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## P-channel 30 V, 0.024 $\Omega$ typ., 6 A, STripFET™ VI DeepGATE™ Power MOSFET in a SO-8 package

Datasheet - preliminary data

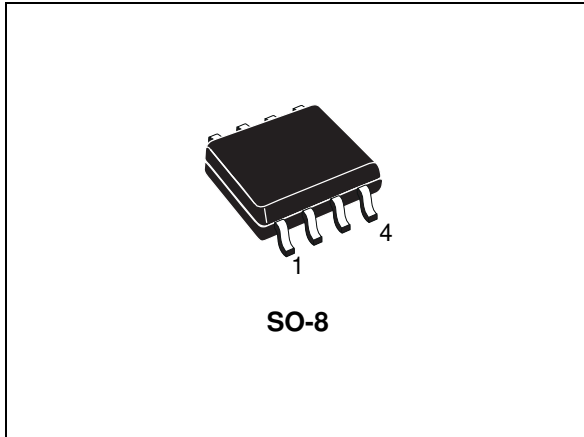
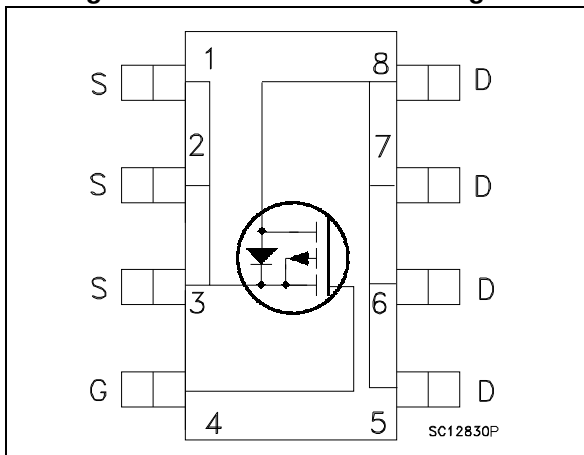


Figure 1. Internal schematic diagram



### Features

Order code	$V_{DS}$	$R_{DS(on)}$ max	$I_D$
STS6P3LLH6	30 V	0.03 $\Omega$	6 A

- $R_{DS(on)}$ \*  $Q_g$  industry benchmark
- Extremely low on-resistance  $R_{DS(on)}$
- High avalanche ruggedness

### 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  $R_{DS(on)}$  in all packages.

Table 1. Device summary

Order code	Marking	Packages	Packaging
STS6P3LLH6	6K3L	SO-8	Tape and reel

Note: For the P-channel MOSFET actual polarity of voltages and current has to be reversed.

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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
$I_D^{(1)}$	Drain current (continuous) at $T_{amb} = 25^\circ\text{C}$	6	A
$I_D^{(1)}$	Drain current (continuous) at $T_{amb} = 100^\circ\text{C}$	4	A
$I_{DM}^{(2)}$	Drain current (pulsed)	24	A
$P_{TOT}^{(1)}$	Total dissipation at $T_{amb} = 25^\circ\text{C}$	2.7	W
$T_{stg}$	Storage temperature	-55 to 150	$^\circ\text{C}$
$T_j$	Operating junction temperature	150	$^\circ\text{C}$

1. This value is rated according to  $R_{thj-amb}$
2. Pulse width limited by safe operating area

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-amb}^{(1)}$	Thermal resistance junction-amb	47	$^\circ\text{C}/\text{W}$

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

*Note:* For the P-channel MOSFET actual polarity of voltages and current has to be reversed.

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$	30			V V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 30\text{ V}$			1	$\mu\text{A}$
		$V_{DS}=30\text{ V}, T_C=125\text{ °C}$				
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1			V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 3\text{ A}$		0.024	0.03	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 3\text{ A}$		0.038	0.05	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 24\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$	-	1450	-	pF
$C_{oss}$	Output capacitance		-	178	-	pF
$C_{rss}$	Reverse transfer capacitance		-	120	-	pF
$Q_g$	Total gate charge	$V_{DD}=24\text{ V}, I_D=6\text{ A}, V_{GS}=4.5\text{ V}$	-	12	-	nC
$Q_{gs}$	Gate-source charge		-	4.4	-	nC
$Q_{gd}$	Gate-drain charge		-	5	-	nC

