

## P-channel -60 V, 0.13 $\Omega$ typ., -3 A STripFET™ F6 Power MOSFET in a SOT-223 package

Datasheet - production data

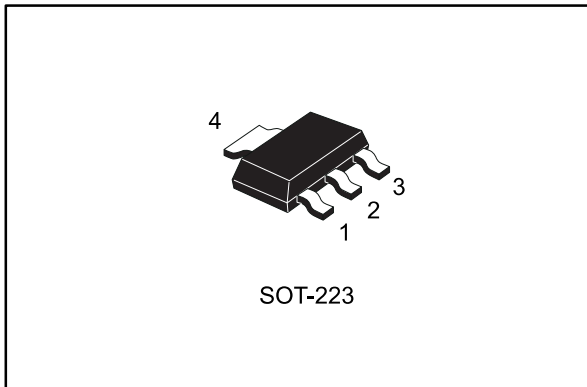
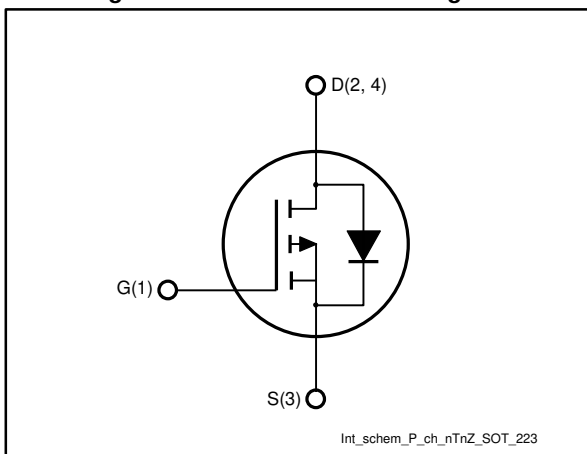


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STN3P6F6	-60 V	0.16 $\Omega$	-3 A

- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

### Applications

- Switching applications

### Description

This device is a P-channel Power MOSFET developed using the STripFET™ F6 technology, with a new trench gate structure. The resulting Power MOSFET exhibits very low R<sub>DS(on)</sub> in all packages.

Table 1: Device summary

Order code	Marking	Package	Packing
STN3P6F6	3P6F6	SOT-223	Tape and reel

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## Contents

<b>1</b>	<b>Electrical ratings .....</b>	<b>3</b>
<b>2</b>	<b>Electrical characteristics .....</b>	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits .....</b>	<b>9</b>
<b>4</b>	<b>Package information .....</b>	<b>10</b>
<b>5</b>	<b>Revision history .....</b>	<b>12</b>

# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	-60	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	-3	A
$I_D$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	-2	A
$I_{DM}$	Drain current (pulsed)	-12	A
$P_{TOT}^{(1)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	2.6	W
$T_j$	Operating junction temperature range	- 55 to 175	$^\circ\text{C}$
$T_{stg}$	Storage temperature range		$^\circ\text{C}$

**Notes:**

<sup>(1)</sup>Pulse width is limited by safe operating area

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	57	$^\circ\text{C}/\text{W}$

**Notes:**

<sup>(1)</sup>When mounted on FR-4 board of 1 inch<sup>2</sup>, 2 Oz Cu, t<10 s

## 2 Electrical characteristics

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

**Table 4: On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS} = 0$ )	$I_D = -250\ \mu\text{A}$	-60			V
$I_{DSS}$	Zero gate voltage Drain current ( $V_{GS} = 0$ )	$V_{DS} = -60\ \text{V}$			-1	$\mu\text{A}$
		$V_{DS} = -60\ \text{V}$ , $T_C = 125\text{ }^\circ\text{C}$ <sup>(1)</sup>			-10	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\ \text{V}$ , $V_{GS} = \pm 20\ \text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = -250\ \mu\text{A}$	-2		-4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = -10\ \text{V}$ , $I_D = -1.5\ \text{A}$		0.13	0.16	$\Omega$

