



STD44N4LF6

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

Features

Order code	V _{DSS}	R _{DS(on)} max	I _D
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_{DS(on)} in all packages.

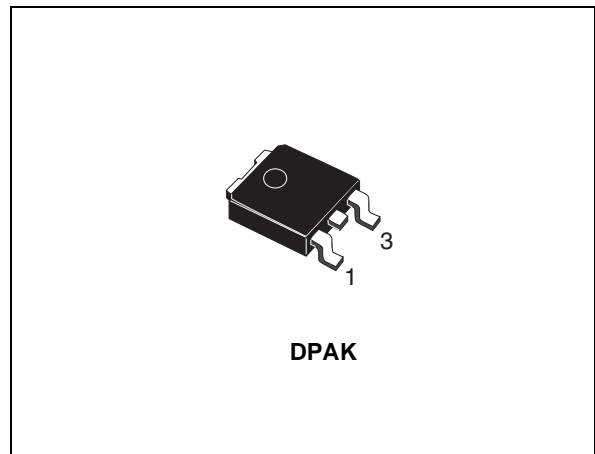


Figure 1. Internal schematic diagram

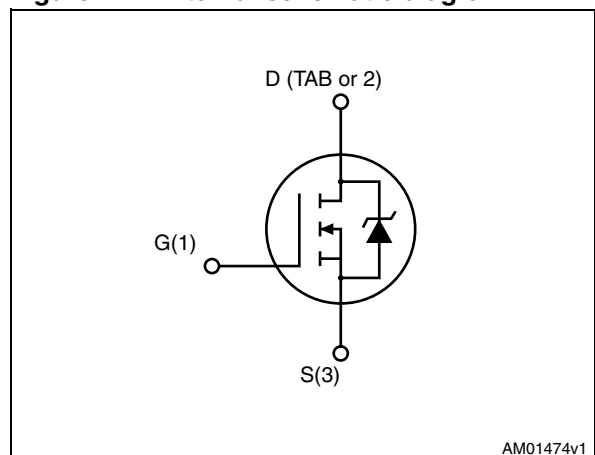


Table 1. Device summary

Order code	Marking	Package	Packaging
STD44N4LF6	44N4LF6	DPAK	Tape and reel

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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	± 20	V
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	44	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	31	A
$I_{DM}^{(1)}$	Drain current (pulsed)	176	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	50	W
	Derating factor	0.33	W/°C
T_{stg}	Storage temperature	- 55 to 175	°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	°C/W
$R_{thj-pcb}$	Thermal resistance junction-pcb max ⁽¹⁾	50	°C/W

1. When mounted on 1 inch², 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 $T_j = 25\text{ °C}$, $I_D = I_{AV}$, $V_{DD} = 24\text{ V}$

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	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\ \text{V}$		-	± 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 Figure 14)		4.3		nC
R_G	Intrinsic gate resistance	$f = 1\ \text{MHz}$ open drain	-	3.1	-	Ω

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 Figure 15)	-	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 Figure 17)	-	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 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

