



# STD44N4LF6

N-channel 40 V, 8.9 mΩ, 44 A DPAK  
STripFET™ VI DeepGATE™ Power MOSFET

## Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STD44N4LF6	40 V	12.5 mΩ	44 A

- 100% avalanche tested
- Logic level drive

## Applications

- Switching applications
- Automotive

## Description

This device is an N-channel Power MOSFET developed using the 6th 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.

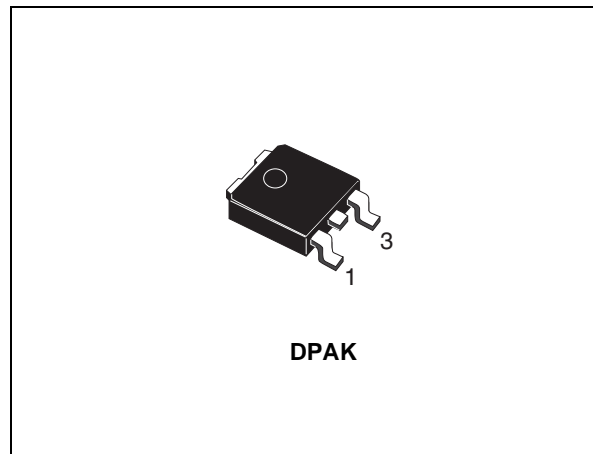


Figure 1. Internal schematic diagram

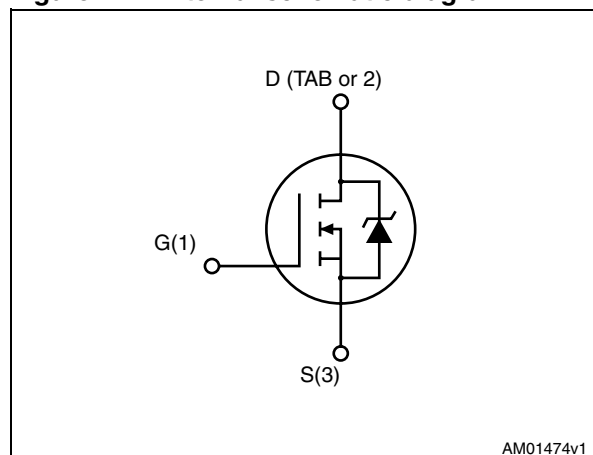


Table 1. Device summary

Order code	Marking	Package	Packaging
STD44N4LF6	44N4LF6	DPAK	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 ( $V_{GS} = 0$ )	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	44	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	31	A
$I_{DM}^{(1)}$	Drain current (pulsed)	176	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	50	W
	Derating factor	0.33	W/ $^\circ\text{C}$
$T_{stg}$	Storage temperature	- 55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

1. Pulse is rated according SOA

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	3	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb max <sup>(1)</sup>	50	$^\circ\text{C}/\text{W}$

1. When mounted on 1 inch<sup>2</sup>, 2 oz Cu.

**Table 4. Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AV}$	Not-repetitive avalanche current	20	A
$E_{AS}^{(1)}$	Single pulse avalanche energy	150	mJ

1. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = I_{AV}$ ,  $V_{DD} = 24\text{ V}$

## 2 Electrical characteristics

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

**Table 5. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage $V_{GS} = 0$	$I_D = 250\ \mu\text{A}$	40	-		V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 20\ \text{V}$ $V_{DS} = 20\ \text{V}, T_c = 125\text{ °C}$		-	1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\ \text{V}$		-	$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1	-	2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 5\ \text{V}, I_D = 20\ \text{A}$ $V_{GS} = 10\ \text{V}, I_D = 20\ \text{A}$		11.3 8.9	18 12.5	$\text{m}\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\ \text{V}, f = 1\ \text{MHz},$ $V_{GS} = 0\ \text{V}$	-	1190	-	pF
$C_{oss}$	Output capacitance			200		pF
$C_{rss}$	Reverse transfer capacitance			110		pF
$Q_g$	Total gate charge	$V_{DD} = 20\ \text{V}, I_D = 40\ \text{A}$	-	22	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\ \text{V}$		5		nC
$Q_{gd}$	Gate-drain charge	(see <a href="#">Figure 14</a> )		4.3		nC
$R_G$	Intrinsic gate resistance	$f = 1\ \text{MHz}$ open drain	-	3.1	-	$\Omega$

