

## N-channel 30 V, 0.021 $\Omega$ typ., 6 A STripFET™ VI DeepGATE™ Power MOSFET in a SOT23-6L package

Datasheet - production data

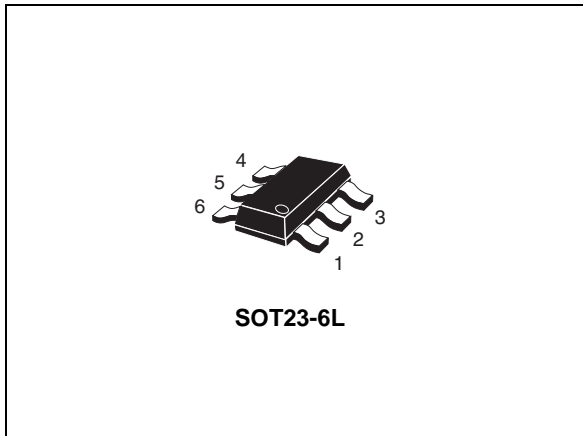
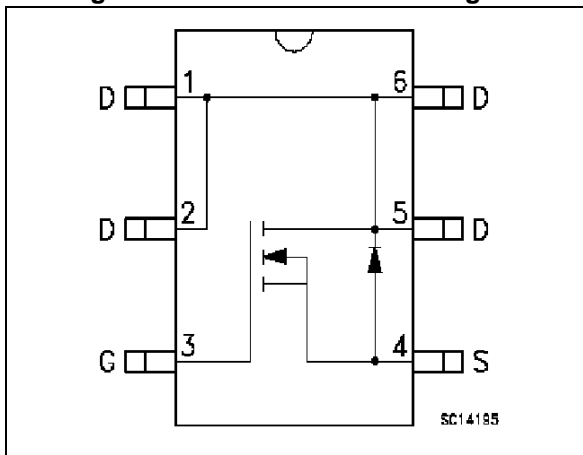


Figure 1. Internal schematic diagram



### Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>	P <sub>TOT</sub>
STT6N3LLH6	30 V	0.025 $\Omega$ (V <sub>GS</sub> = 10 V)	6 A	1.6 W
		0.036 $\Omega$ (V <sub>GS</sub> = 4.5 V)		

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- High avalanche ruggedness
- Low gate drive power losses

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the 6<sup>th</sup> generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

Table 1. Device summary

Order code	Marking	Package	Packaging
STT6N3LLH6	STG1	SOT23-6L	Tape and reel

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	30	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	6	A
$I_D$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	3.75	A
$I_{DM}^{(1)}$	Drain current (pulsed)	24	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	1.6	W
	Derating factor	0.013	W/ $^\circ\text{C}$
$T_{stg}$	Storage temperature	-55 to 150	$^\circ\text{C}$
$T_j$	Max. operating junction temperature	150	$^\circ\text{C}$

1. Pulse width limited by safe operating area

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	78	$^\circ\text{C}/\text{W}$

1. When mounted on FR-4 board of 1 inch<sup>2</sup>, 2oz Cu, t < 10 sec

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$  unless otherwise specified).

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	$I_D = 250\ \mu A, V_{GS} = 0$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 30\text{ V}$ $V_{DS} = 30\text{ V}, T_c = 125\text{ °C}$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	1			V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 3\text{ A}$		0.021	0.025	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 3\text{ A}$		0.032	0.036	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance		-	283	-	pF
$C_{oss}$	Output capacitance	$V_{DS} = 24\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	61	-	pF
$C_{rss}$	Reverse transfer capacitance		-	31	-	pF
$Q_g$	Total gate charge	$V_{DD} = 10\text{ V}, I_D = 6\text{ A}$	-	3.6	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 4.5\text{ V}$	-	1.5	-	nC
$Q_{gd}$	Gate-drain charge	<a href="#">Figure 14</a>	-	1.1	-	nC

**Table 6. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 10\text{ V}, I_D = 3\text{ A},$ $R_G = 4.7\ \Omega, V_{GS} = 4.5\text{ V}$ <a href="#">Figure 13</a>	-	4.8	-	ns
$t_r$	Rise time		-	11.2	-	ns
$t_{d(off)}$	Turn-off delay time		-	9.4	-	ns
$t_f$	Fall time		-	5.4	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		6	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		24	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 6 \text{ A}$ , $V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 6 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 16 \text{ V}$ , $T_J = 150 \text{ }^\circ\text{C}$ <a href="#">Figure 15</a>	-	10.6	-	ns
$Q_{rr}$	Reverse recovery charge		-	2.8	-	nC
$I_{RRM}$	Reverse recovery current		-	0.5	-	A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