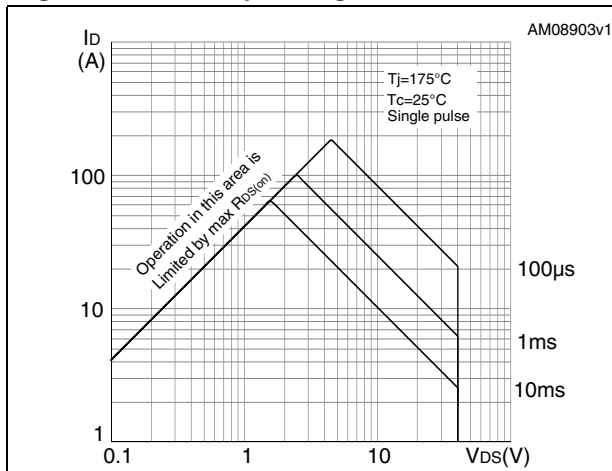


Figure 3. Thermal impedance

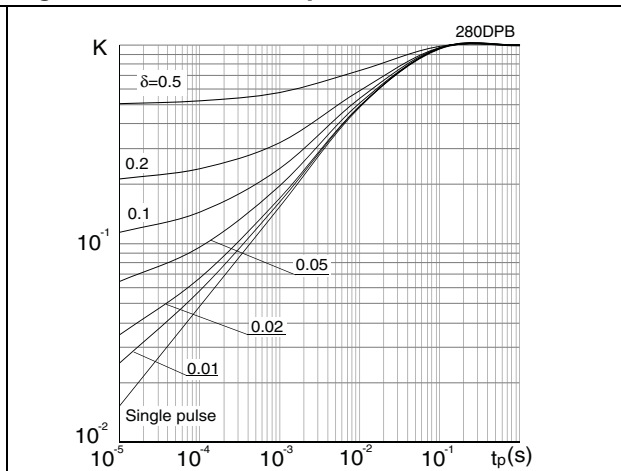


Figure 4. Output characteristics

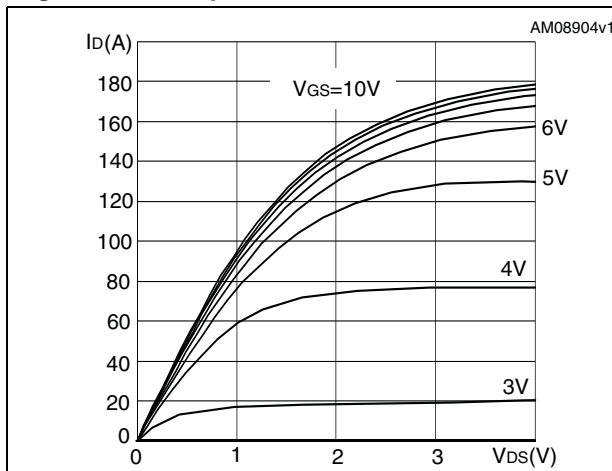


Figure 5. Transfer characteristics

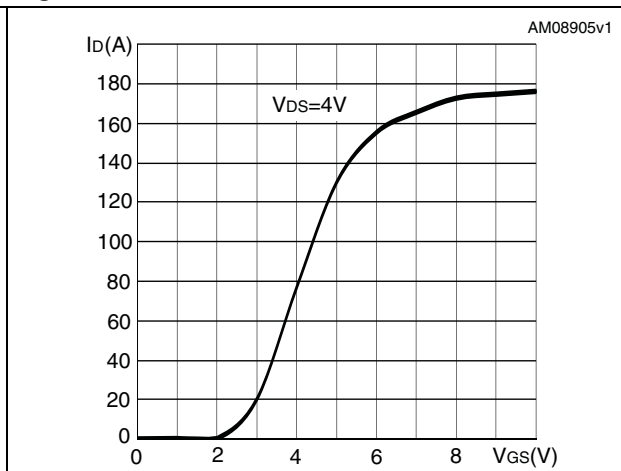


Figure 6. Normalized $B_{V_{DSS}}$ vs temperature

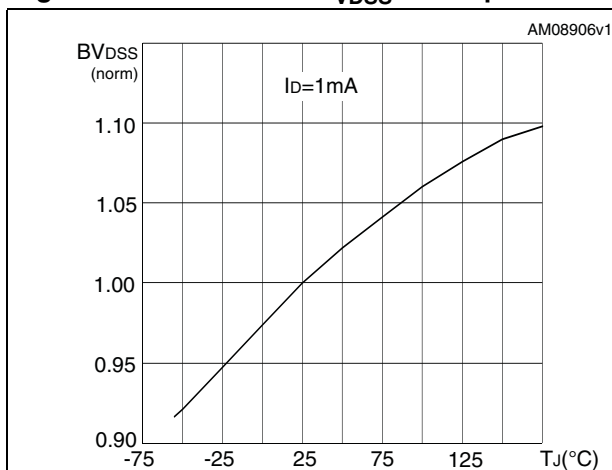