Note: For the P-channel MOSFET actual polarity of voltages and current has to be reversed

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 24\text{ V}, I_D = 3\text{ A}, R_G=4.7\ \Omega, V_{GS} = 10\text{ V}$ <i>Figure 13</i>	-	15	-	ns
$t_r$	Rise time		-	15	-	ns
$t_{d(off)}$	Turn-off delay time		-	24	-	ns
$t_f$	Fall time		-	21	-	ns

Note: For the P-channel MOSFET actual polarity of voltages and current has to be reversed

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	$I_{SD} = 3A, V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 3 A, di/dt = 100 A/\mu s$ $V_{DD} = 16 V, T_j = 150 ^\circ C$	-	15		ns
$Q_{rr}$	Reverse recovery charge		-	6.5		nC
$I_{RRM}$	Reverse recovery current		-	0.9		A

1. Pulse width limited by safe operating area.

2. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5%

*Note:* For the P-channel MOSFET actual polarity of voltages and current has to be reversed

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

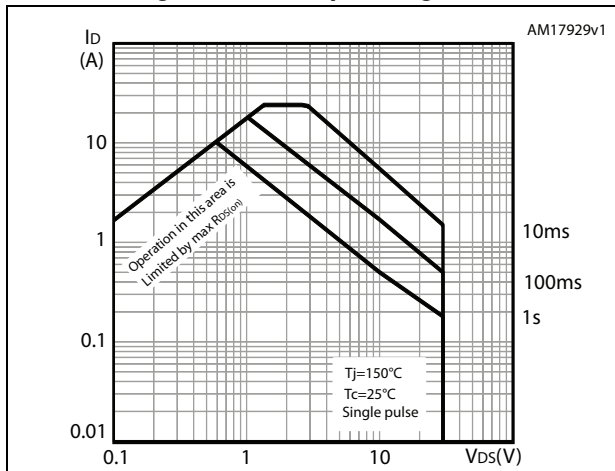


Figure 3. Thermal impedance

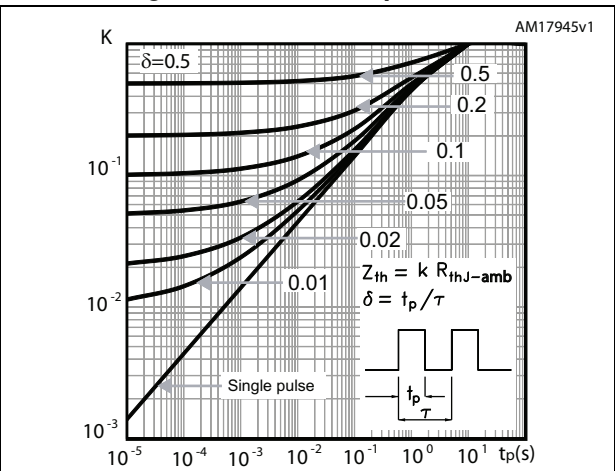


Figure 4. Output characteristics

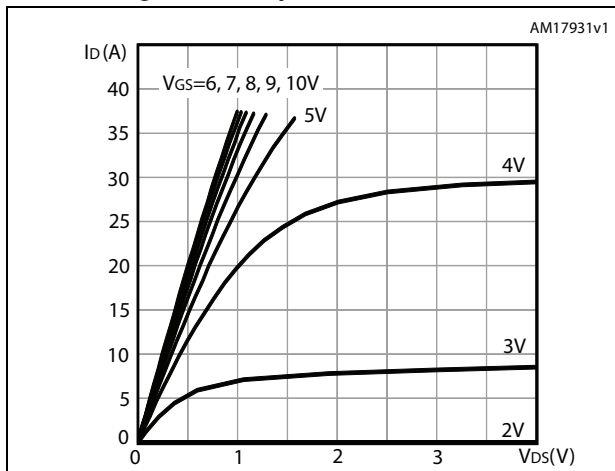


Figure 5. Transfer characteristics