**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	$V_{DS} = -48\ \text{V}$ , $f = 1\ \text{MHz}$ , $V_{GS} = 0$	-	340	-	pF
$C_{oss}$	Output capacitance		-	40	-	pF
$C_{rSS}$	Reverse transfer capacitance		-	20	-	pF
$Q_g$	Total gate charge	$V_{DD} = -48\ \text{V}$ , $I_D = -3\ \text{A}$ , $V_{GS} = -10\ \text{V}$ (see <a href="#">Figure 14: "Gate charge test circuit"</a> )	-	6.4	-	nC
$Q_{gs}$	Gate-source charge		-	1.7	-	nC
$Q_{gd}$	Gate-drain charge		-	1.7	-	nC

**Table 6: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = -48\ \text{V}$ , $I_D = -1.5\ \text{A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = -10\ \text{V}$ (see <a href="#">Figure 13: "Switching times test circuit for resistive load"</a> )	-	6.4	-	ns
$t_r$	Rise time		-	5.3	-	ns
$t_{d(off)}$	Turn-off delay time		-	14	-	ns
$t_f$	Fall time		-	3.7	-	ns

Table 7: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		-3	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		-12	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = -3 \text{ A}, V_{GS} = 0$	-		-1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = -5 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s}, V_{DD} = -16 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 15: "Test circuit for inductive load switching and diode recovery times")</i>	-	20		ns
$Q_{rr}$	Reverse recovery charge		-	17.8		nC
$I_{RRM}$	Reverse recovery current		-	-1.8		A

**Notes:**

<sup>(1)</sup>Pulse width limited by safe operating area.

<sup>(2)</sup>Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)



For the P-channel Power MOSFET, current polarity of voltages and current have to be reversed .

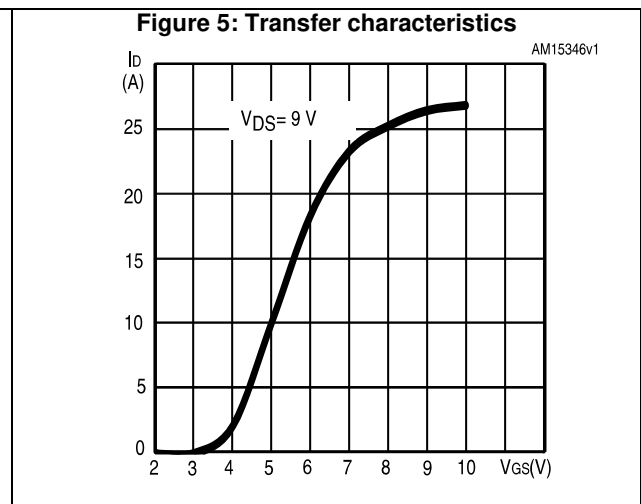
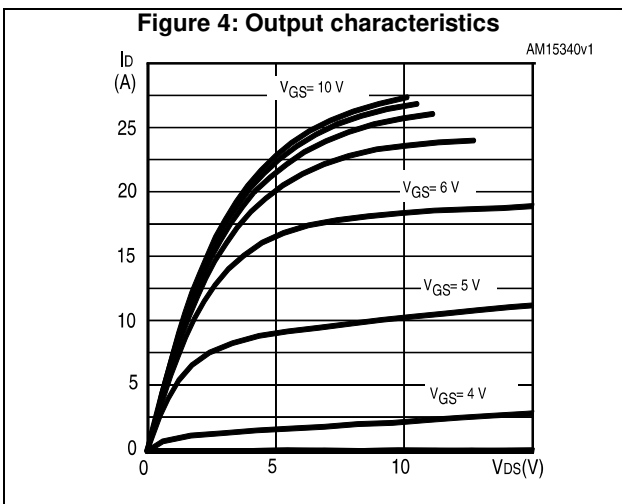
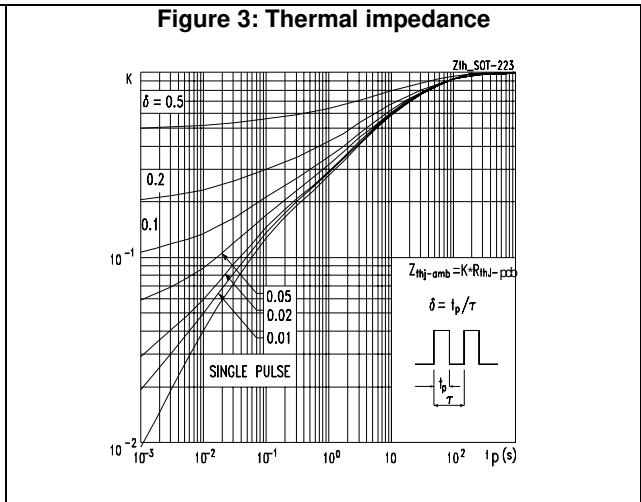
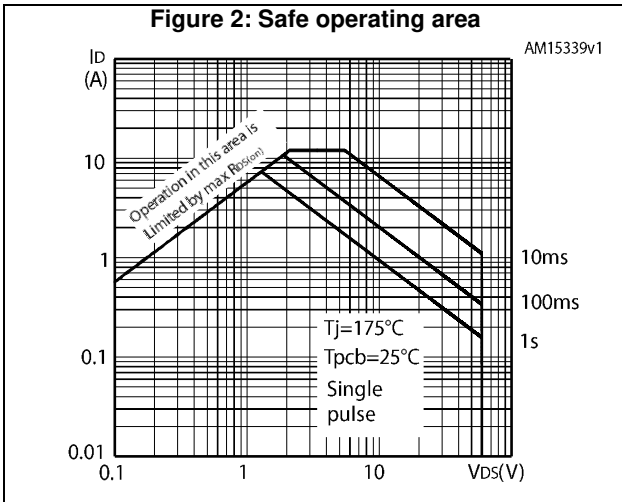