Figure 7. Static drain-source on resistance

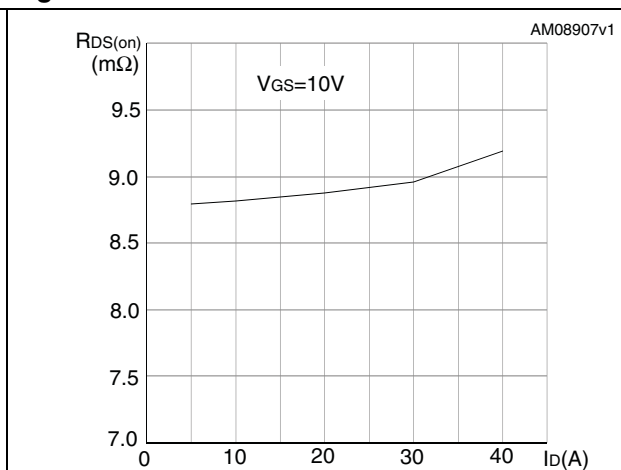


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

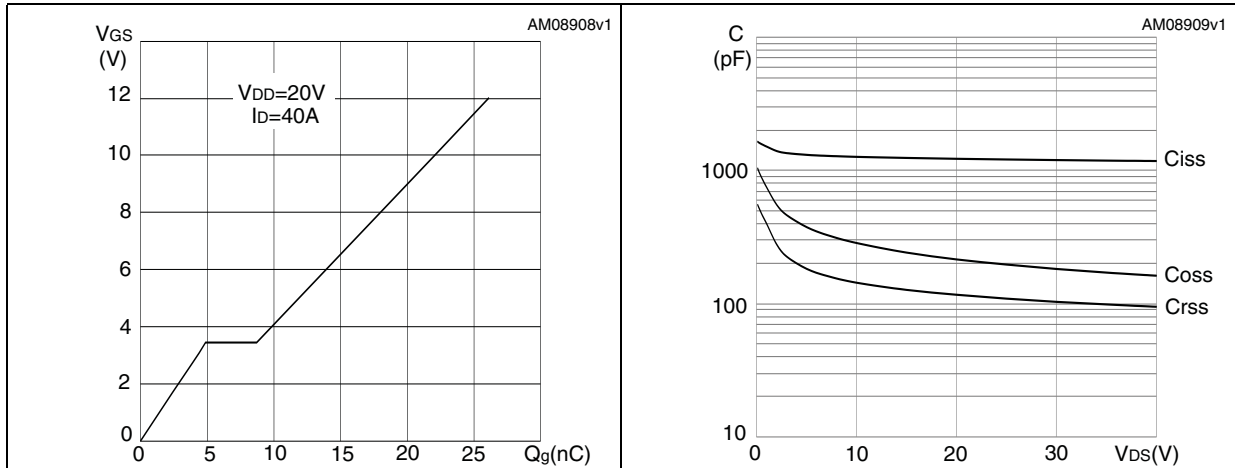


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

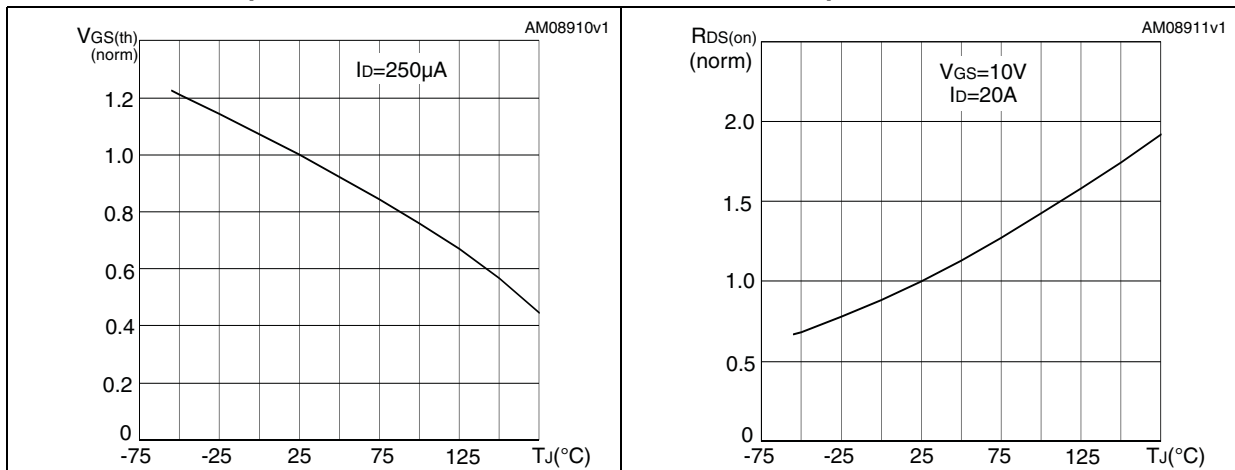
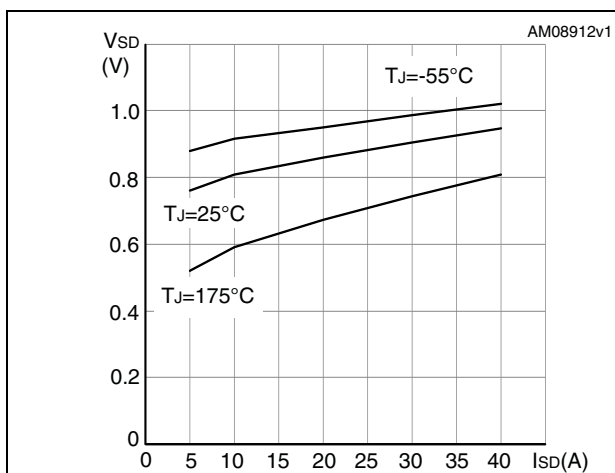