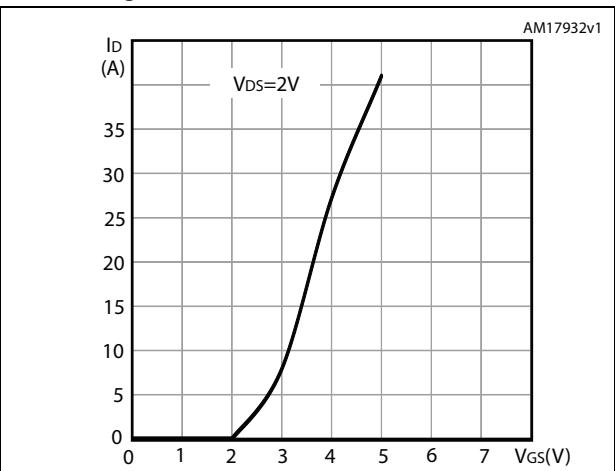


Figure 6. Gate charge vs gate-source voltage

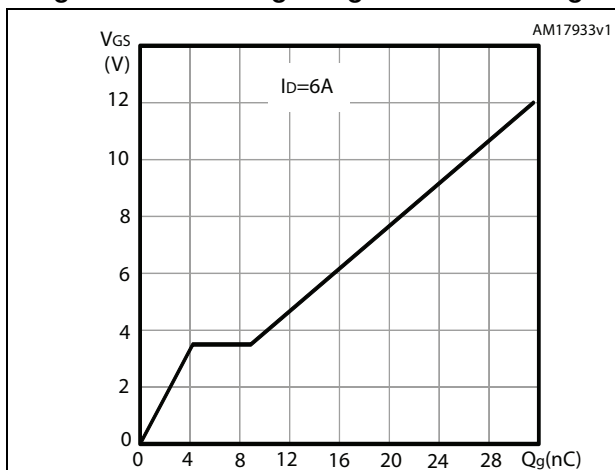


Figure 7. Static drain-source on-resistance

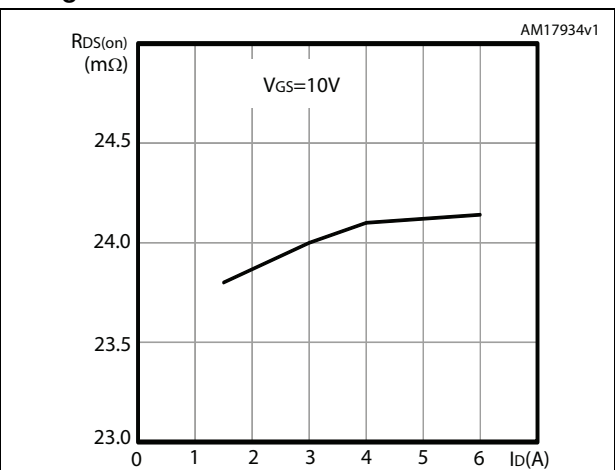


Figure 8. Capacitance variations

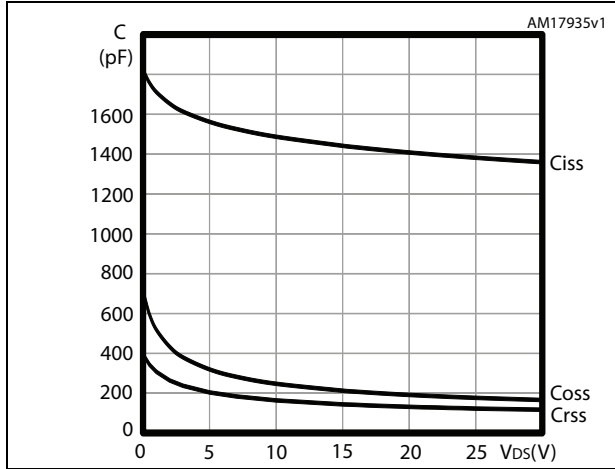


Figure 9. Normalized gate threshold voltage vs temperature

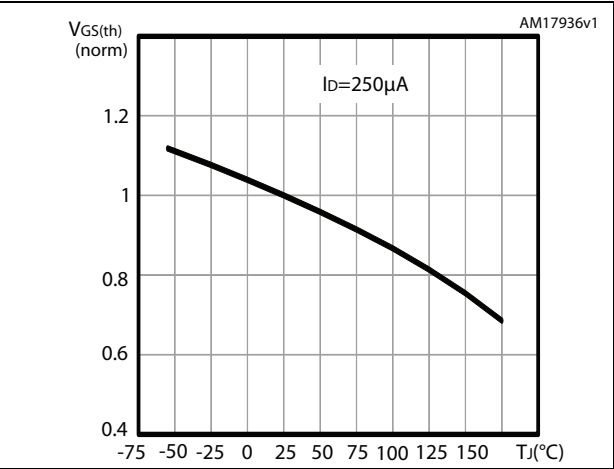


Figure 10. Normalized on-resistance vs temperature

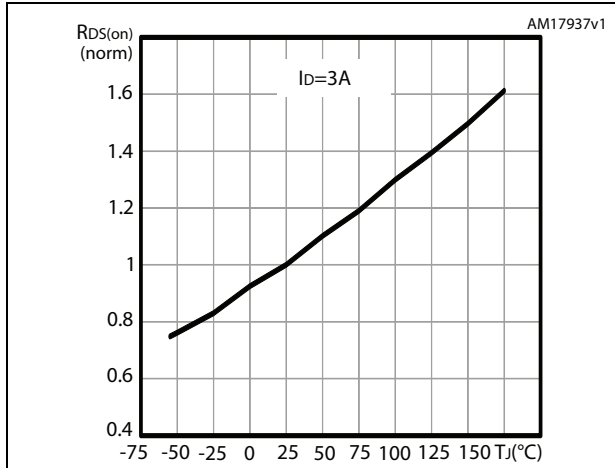


Figure 11. Normalized VDS vs temperature

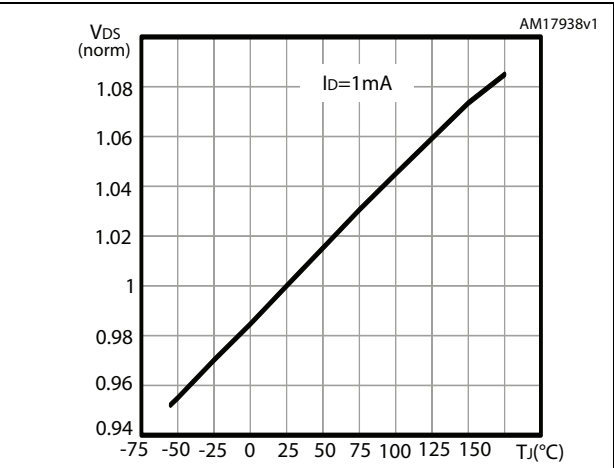
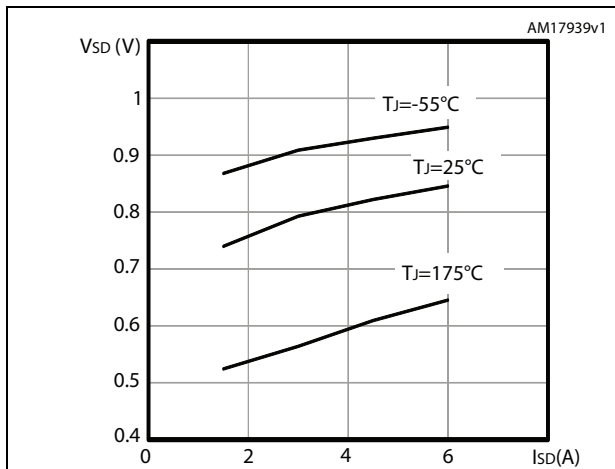


