



STB50N25M5

N-channel 250 V, 0.065 Ω , 28 A, MDmesh™ V Power MOSFET in D²PAK package

Datasheet — production data

Features

Type	V _{DSS}	R _{DS(on) max}	I _D
STB50N25M5	250 V	< 0.075 Ω	28 A

- Amongst the best R_{DS(on)}* area
- High dv/dt capability
- Excellent switching performance
- Easy to drive
- 100% avalanche tested

Application

- Switching applications

Description

This device is an N-channel MDmesh™ V Power MOSFET based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

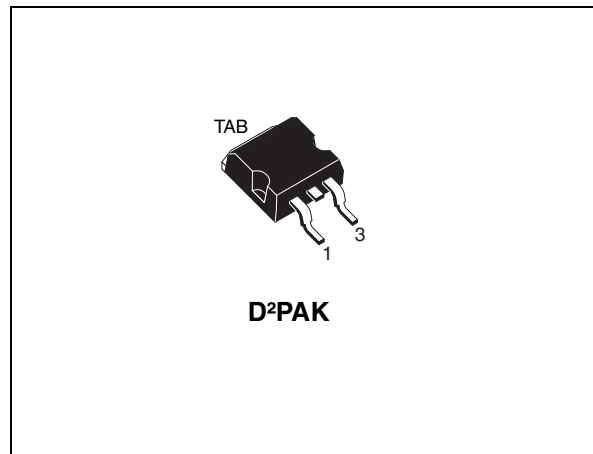


Figure 1. Internal schematic diagram

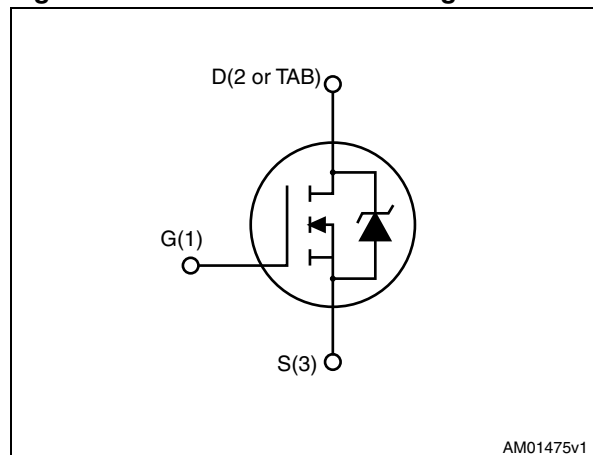


Table 1. Device summary

Order code	Marking	Package	Packaging
STB50N25M5	50N25M5	D ² PAK	Tape and reel

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
2.1	Electrical characteristics (curves)	6
3	Test circuits	8
4	Package mechanical data	9
5	Packaging mechanical data	11
6	Revision history	13

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate- source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	28	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	18	A
$I_{DM}^{(1)}$	Drain current (pulsed)	112	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	110	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	9	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	350	mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 150	$^\circ\text{C}$

1. Pulse width limited by safe operating area

2. $I_{SD} \leq 28\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{Peak} < V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.31	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb max	30	$^\circ\text{C}/\text{W}$

2 Electrical characteristics

(T_{case} =25°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 = 1 mA, V _{GS} = 0	250			V
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V _{DS} = 250 V V _{DS} = 250 V, T _C =125 °C			1 100	μA μA
I _{GSS}	Gate-body leakage current (V _{DS} = 0)	V _{GS} = ± 25 V			±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 100 μA	3	4	5	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 14 A		0.065	0.075	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} = 50 V, f = 1 MHz, V _{GS} = 0	-	1700 100 15	-	pF pF pF
C _{o(er)} ⁽¹⁾	Equivalent output capacitance energy related	V _{GS} = 0, V _{DS} = 0 to 80% V _{(BR)DSS}	-	89	-	pF
C _{o(tr)} ⁽²⁾	Equivalent output capacitance time related	V _{GS} = 0, V _{DS} = 0 to 80% V _{(BR)DSS}	-	171	-	pF
R _g	Gate input resistance	f=1 MHz open drain	-	1.8	-	Ω
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V _{DD} = 200 V, I _D = 28 A, V _{GS} = 10 V <i>(see Figure 15)</i>	-	44 10 23	-	nC nC nC