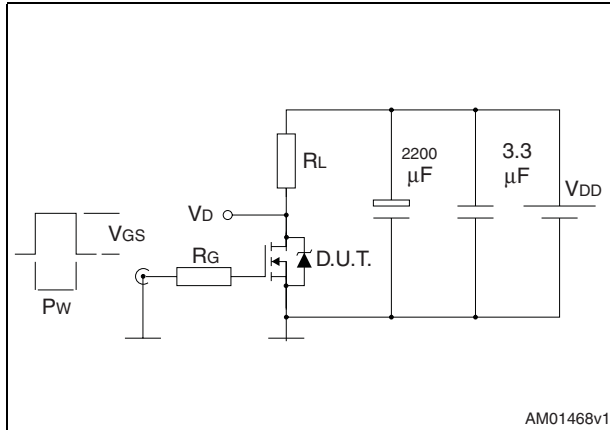


Figure 12. Source-drain diode forward characteristics



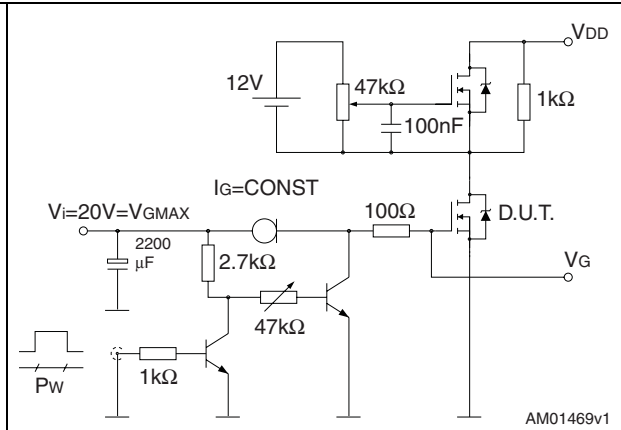
3 Test circuits

Figure 13. Switching times test circuit for resistive load



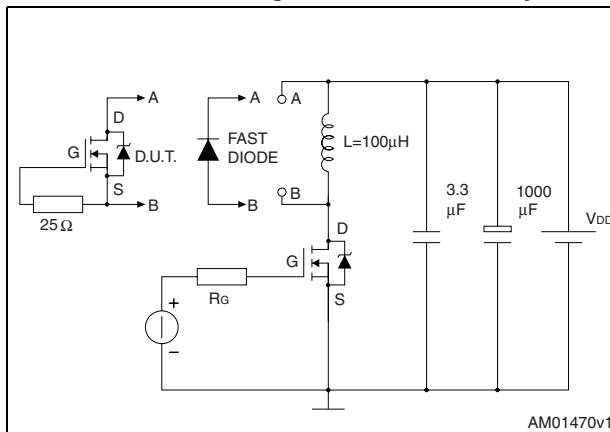
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Figure 14. Gate charge test circuit



