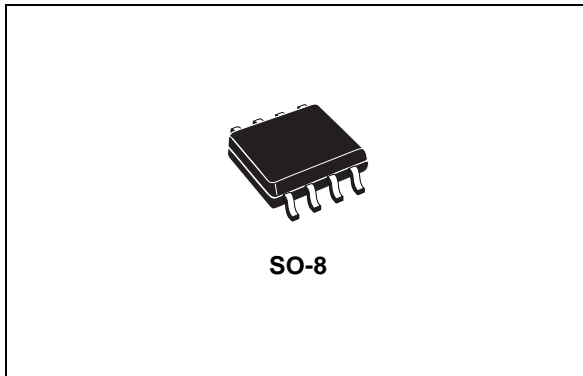


## N-channel 20 V, 0.030 $\Omega$ typ, 5 A STripFET™ II Power MOSFET in a SO-8 package

Datasheet - production data



### Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STS5DNF20V	20 V	0.040 $\Omega$ @ 4.5 V	5 A
		0.045 $\Omega$ @ 2.7 V	

- Ultra low threshold gate drive (2.7 V)
- Standard outline for easy automated surface mount assembly

### Applications

- Switching application

### Description

This Power MOSFET has been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

Figure 1. Internal schematic diagram

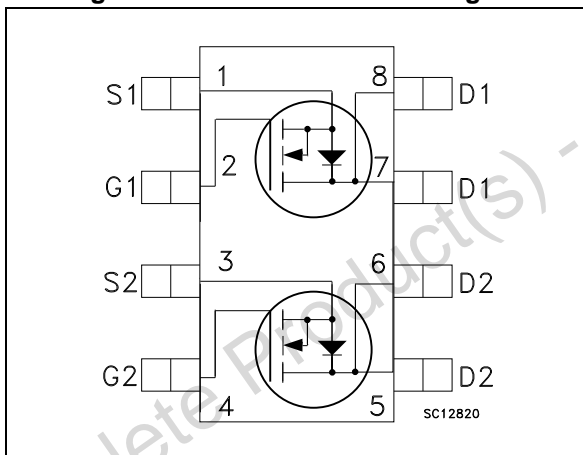


Table 1. Device summary

Order code	Marking	Package	Packaging
STS5DNF20V	5DF20V	SO-8	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 ( $V_{GS} = 0$ )	20	V
$V_{GS}$	Gate-source voltage	$\pm 12$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	5	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	3	A
$I_{DM}^{(1)}$	Drain current (pulsed)	20	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ (dual operation)	1.6	W
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ (single operation)	2	W
$T_J$	Max. operating junction temperature	-55 to 150	$^\circ\text{C}$
$T_{stg}$	Storage temperature		

1. Pulse width limited by safe operating area.

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-a}$	Thermal resistance junction-ambient single operation	62.5	$^\circ\text{C}/\text{W}$
	Thermal resistance junction-ambient dual operation	78	$^\circ\text{C}/\text{W}$

## 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	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	20			V
$I_{DSS}$	Zero gate voltage Drain current ( $V_{GS} = 0$ )	$V_{DS} = 20$			1	$\mu\text{A}$
		$V_{DS} = 20\text{ V}$ , $T_C = 125\text{ °C}$			10	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 12\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	0.6			$\Omega$
$R_{DS(on)}$	Static drain-source on- resistance	$V_{GS} = 4.5\text{ V}$ , $I_D = 2.5\text{ A}$		0.030	0.040	$\Omega$
		$V_{GS} = 2.7\text{ V}$ , $I_D = 2.5\text{ A}$		0.037	0.045	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	460		pF
$C_{oss}$	Output capacitance		-	200		pF
$C_{rss}$	Reverse transfer capacitance		-	50		pF
$Q_g$	Total gate charge	$V_{DD} = 16\text{ V}$ , $I_D = 5\text{ A}$ , $V_{GS} = 4.5\text{ V}$ (see <a href="#">Figure 13</a> )	-	8.5	11.5	nC
$Q_{gs}$	Gate-source charge		-	1.8		nC
$Q_{gd}$	Gate-drain charge		-	2.4		nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 10\text{ V}$ , $I_D = 2.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 4.5\text{ V}$ (see <a href="#">Figure 12</a> )	-	7	-	ns
$t_r$	Rise time		-	33	-	ns
$t_{d(off)}$	Turn-off delay time		-	27	-	ns
$t_f$	Fall Time		-	10	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		20	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 5\text{ A}$ , $V_{GS} = 0$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 5\text{ A}$ , $V_{DD} = 10\text{ V}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $T_j = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 14</a> )	-	26		ns
$Q_{rr}$	Reverse recovery charge		-	13		nC
$I_{RRM}$	Reverse recovery current		-	1		A