Figure 6: Gate charge vs gate-source voltage

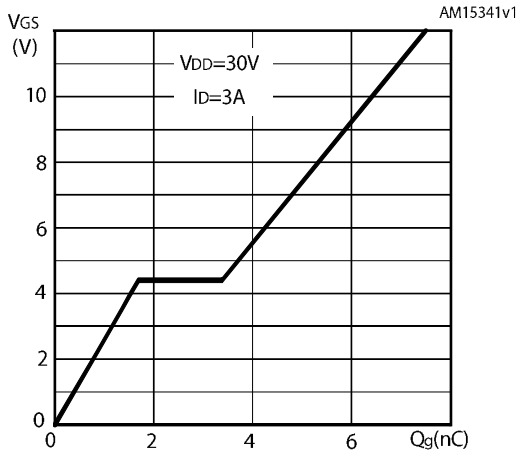


Figure 7: Static drain-source on-resistance

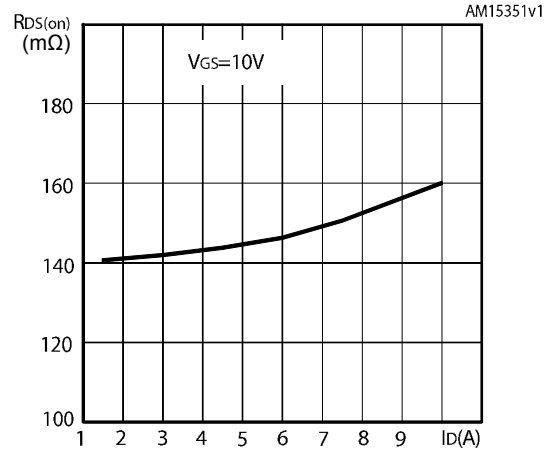


Figure 8: Capacitance variations

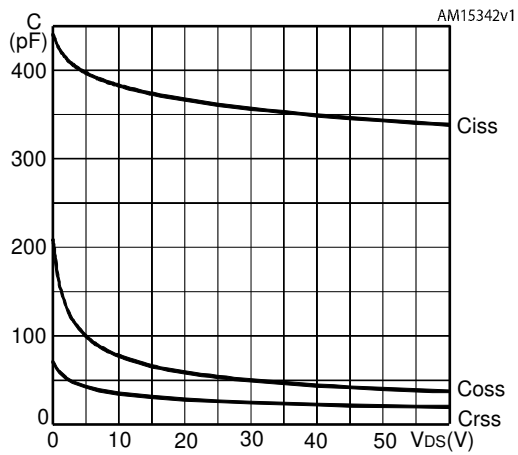


Figure 9: Normalized V(BR)DSS vs. temperature

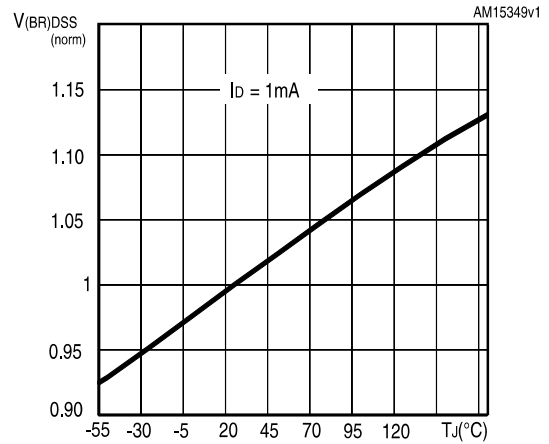