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load

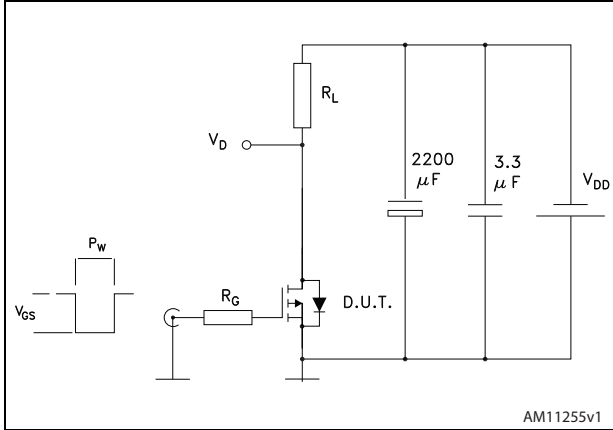


Figure 14. Gate charge test circuit

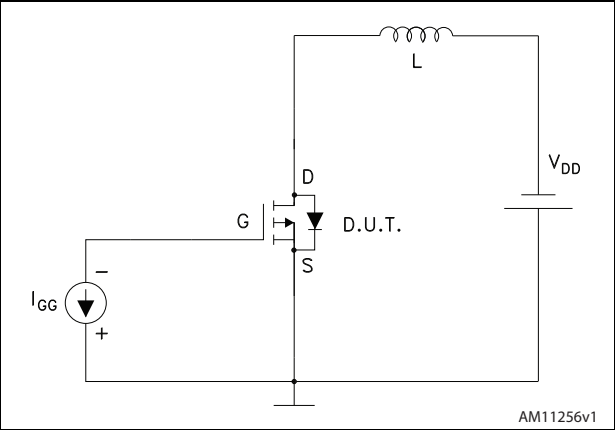
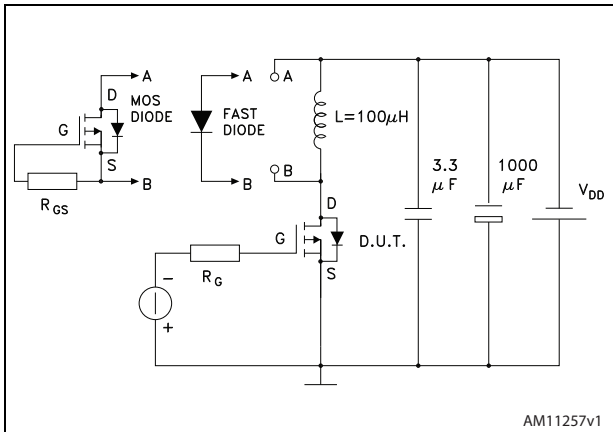


Figure 15. Test circuit for diode recovery behavior



## 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.

Table 8. SO-8 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.75
A1	0.10		0.25
A2	1.25		
b	0.31		0.51
b1	0.28		0.48
c	0.10		0.25
c1	0.10		0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27	
h	0.25		0.50
L	0.40		1.27
L1		1.04	
L2		0.25	
k	0°		8°
ccc			0.10