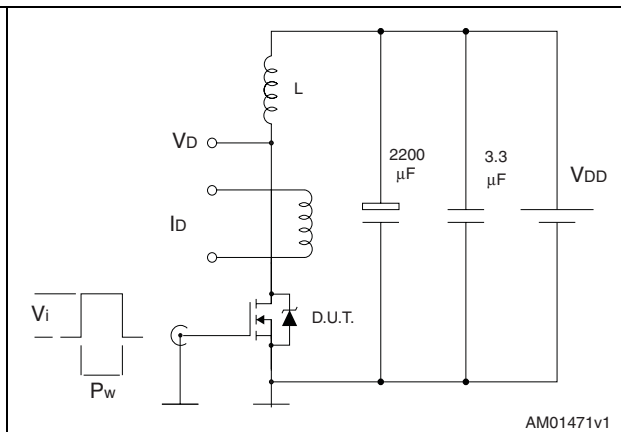
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Figure 15. Test circuit for inductive load switching and diode recovery times



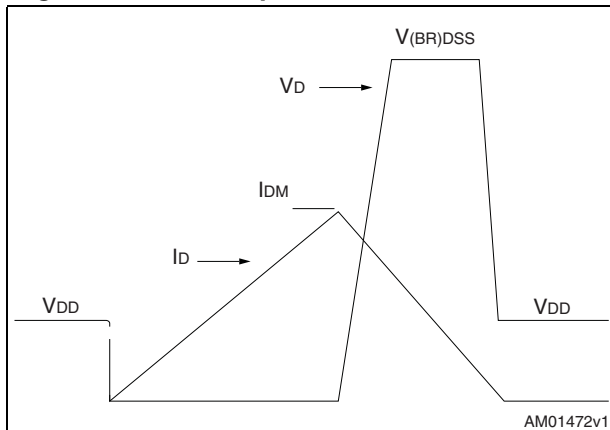
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Figure 16. Unclamped inductive load test circuit



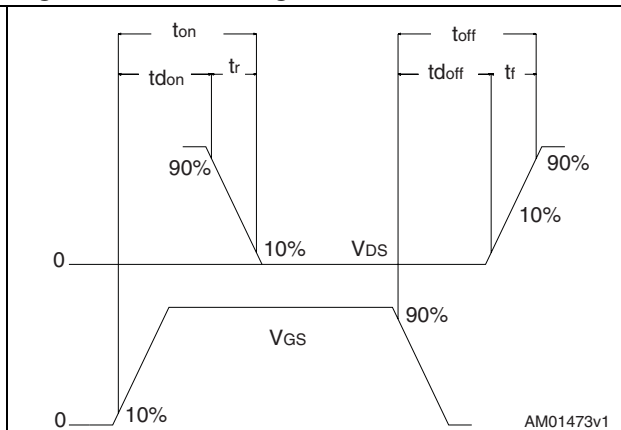
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Figure 17. Unclamped inductive waveform



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[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and products status are available at: 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