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

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## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

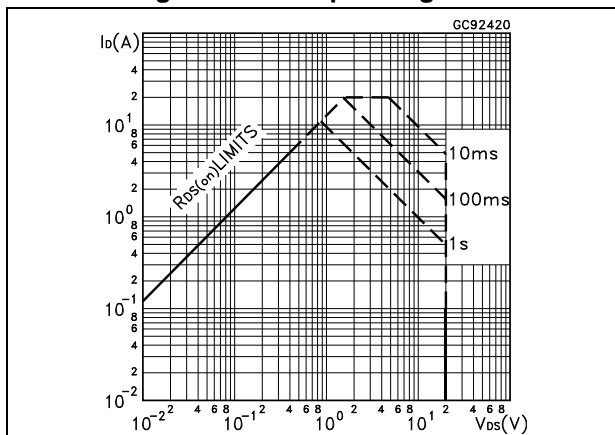


Figure 3. Thermal impedance

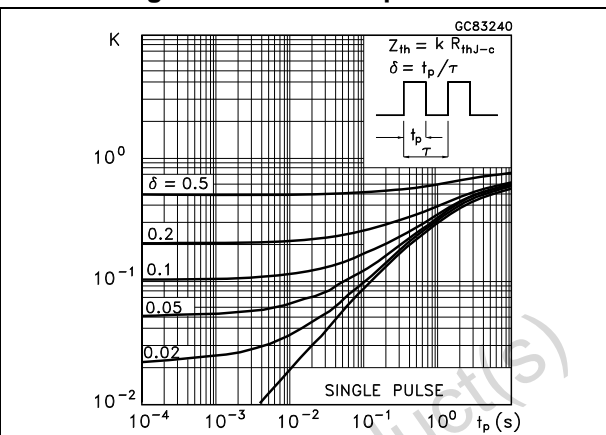


Figure 4. Output characteristics

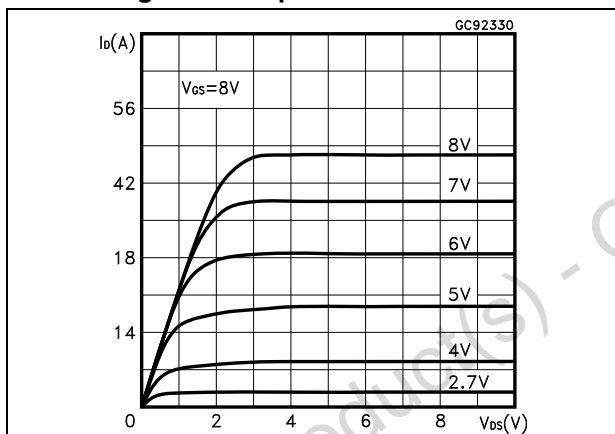


Figure 5. Transfer characteristics

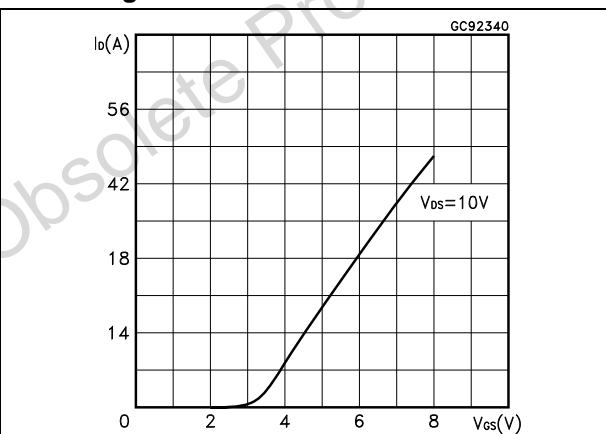


Figure 6. Source-drain diode forward characteristics