Figure 16. SO-8 drawing

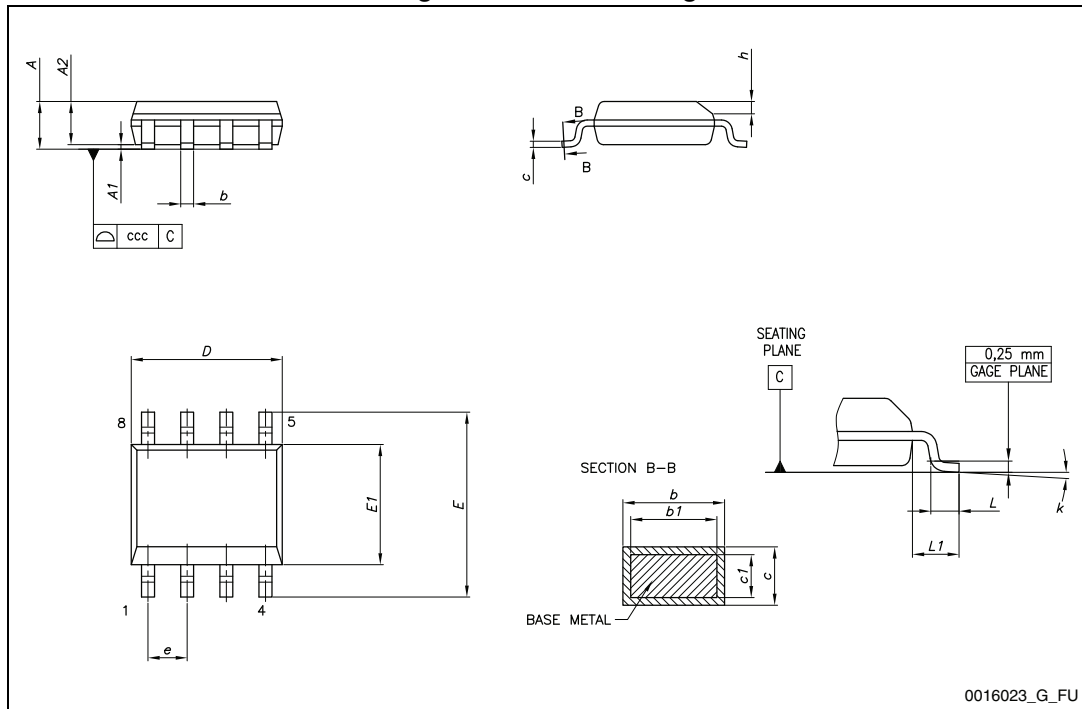
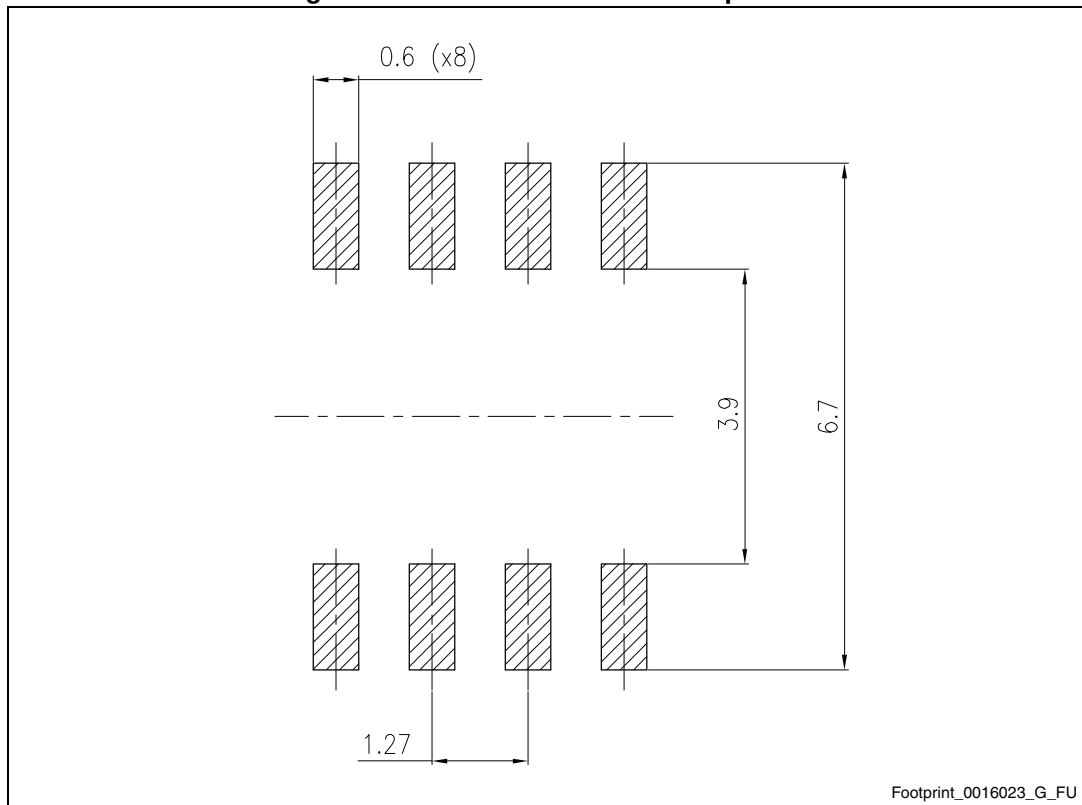