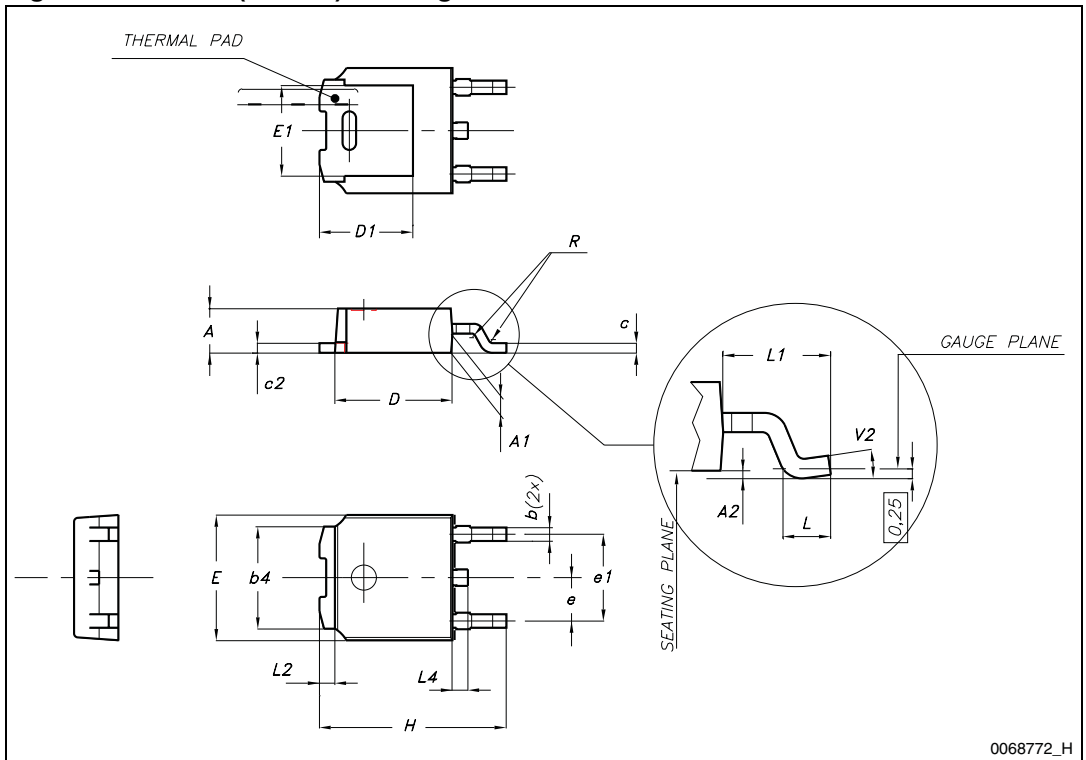
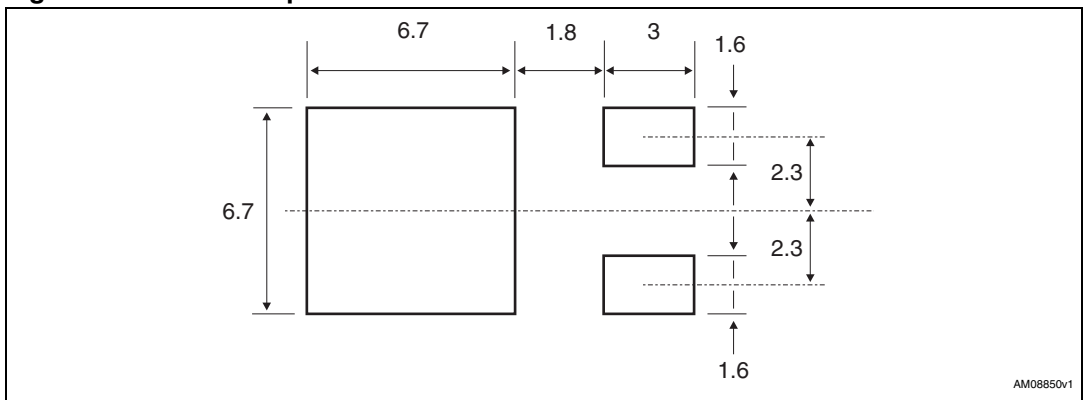


Figure 20. DPAK footprint^(a)



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)