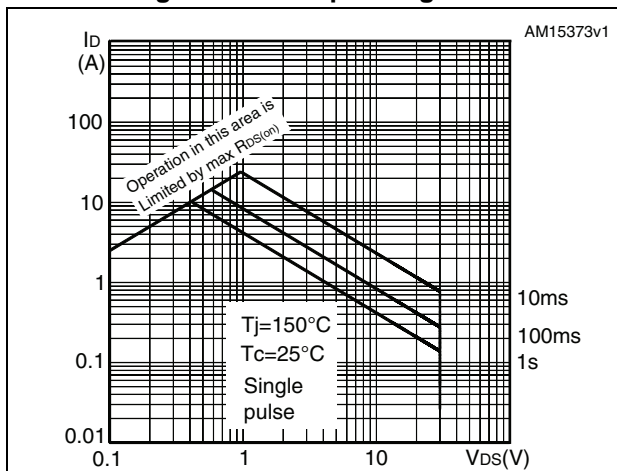


Figure 3. Thermal impedance

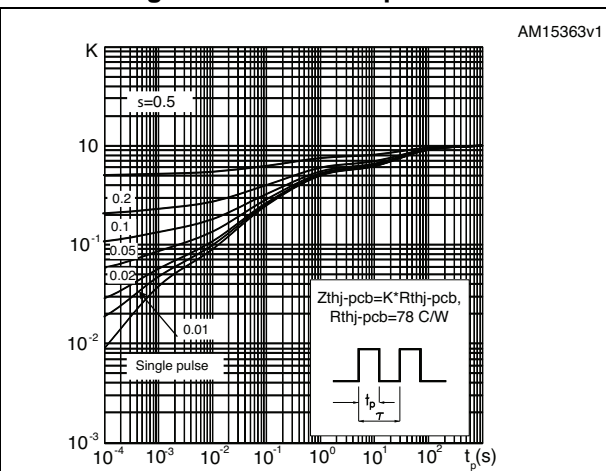


Figure 4. Output characteristics

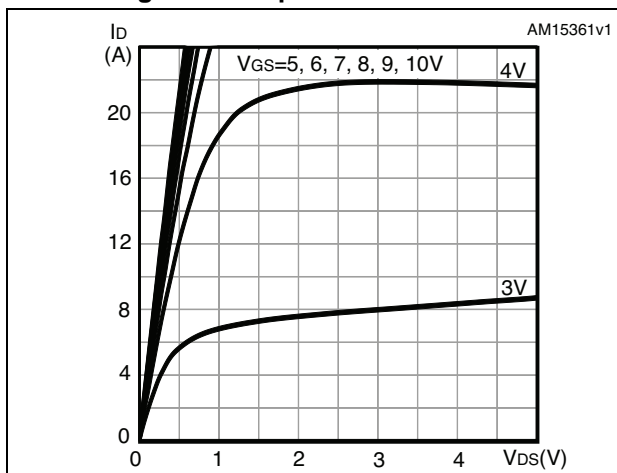


Figure 5. Transfer characteristics

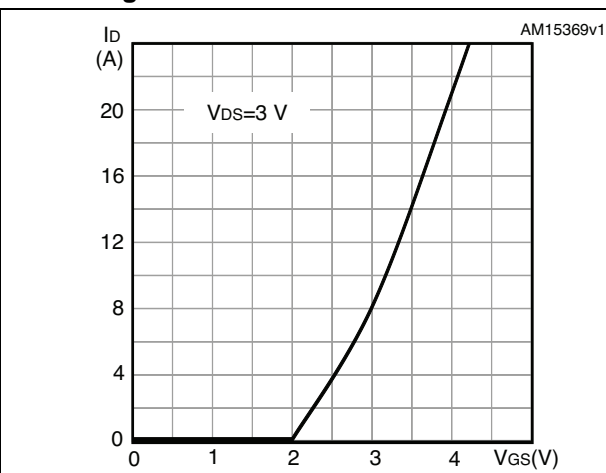