Figure 10: Normalized gate threshold voltage vs temperature

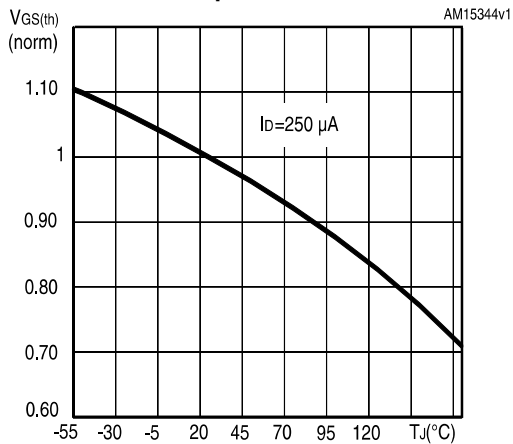


Figure 11: Normalized on-resistance vs. temperature

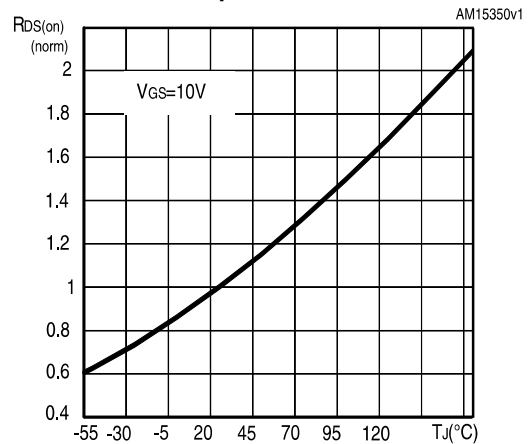
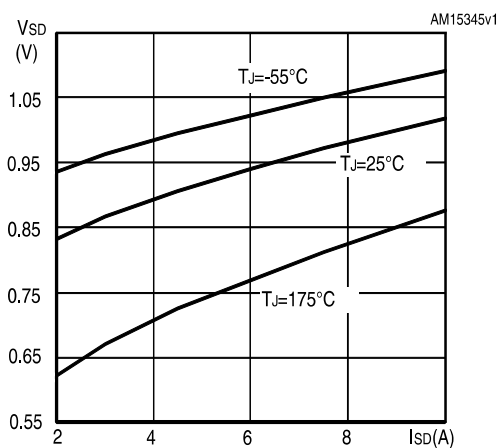


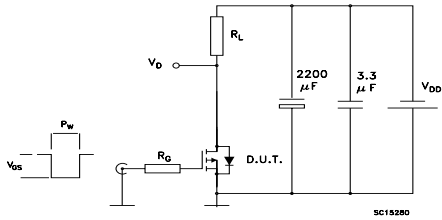
Figure 12: Source-drain diode forward characteristics