1. C_{o(er)} is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}
2. C_{o(tr)} is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 125\text{ V}$, $I_D = 14\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14)	-	16	-	ns
t_r	Rise time			44		ns
$t_{d(off)}$	Turn-off-delay time			35		ns
t_f	Fall time			20		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD}	Source-drain current		-		28	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				112	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 28\text{ A}$, $V_{GS} = 0$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 28\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_J = 25\text{ }^\circ\text{C}$ (see Figure 16)	-	174		ns
Q_{rr}	Reverse recovery charge			1.5		μC
I_{RRM}	Reverse recovery current			18		A
t_{rr}	Reverse recovery time	$I_{SD} = 28\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 16)	-	195		ns
Q_{rr}	Reverse recovery charge			2		μC
I_{RRM}	Reverse recovery current			20		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

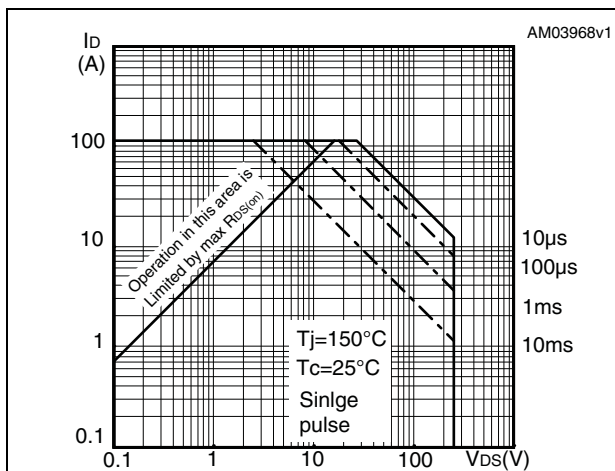


Figure 3. Thermal impedance

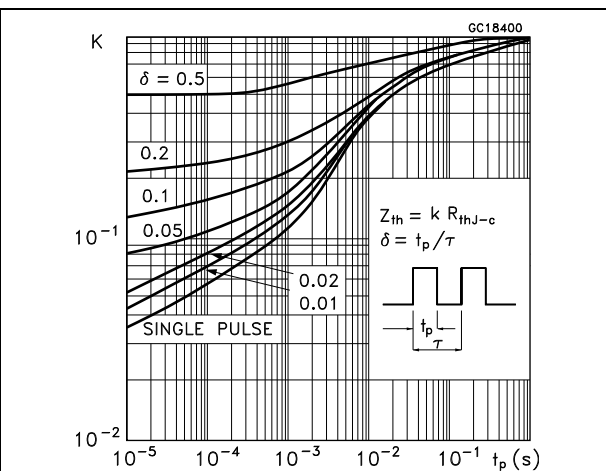


Figure 4. Output characteristics

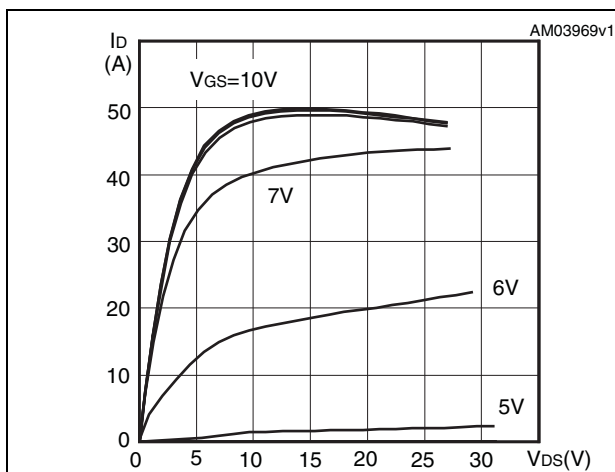


Figure 5. Transfer characteristics

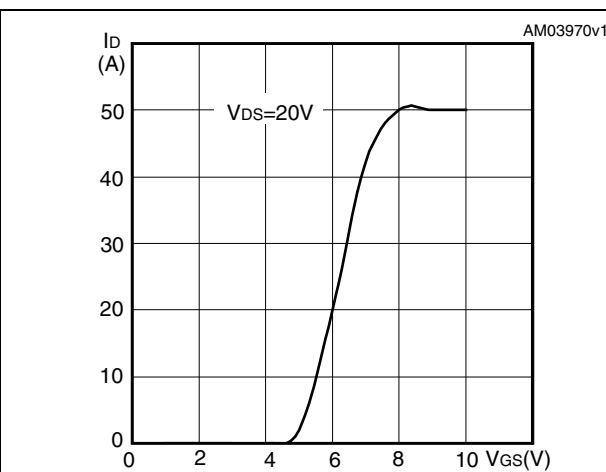


Figure 6. Normalized BV_{DSS} vs temperature