Figure 6. Gate charge vs gate-source voltage

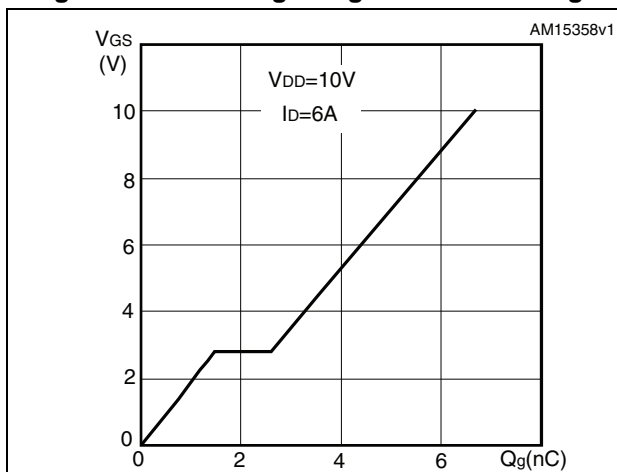


Figure 7. Static drain-source on-resistance

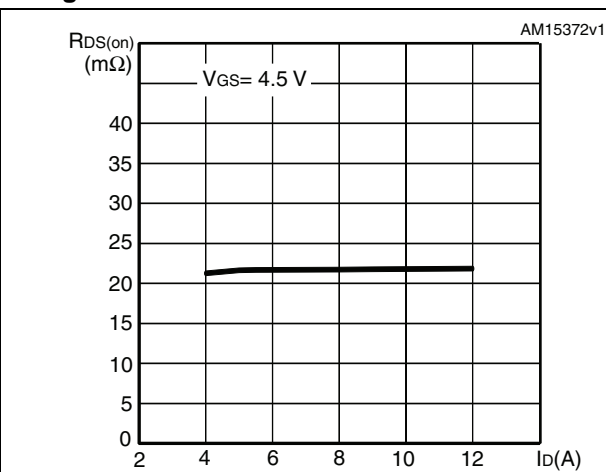


Figure 8. Capacitance variations

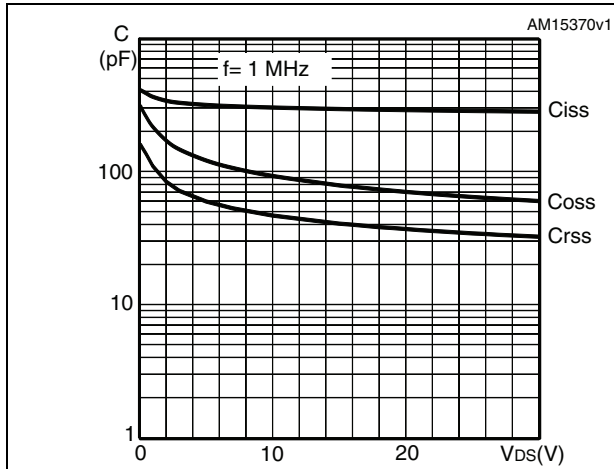


Figure 9. Normalized on-resistance vs temperature