**Table 7. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\ \text{V}, I_D = 20\ \text{A},$ $R_G = 4.7\ \Omega, V_{GS} = 10\ \text{V}$ (see <a href="#">Figure 15</a> )	-	8.5	-	ns
$t_r$	Rise time			45		ns
$t_{d(off)}$	Turn-off delay time			30		ns
$t_f$	Fall time			8		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		44	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		176	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 20 \text{ A}, V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 40 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 32 \text{ V}, T_J = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 17</a> )	-	25		ns
$Q_{rr}$	Reverse recovery charge			25		nC
$I_{RRM}$	Reverse recovery current			2		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

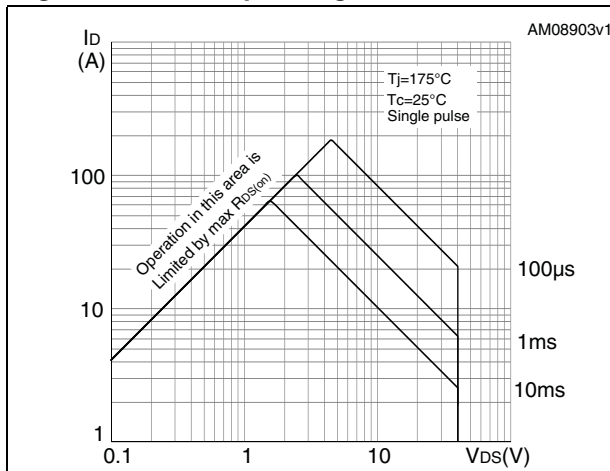


Figure 3. Thermal impedance

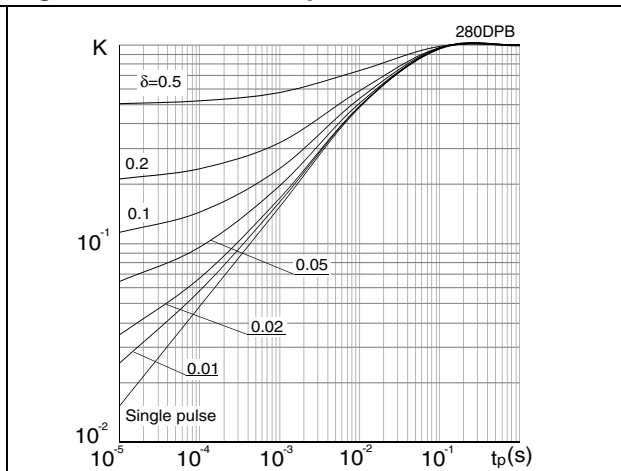


Figure 4. Output characteristics

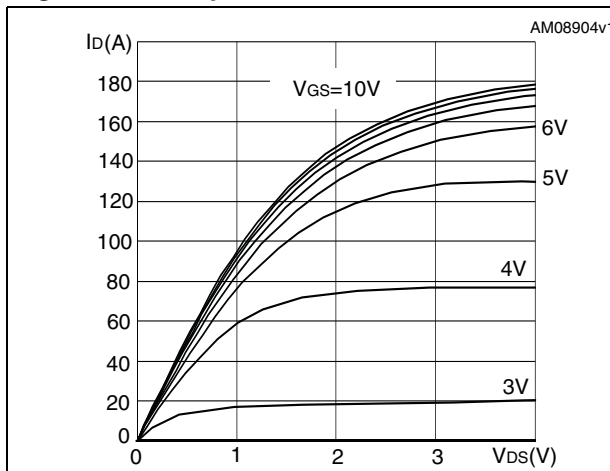