Figure 17. SO-8 recommended footprint<sup>(a)</sup>



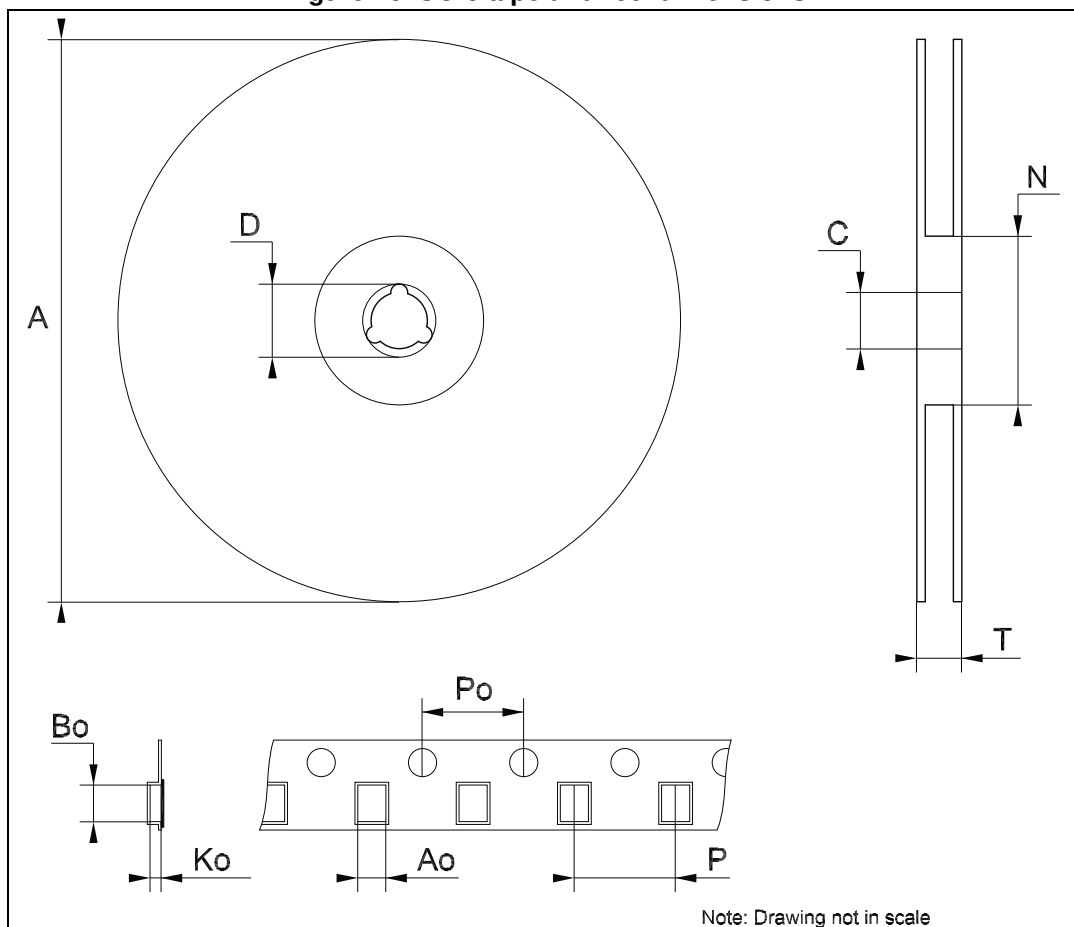
a. All dimensions are in millimeters.

## 5 Packaging mechanical data

**Table 9. SO-8 tape and reel mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A			330
C	12.8		13.2
D	20.2		
N	60		
T			22.4
Ao	8.1		8.5
Bo	5.5		5.9
Ko	2.1		2.3
Po	3.9		4.1
P	7.9		8.1

Figure 18. SO-8 tape and reel dimensions



## 6 Revision history

**Table 10. Revision history**

Date	Revision	Changes
01-Feb-2013	1	First revision.
28-Nov-2013	2	<ul style="list-style-type: none"><li>– Modified: <math>R_{DS(on)}</math> value in cover page</li><li>– Modified: <math>V_{GS}</math> value in <a href="#">Table 2</a></li><li>– Modified: IGSS test conditions value in <a href="#">Table 4</a></li><li>– Modified: <math>Q_g</math> typical value in <a href="#">Table 5</a></li><li>– Added: <a href="#">Section 2.1: Electrical characteristics (curves)</a></li><li>– Minor text changes</li></ul>

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