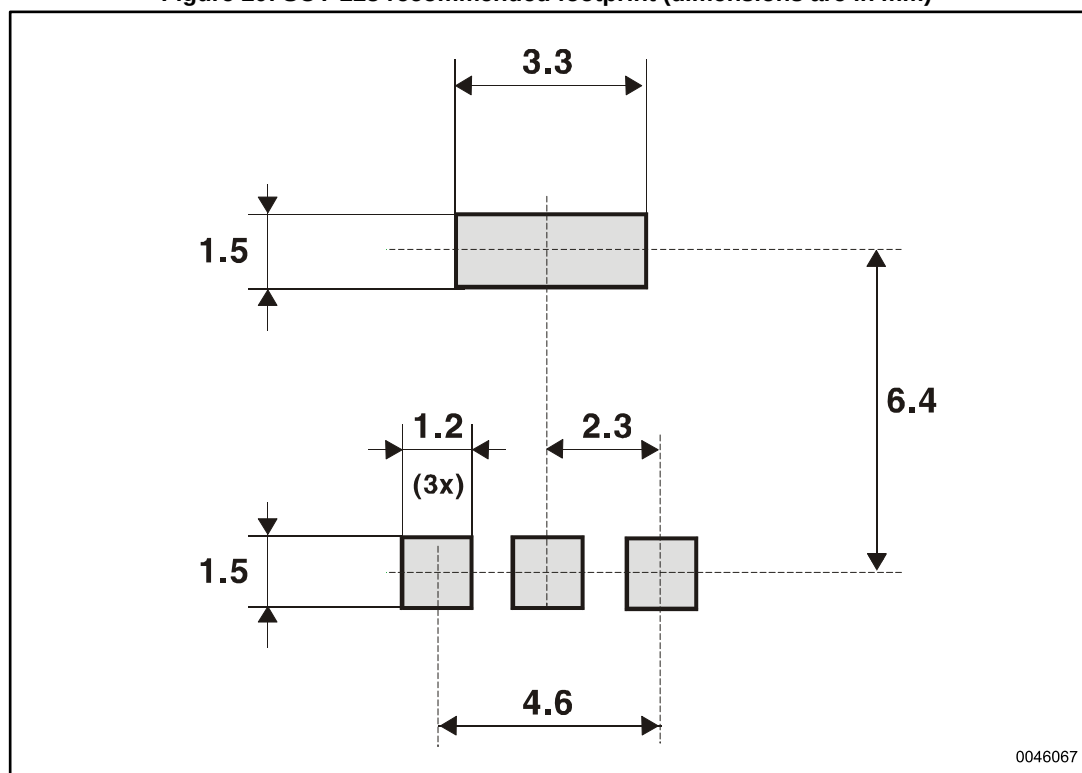


Table 8: SOT-223 package mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      |      | 1.8  |
| A1   | 0.02 |      | 0.1  |
| B    | 0.6  | 0.7  | 0.85 |
| B1   | 2.9  | 3    | 3.15 |
| c    | 0.24 | 0.26 | 0.35 |
| D    | 6.3  | 6.5  | 6.7  |
| e    |      | 2.3  |      |
| e1   |      | 4.6  |      |
| E    | 3.3  | 3.5  | 3.7  |
| H    | 6.7  | 7.0  | 7.3  |
| V    |      |      | 10°  |

Figure 20: SOT-223 recommended footprint (dimensions are in mm)



## 5 Revision history

**Table 9: Document revision history**

| Date        | Revision | Changes                                                                                                                                 |
|-------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 21-Jun-2004 | 5        | Complete version.                                                                                                                       |
| 04-Oct-2006 | 6        | New template, no content change.                                                                                                        |
| 01-Feb-2007 | 7        | Typo mistake on Table 2.                                                                                                                |
| 12-Jun-2008 | 8        | Corrected marking on Table 1                                                                                                            |
| 03-Jul-2017 | 9        | Modified internal schematic diagram on cover page.<br>Updated <a href="#">Section 4: "Package information"</a> .<br>Minor text changes. |

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