Figure 5. Transfer characteristics

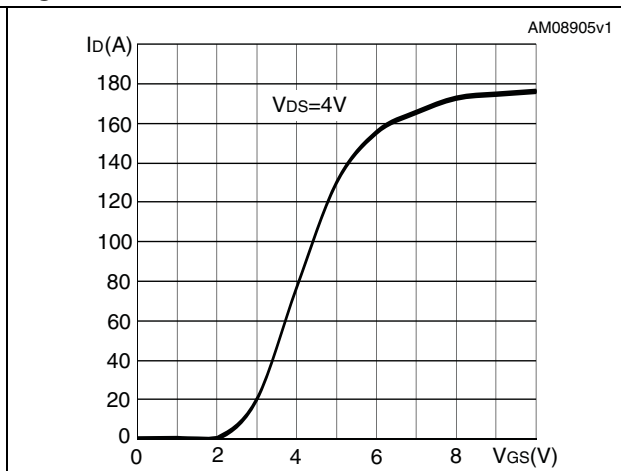


Figure 6. Normalized  $B_{V_{DS}}$  vs temperature

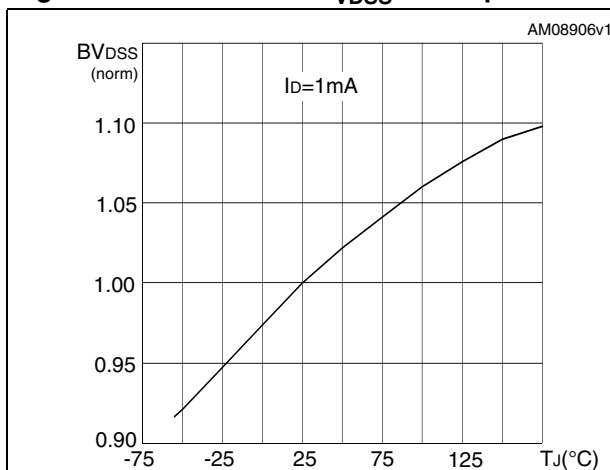


Figure 7. Static drain-source on resistance

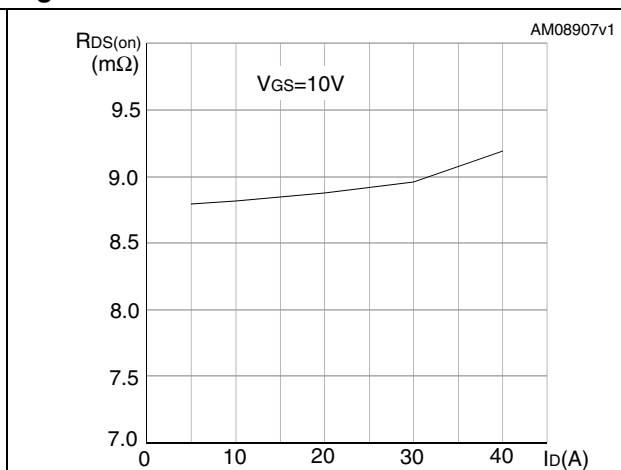


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

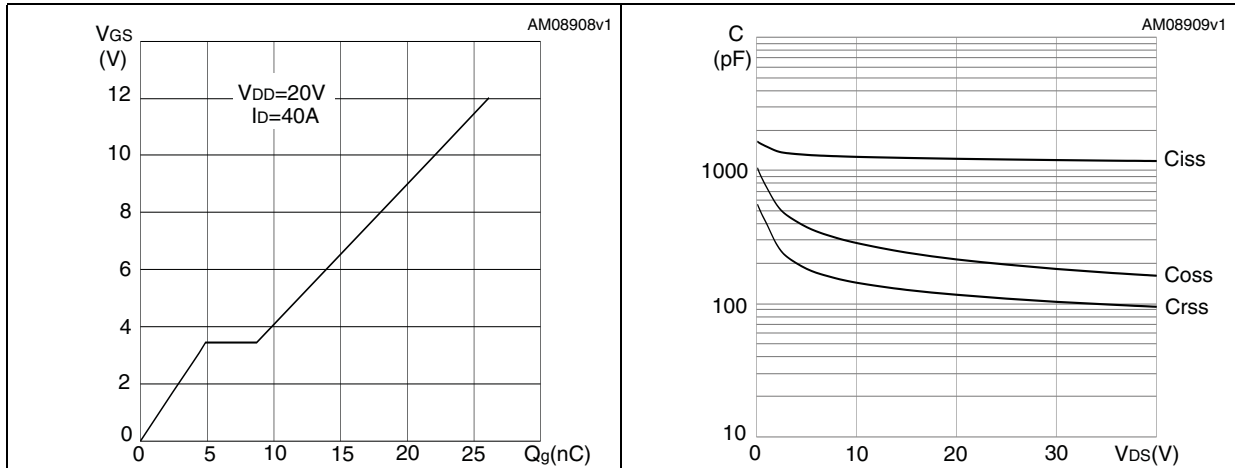


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

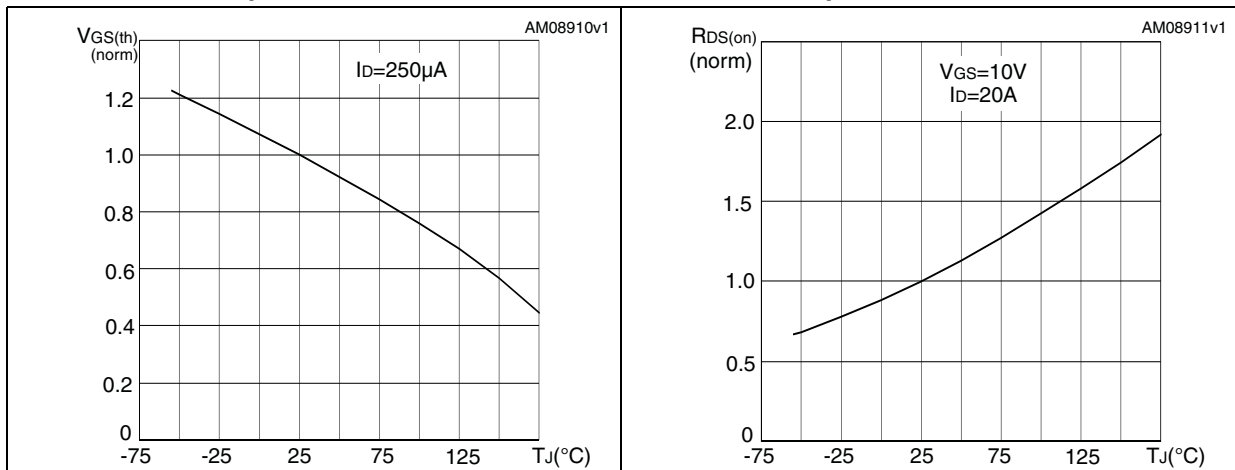
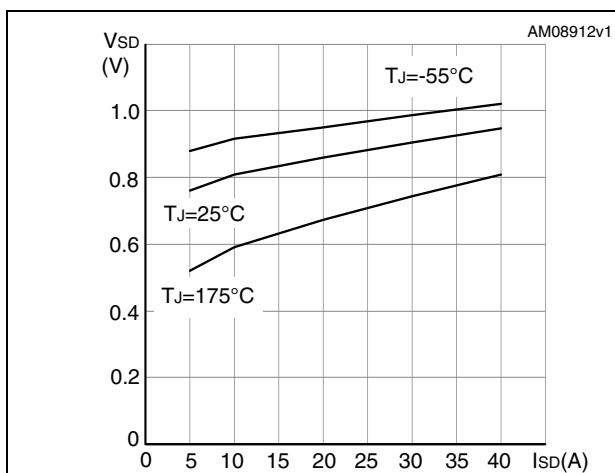