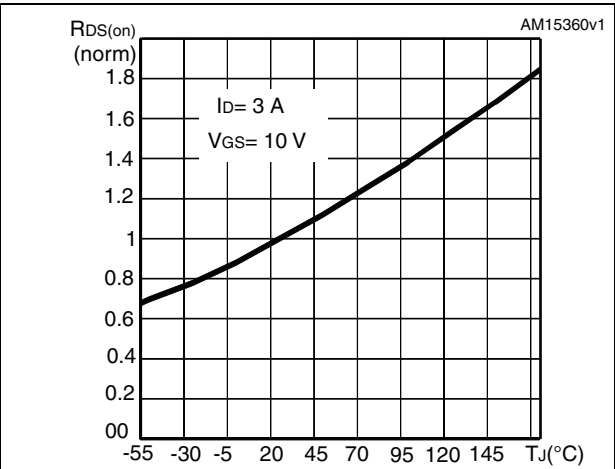


Figure 10. Normalized gate threshold voltage vs temperature

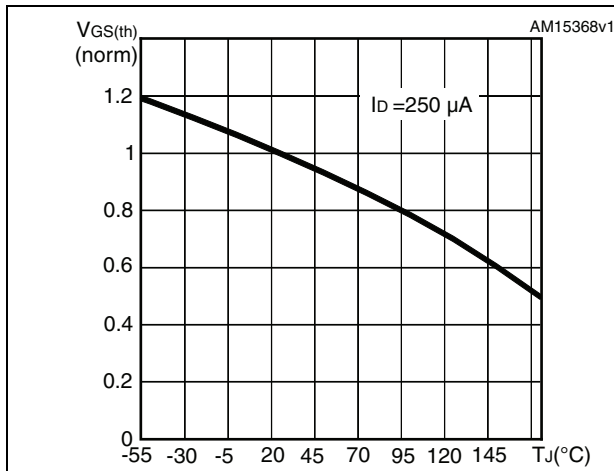


Figure 11. Normalized V(BR)DSS vs temperature

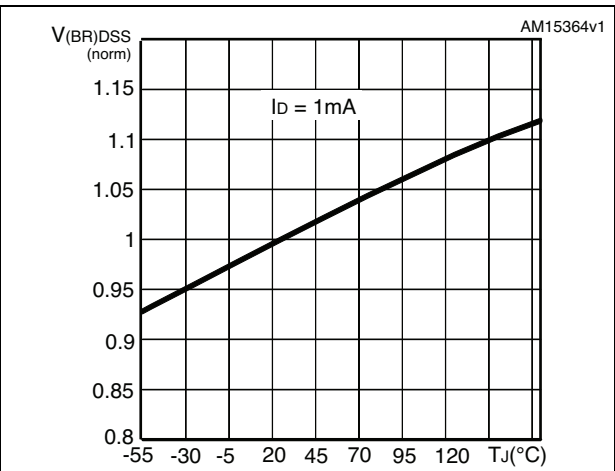
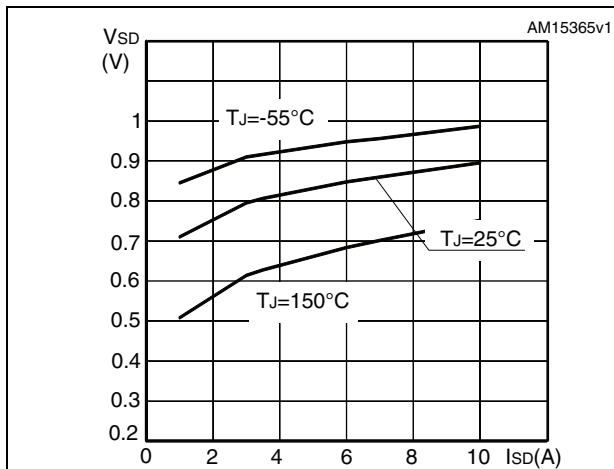