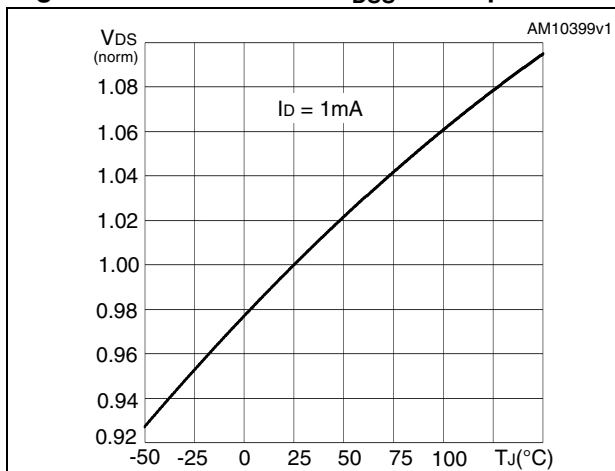


Figure 7. Static drain-source on-resistance

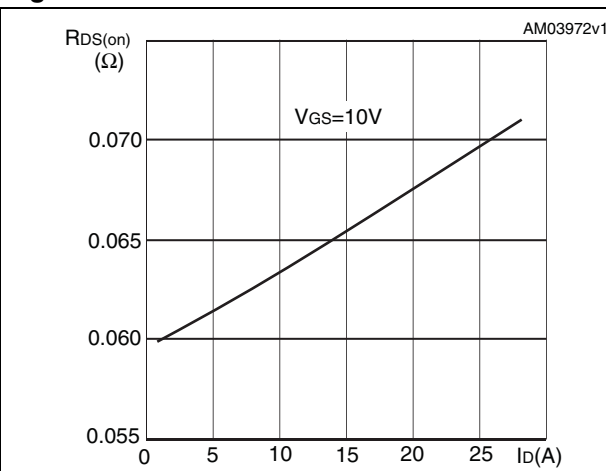


Figure 8. Output capacitance stored energy

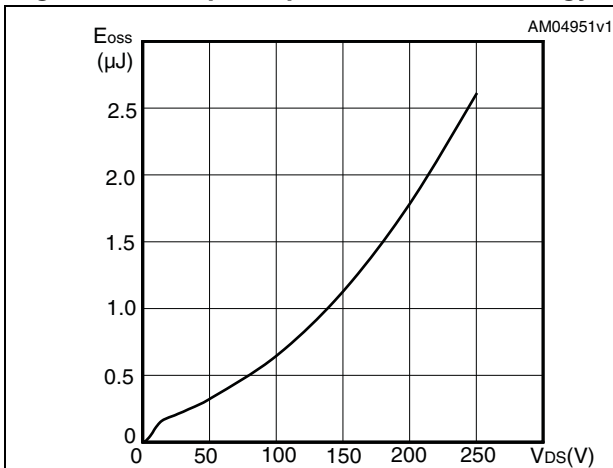


Figure 9. Capacitance variations

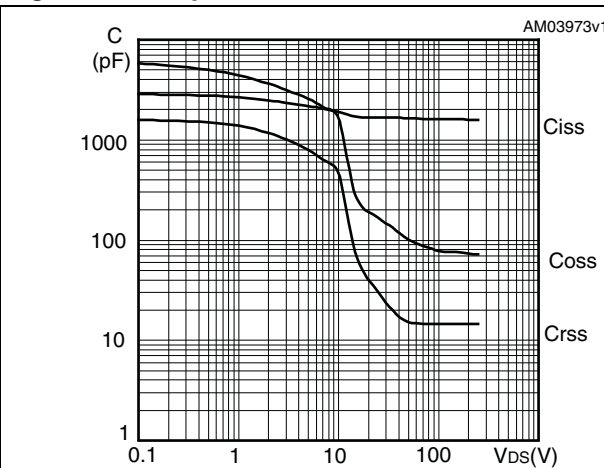


Figure 10. Gate charge vs gate-source voltage

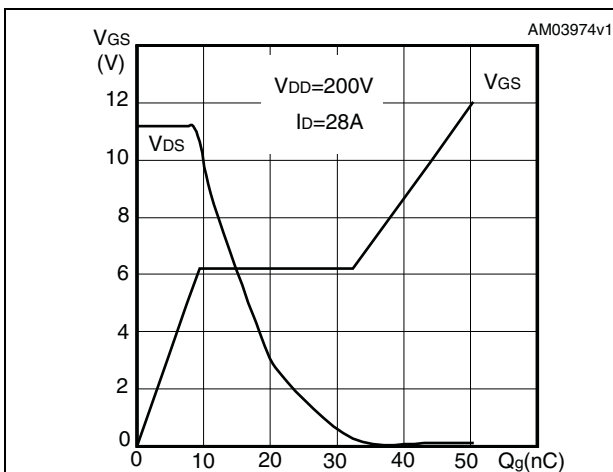


Figure 11. Normalized on-resistance vs temperature

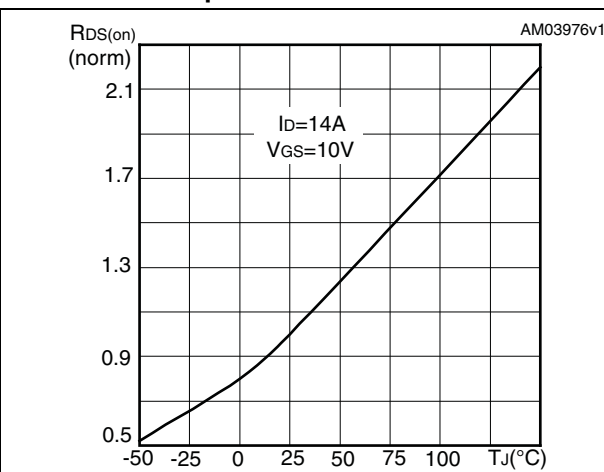


Figure 12. Normalized gate threshold voltage vs temperature

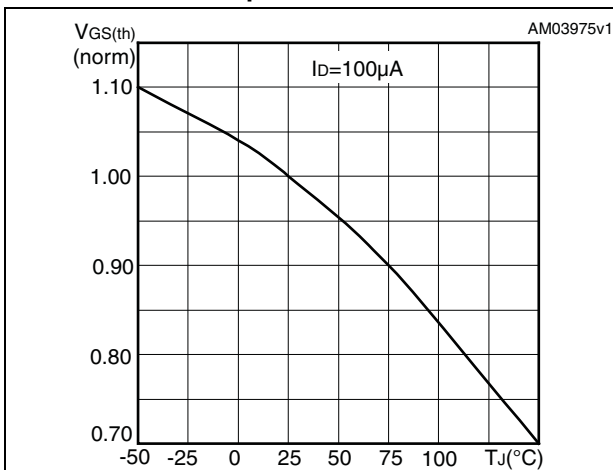
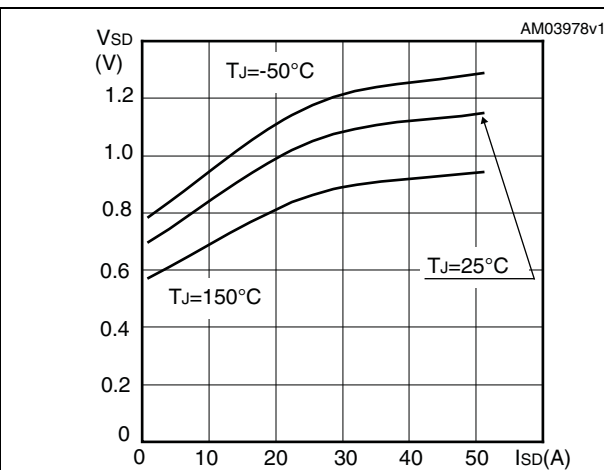
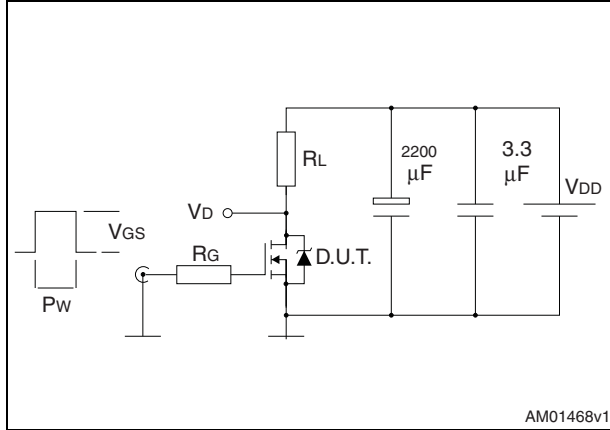