Figure 12. Source-drain diode forward characteristics



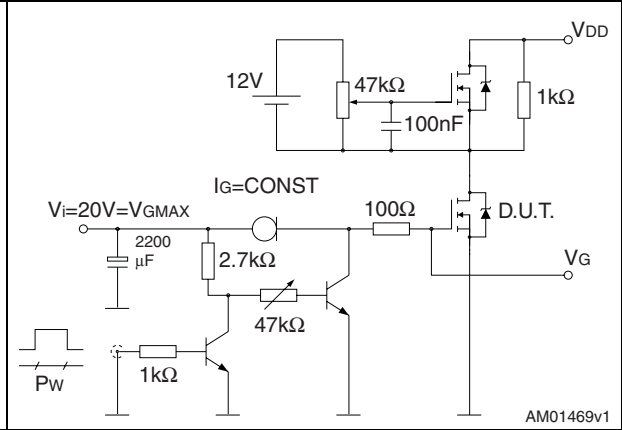
### 3 Test circuits

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



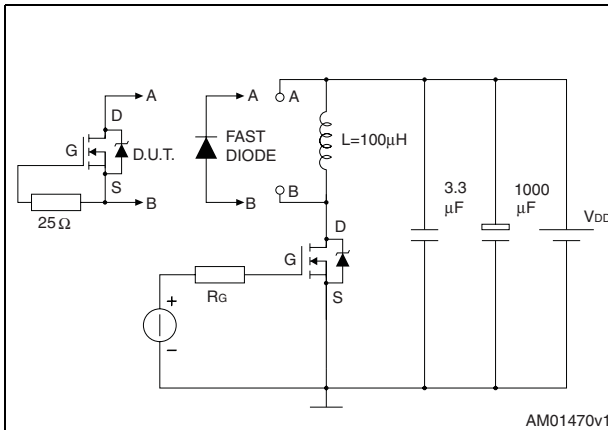
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**Figure 14. Gate charge test circuit**



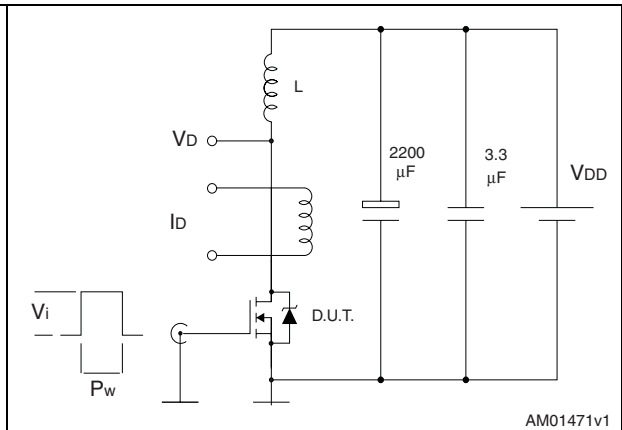
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**Figure 15. Test circuit for inductive load switching and diode recovery times**



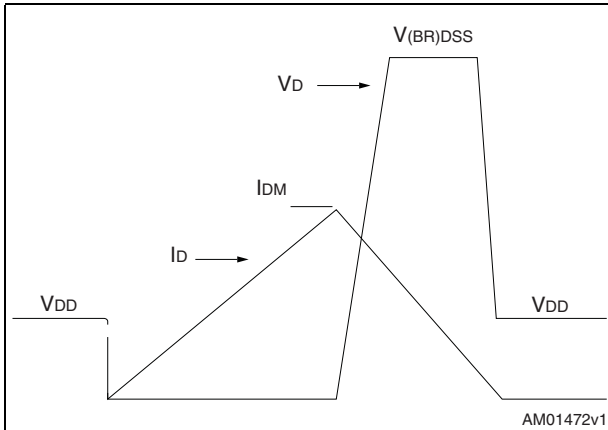
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**Figure 16. Unclamped inductive load test circuit**