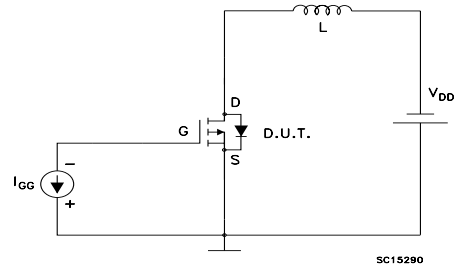


### 3 Test circuits

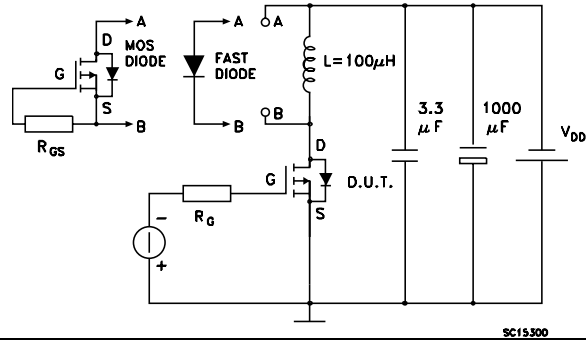
**Figure 13: Switching times test circuit for resistive load**



**Figure 14: Gate charge test circuit**



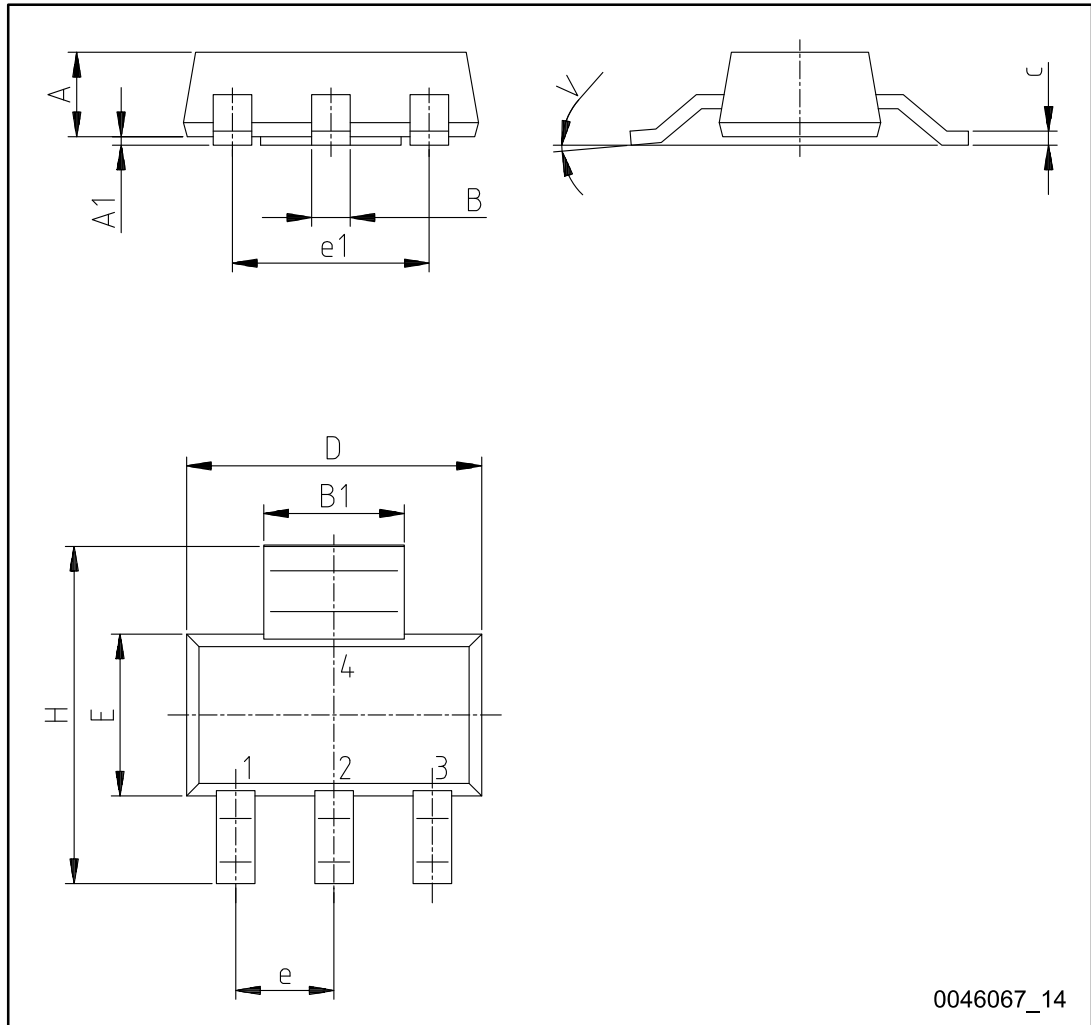
**Figure 15: Test circuit for inductive load switching and diode recovery times**