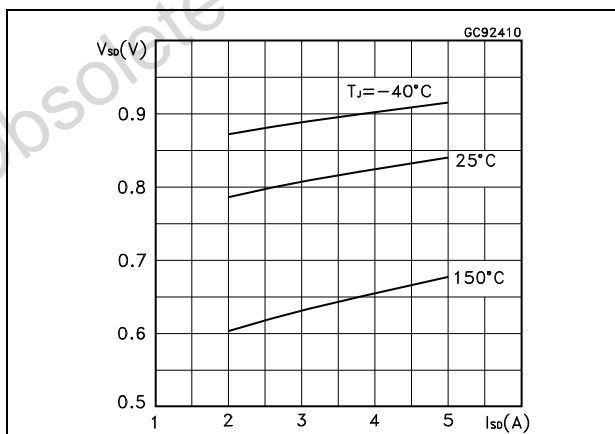


Figure 7. Static drain-source on resistance

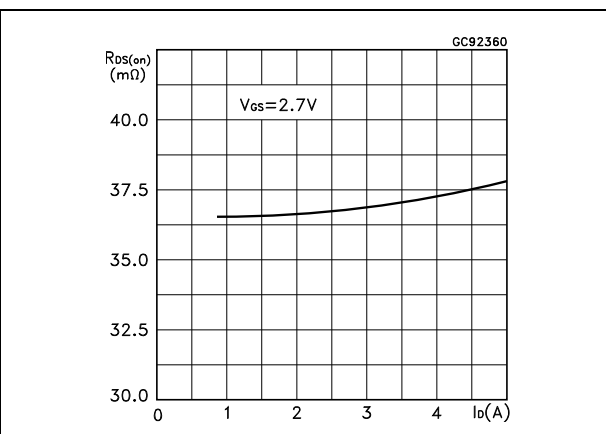


Figure 8. Gate charge vs gate-source voltage

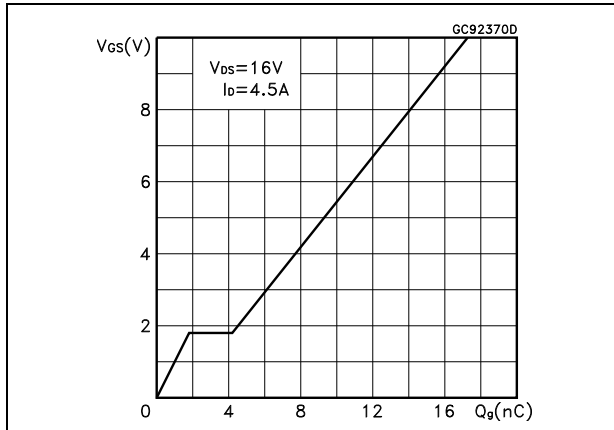


Figure 9. Capacitance variations

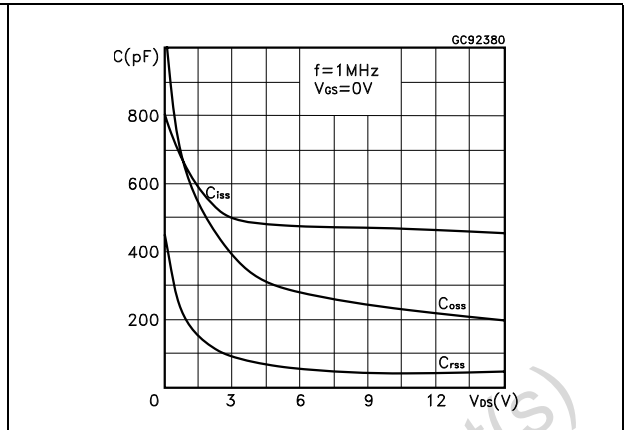


Figure 10. Normalized gate threshold voltage vs temperature

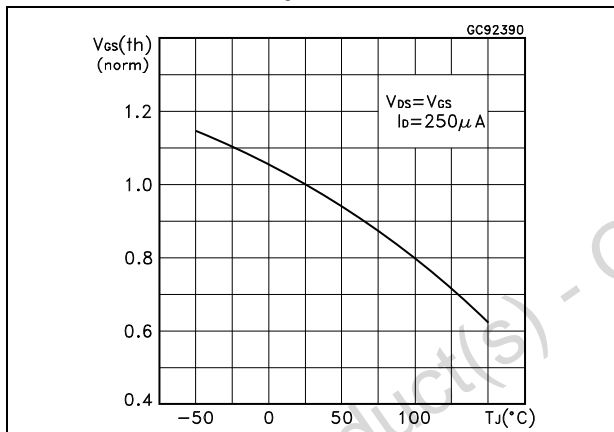
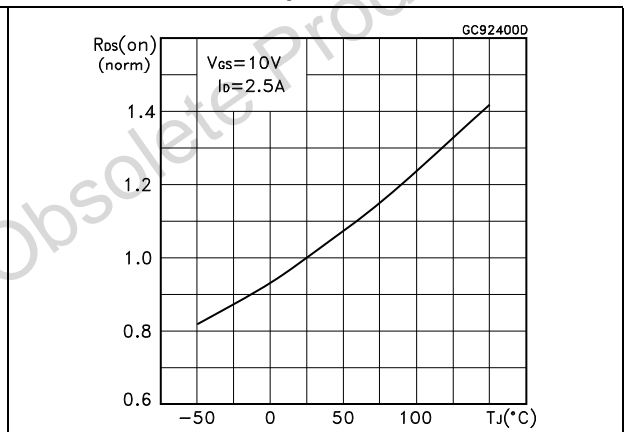