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load

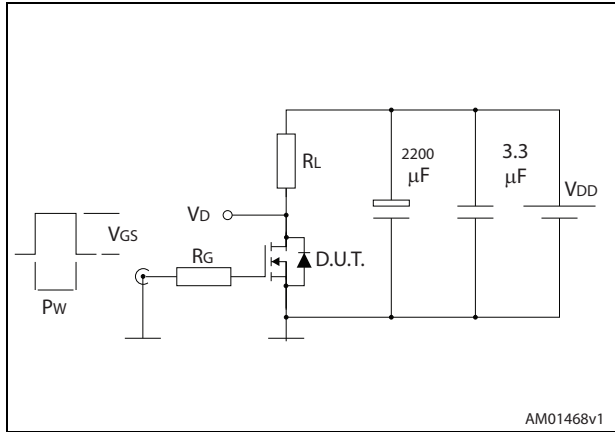


Figure 14. Gate charge test circuit

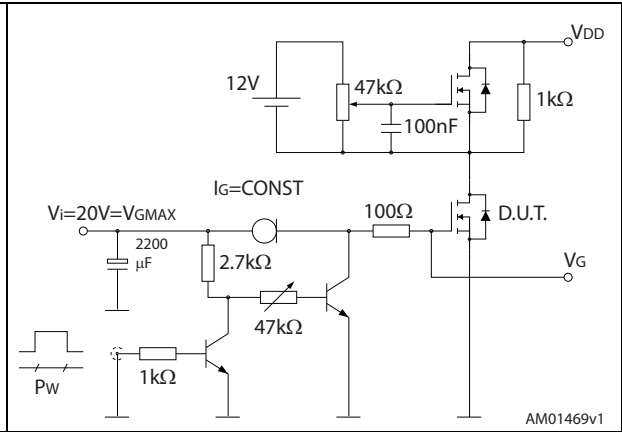


Figure 15. Test circuit for inductive load switching and diode recovery times

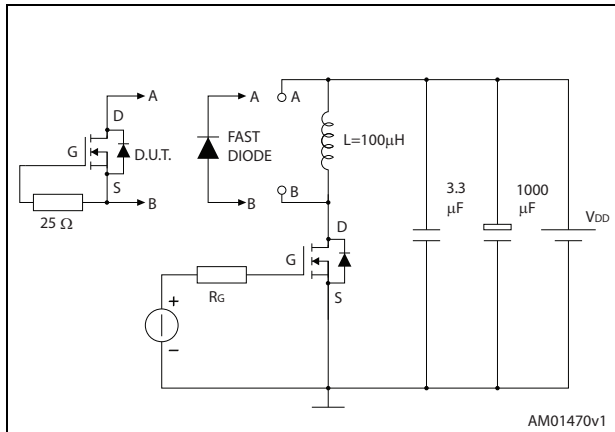


Figure 16. Unclamped inductive load test circuit



Figure 17. Unclamped inductive waveform

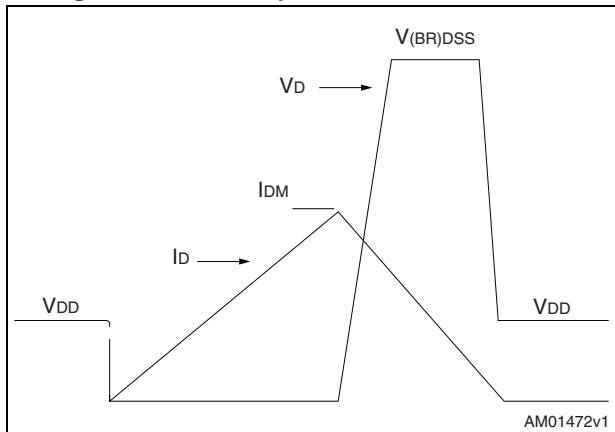


Figure 18. Switching time waveform

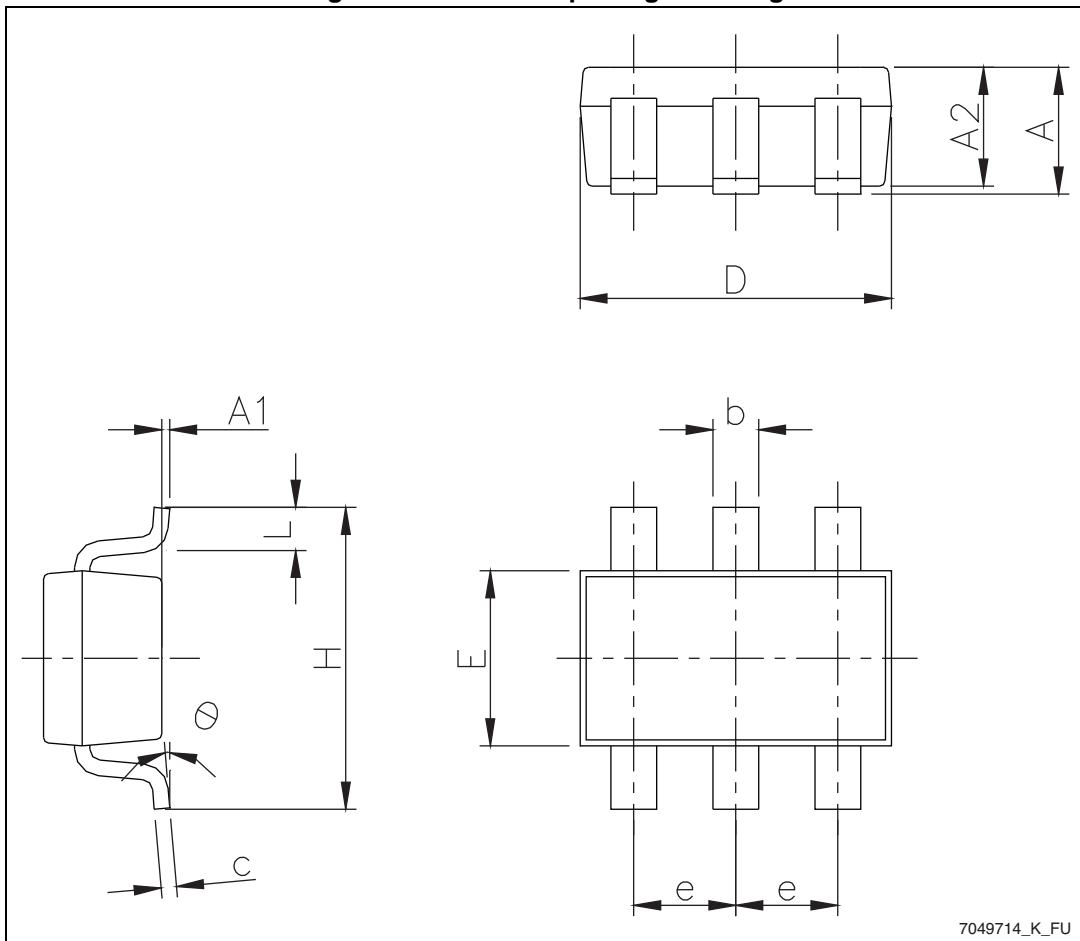




## 4 Package mechanical data

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.

Figure 19. SOT23-6L package drawing

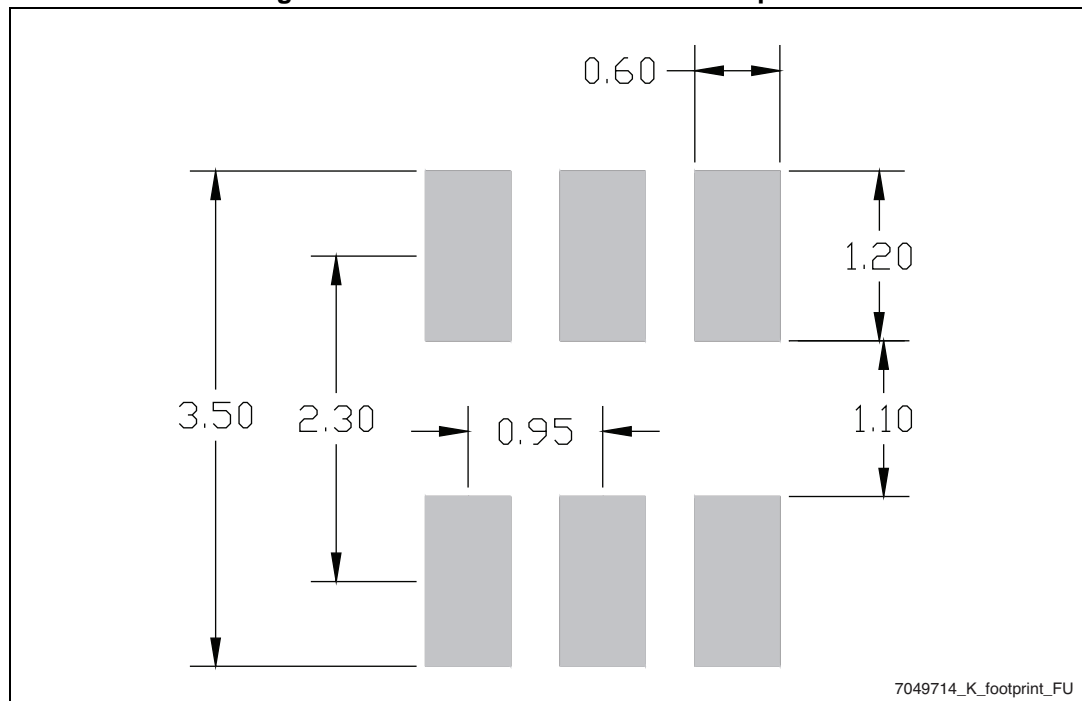


7049714\_K\_FU

Table 8. SOT23-6L package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.25
A1	0.00		0.15
A2	1.00	1.10	1.20
b	0.36		0.50
C	0.14		0.20
D	2.826	2.926	3.026
E	1.526	1.626	1.726
e	0.90	0.95	1.00
H	2.60	2.80	3.00
L	0.35	0.45	0.60
$\theta$	0°		8°

Figure 20. SOT23-6L recommended footprint<sup>(a)</sup>



a. All dimensions are in millimeters

## 5 Revision history

Table 9. Document revision history

Date	Revision	Changes
11-Oct-2012	1	First release.
24-Oct-2013	2	Modified: $R_{DS(on)}$ value on : <a href="#">Features table</a> and in <a href="#">Table 4</a> . Document status promoted from preliminary to production data.
11-Mar-2014	3	Updated <a href="#">Section 4: Package mechanical data</a> . Minor text changes

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