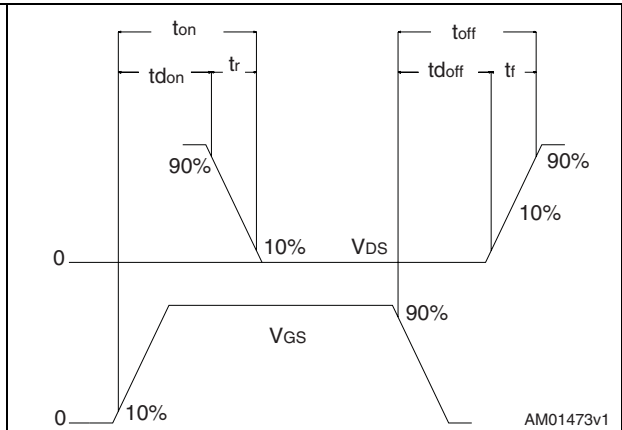
AM01471v1

**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



AM01473v1



## 4 Package 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 products status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 9. DPAK (TO-252) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		1.50
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

Figure 19. DPAK (TO-252) drawing

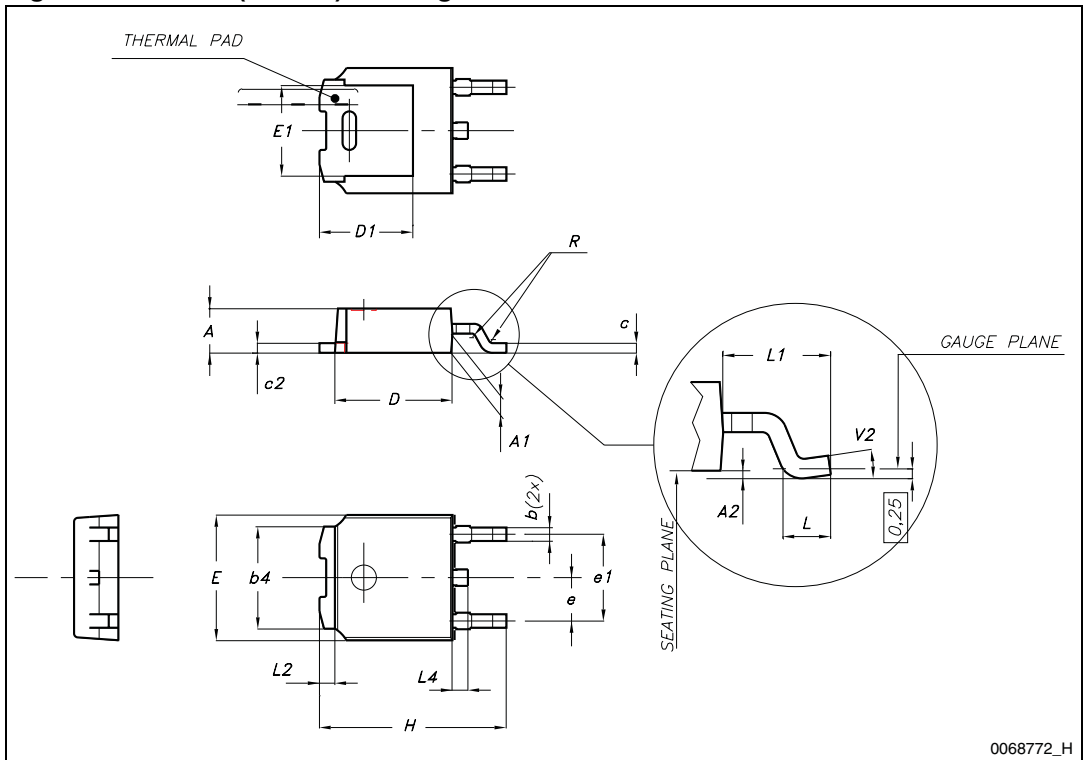
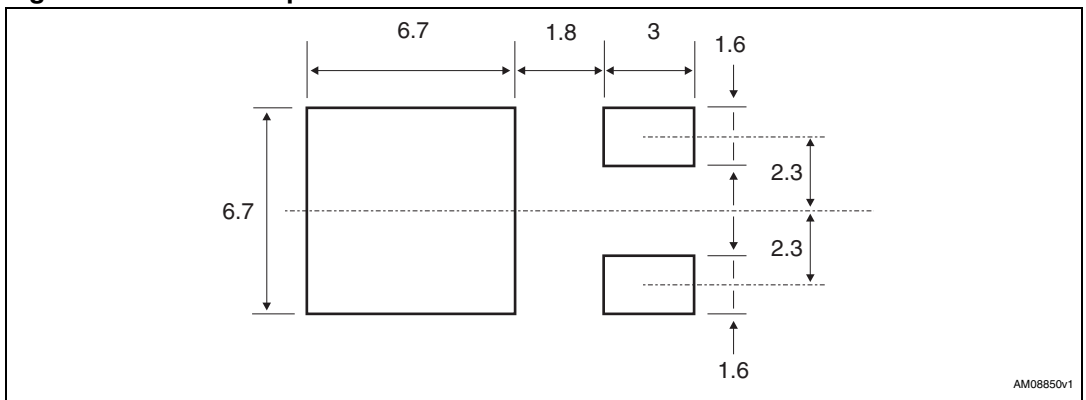