Figure 13. Source-drain diode forward characteristics



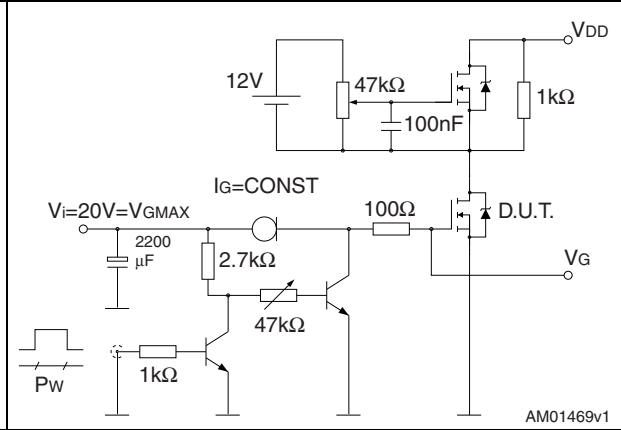
3 Test circuits

Figure 14. Switching times test circuit for resistive load



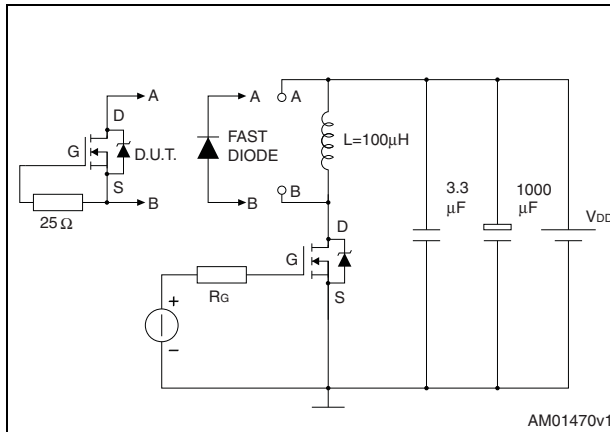
AM01468v1

Figure 15. Gate charge test circuit



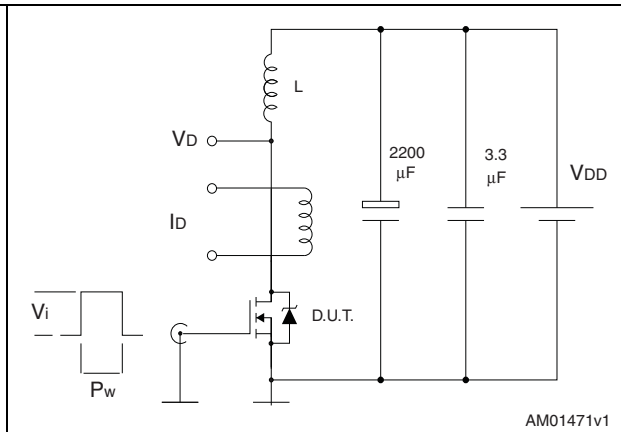
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Figure 16. Test circuit for inductive load switching and diode recovery times