## 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.

Figure 16: SOT-223 package outline

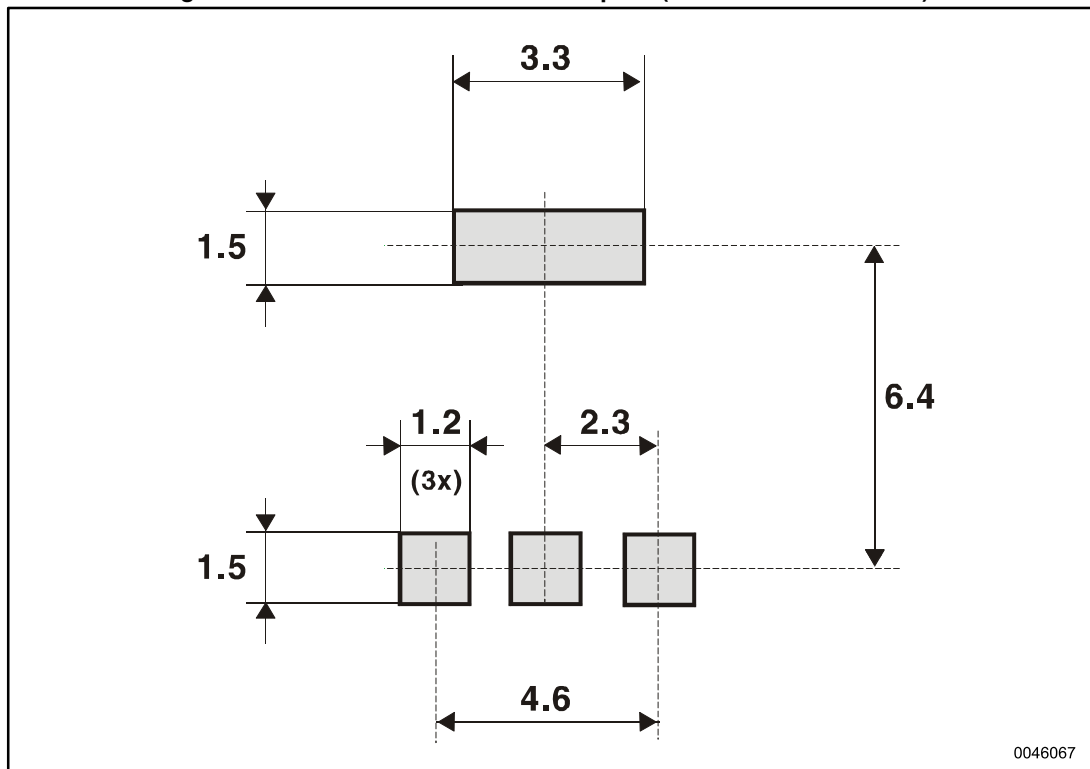


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Table 8: SOT-223 package mechanical data

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 <sup>9</sup>

Figure 17: SOT-223 recommended footprint (dimensions are in mm)



## 5 Revision history

**Table 9: Document revision history**

Date	Revision	Changes
31-Oct-2012	1	First release.
09-Nov-2012	2	Modified: note 1 in Table 3
16-Jan-2013	3	Document status promoted from preliminary data to production data
14-Mar-2013	4	Modified: Figure 1, 3, Ciss, Coss, Crss typical values in Table 5
07-Oct-2016	5	Updated title, features and description in cover page. Updated silhouette and <a href="#">Figure 1: "Internal schematic diagram"</a> . Updated <a href="#">Figure 16: "SOT-223 package outline"</a> . Minor text changes.

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