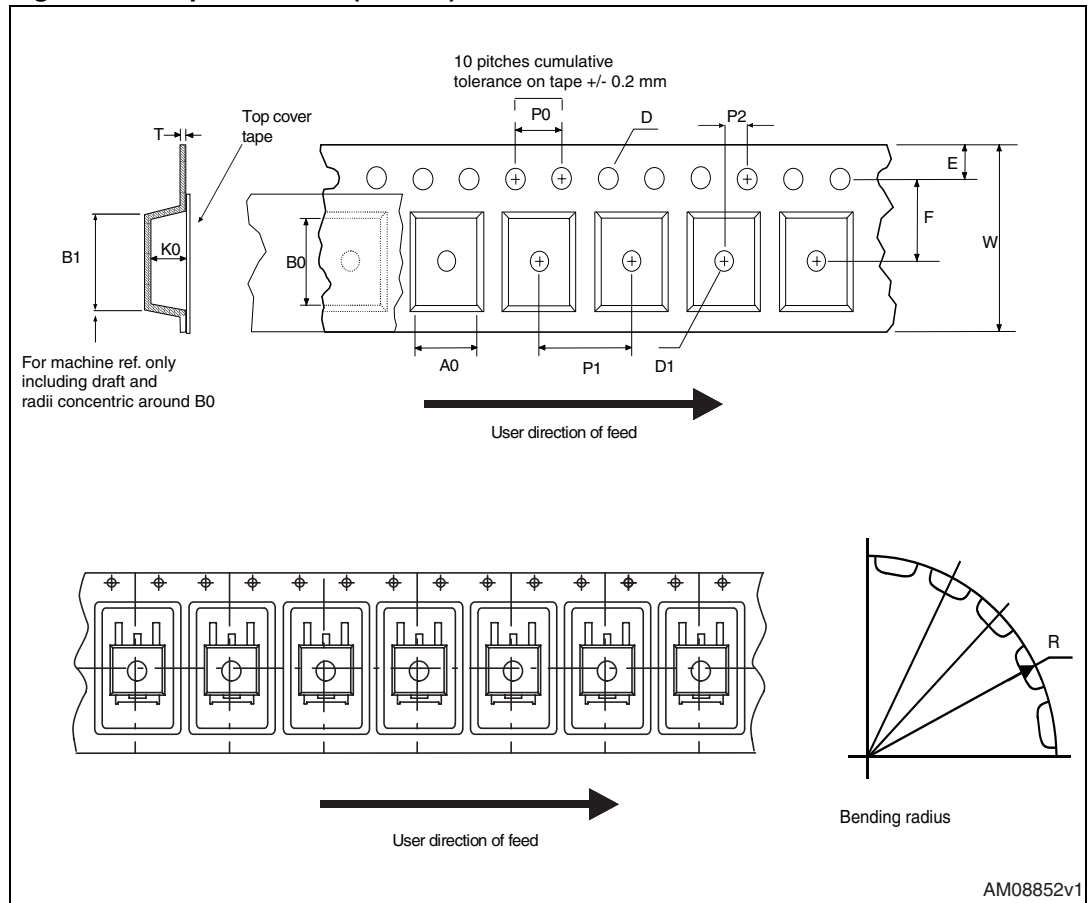
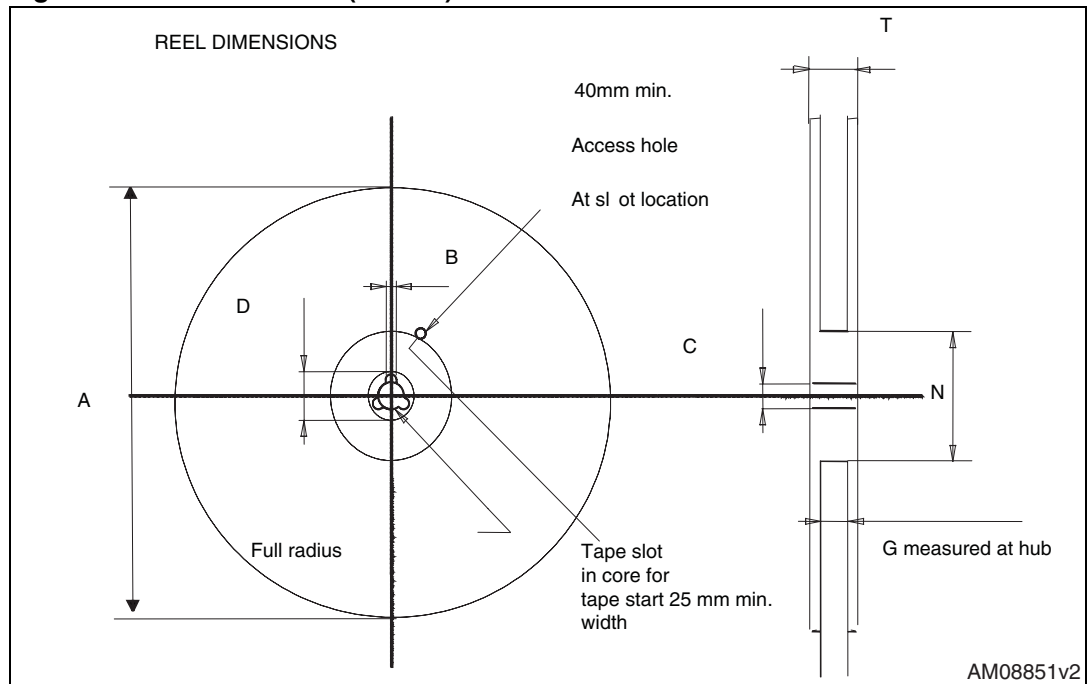


Figure 22. Reel for DPAK (TO-252)



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 Table 4: Package mechanical data . Minor text changes in cover page.
25-Oct-2011	4	Updated Table 7: Switching on/off (inductive load) and Table 8: Source drain diode . Updated Table 4: Package mechanical data .

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