Figure 20. DPAK footprint<sup>(a)</sup>



a. All dimension are in millimeters

## 5 Packaging mechanical data

Table 10. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 21. Tape for DPAK (TO-252)

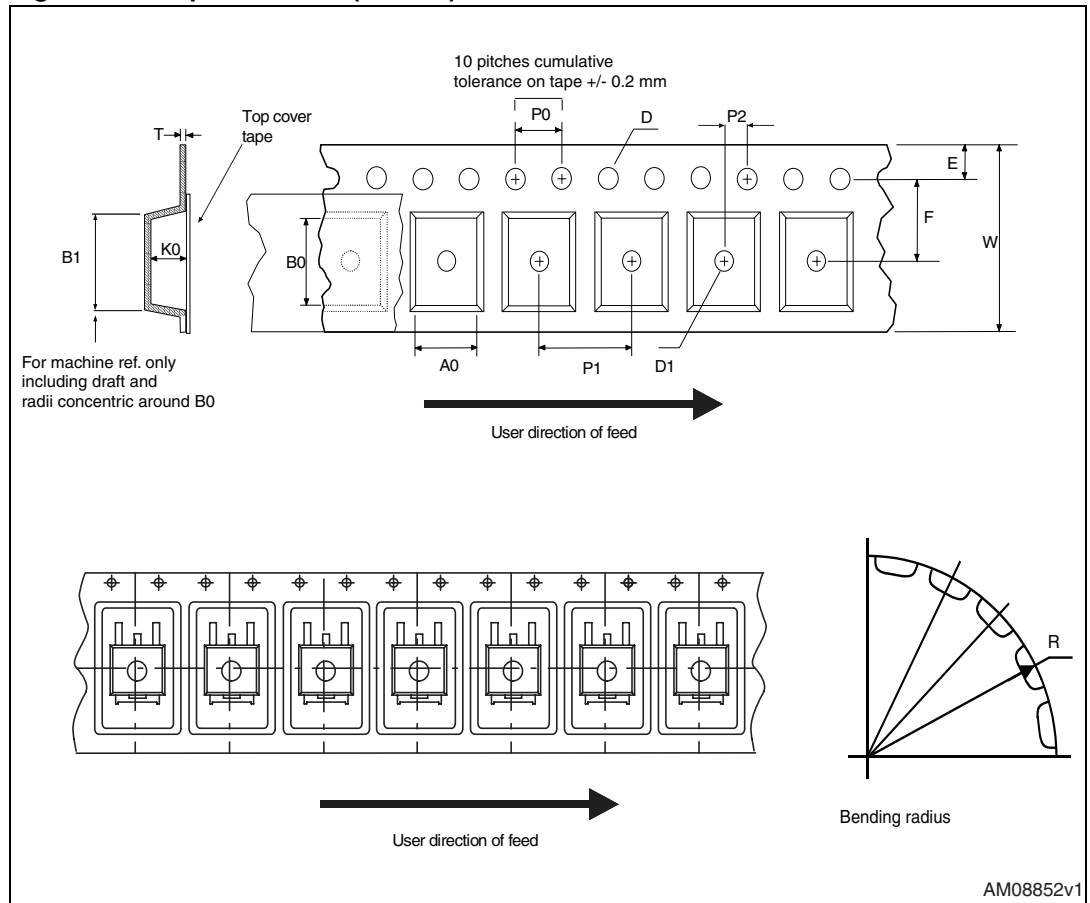
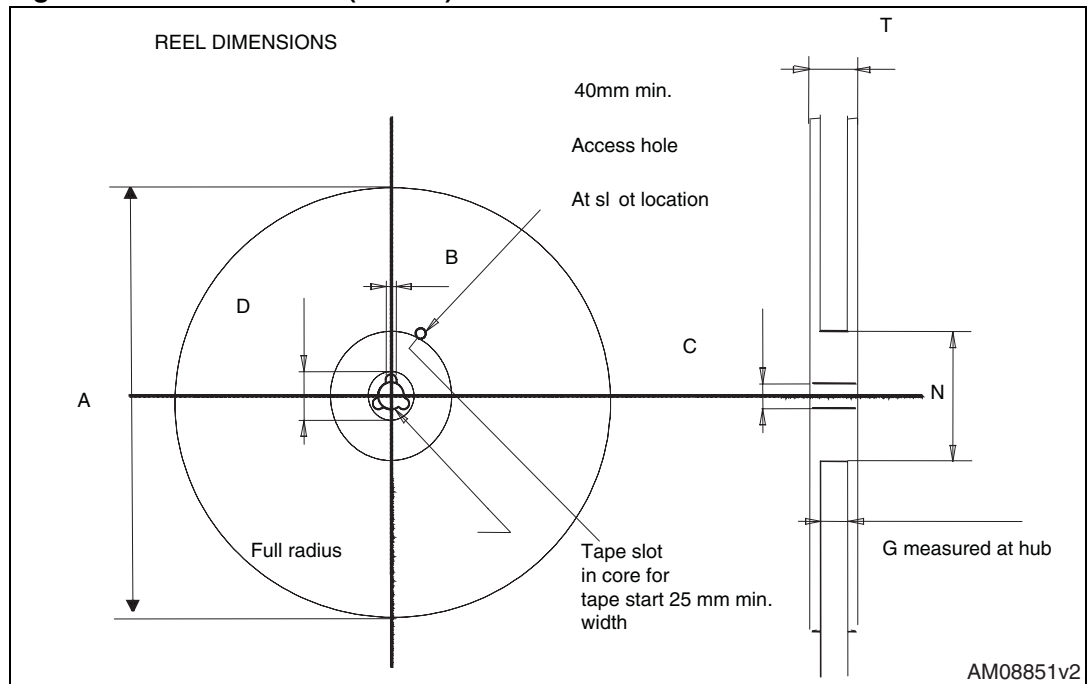


Figure 22. Reel for DPAK (TO-252)



## 6 Revision history

**Table 11. Document revision history**

Date	Revision	Changes
23-Feb-2010	1	First release.
03-Feb-2011	2	Document status promoted from preliminary data to datasheet.
16-Sep-2011	3	Updated <a href="#">Table 4: Package mechanical data</a> . Minor text changes in cover page.
25-Oct-2011	4	Updated <a href="#">Table 7: Switching on/off (inductive load)</a> and <a href="#">Table 8: Source drain diode</a> . Updated <a href="#">Table 4: Package mechanical data</a> .

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