Figure 11. Normalized on-resistance vs temperature



### 3 Test circuit

Figure 12. Switching times test circuit for resistive load



Figure 13. Gate charge test circuit

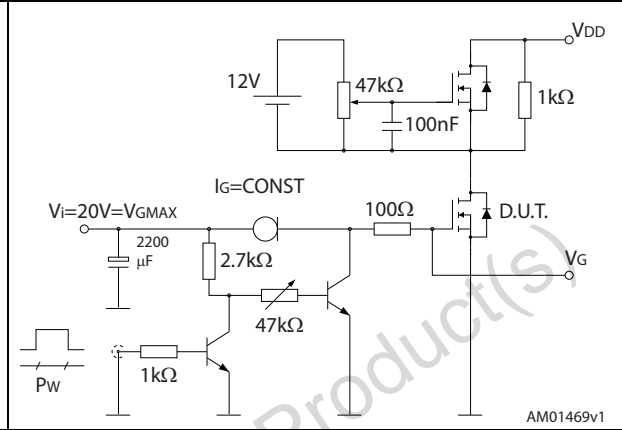


Figure 14. Test circuit for inductive load switching and diode recovery times

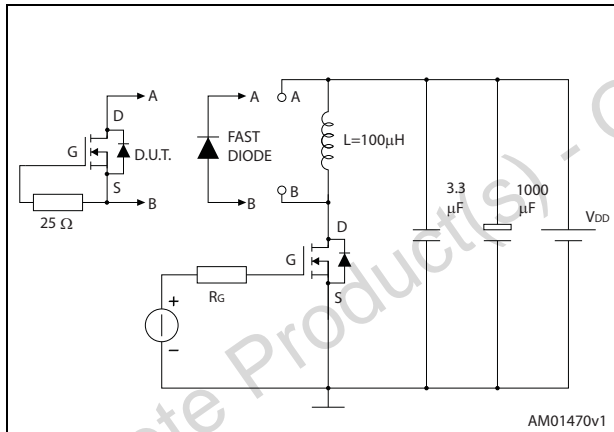


Figure 15. Unclamped Inductive load test circuit

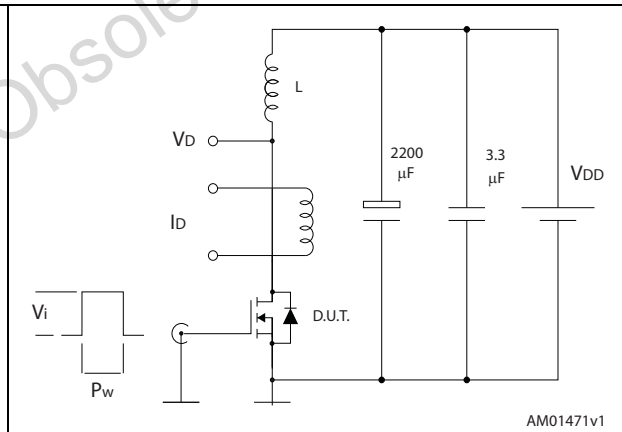


Figure 16. Unclamped inductive waveform

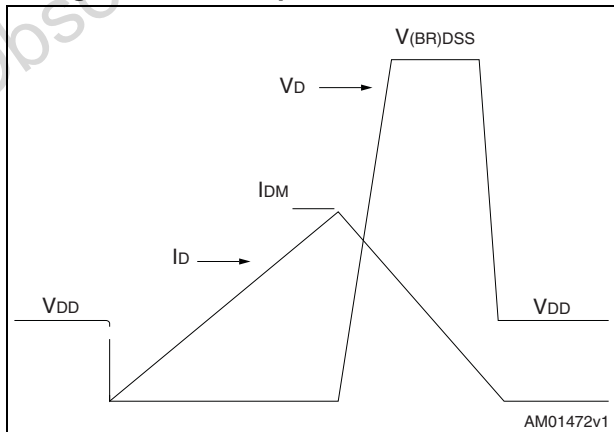
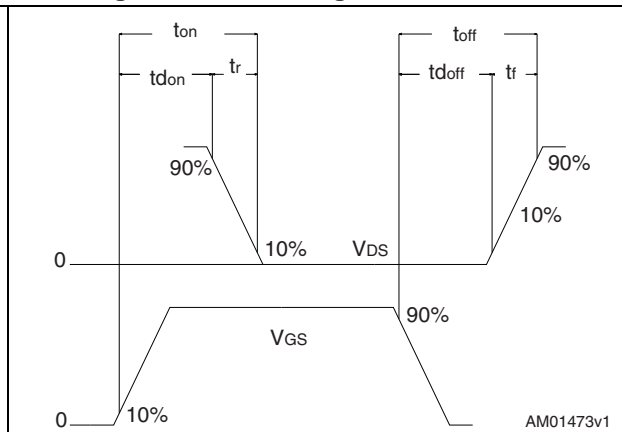


Figure 17. Switching time waveform



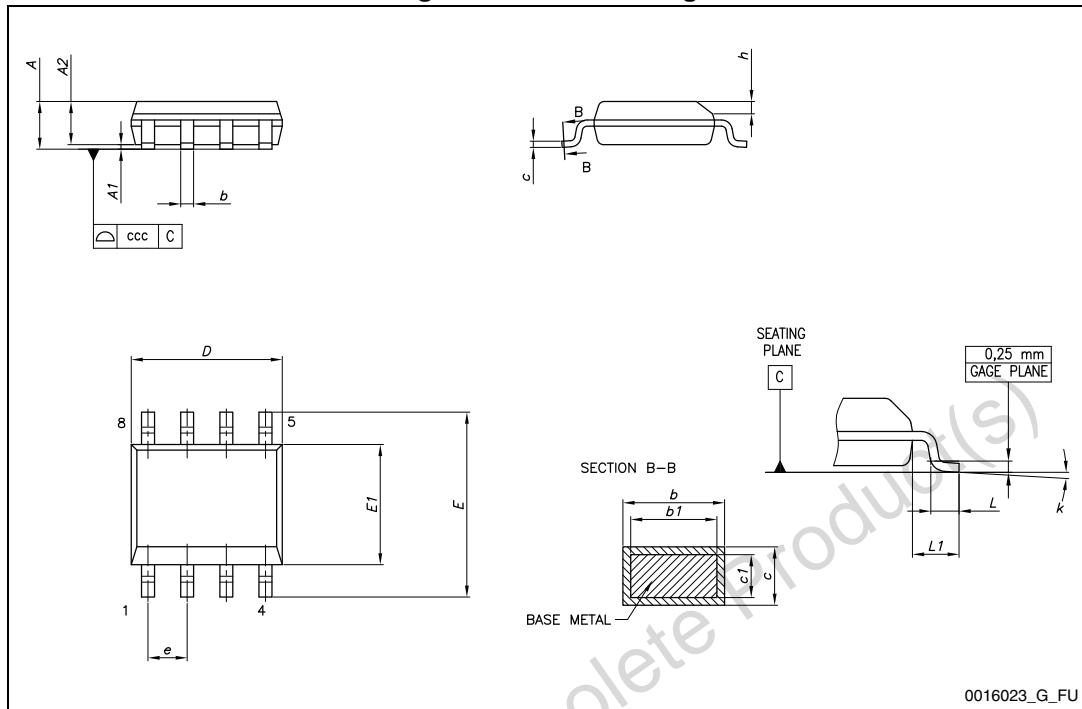


## 4 Package mechanical data

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.

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Figure 18. SO-8 drawing

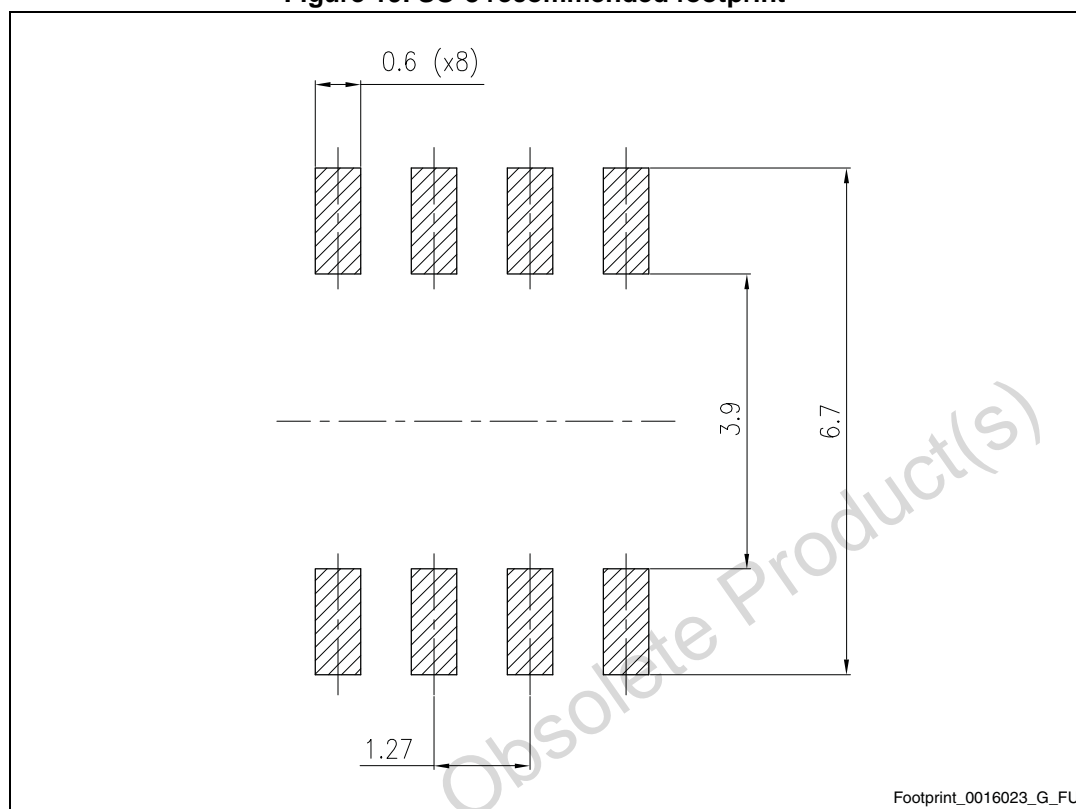


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Table 8. SO-8 mechanical data

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



a. All dimensions are in millimeters.

## 5 Revision history

Table 9. Revision history

Date	Revision	Changes
21-Jun-2004	4	Complete document
13-Nov-2006	5	The document has been reformatted
02-May-2011	6	<i>Table 1: Device summary</i> has been corrected
06-Mar-2014	7	Modified: Marking in <i>Table 1</i> Updated: <i>Section 4: Package mechanical data, Figure 12: Switching times test circuit for resistive load, Figure 13: Gate charge test circuit, Figure 14: Test circuit for inductive load switching and diode recovery times</i> and <i>Figure 15: Unclamped Inductive load test circuit.</i> Minor text changes.

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