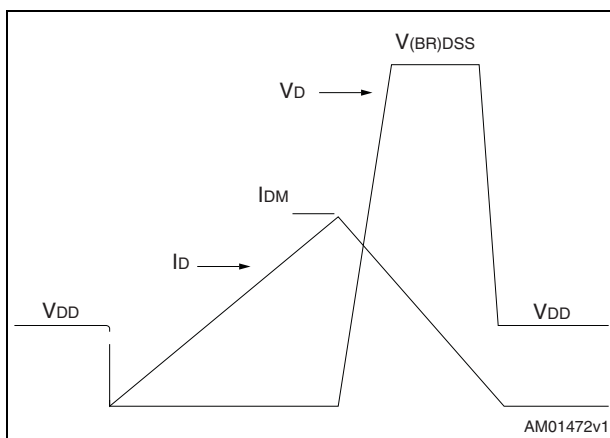
AM01470v1

Figure 17. Unclamped inductive load test circuit



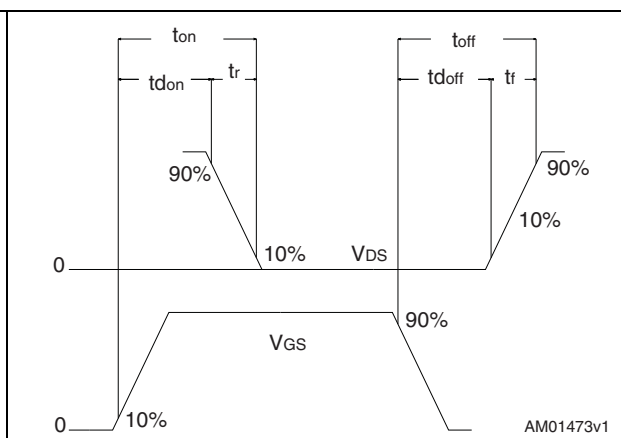
AM01471v1

Figure 18. Unclamped inductive waveform



AM01472v1

Figure 19. 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 product status are available at: www.st.com. ECOPACK is an ST trademark.

Table 8. D²PAK (TO-263) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 20. D²PAK (TO-263) drawing

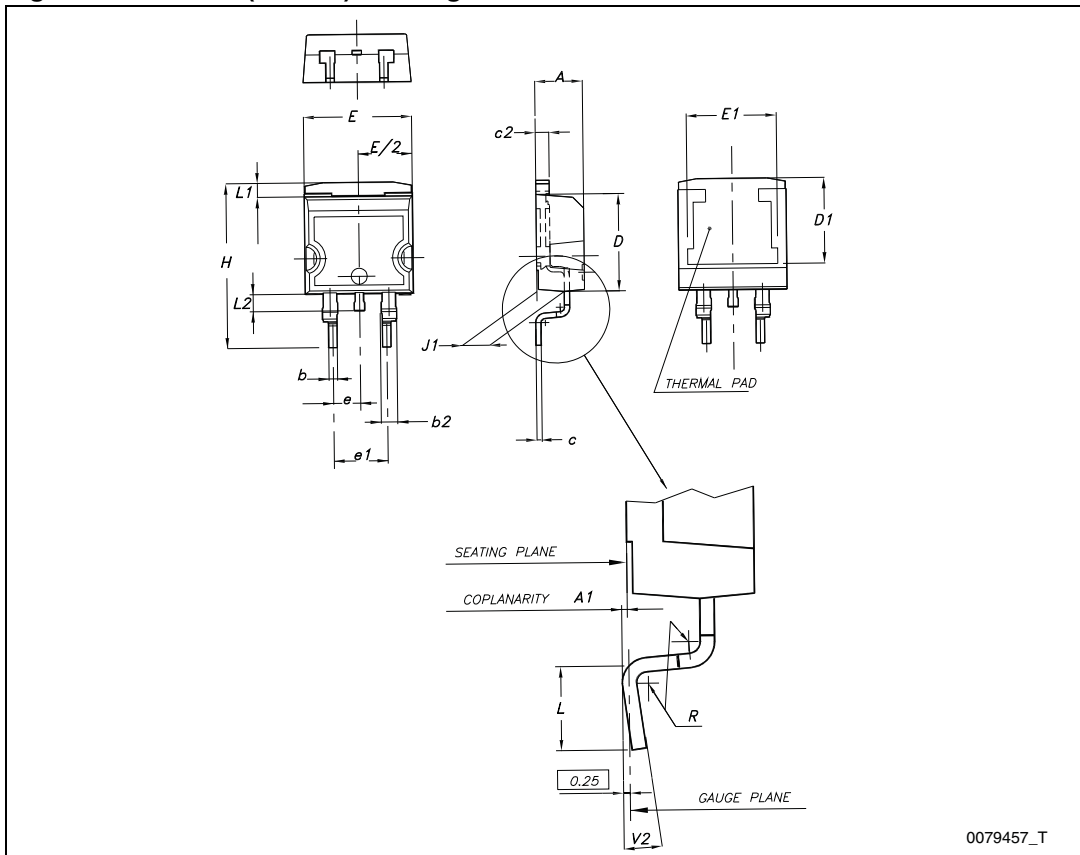
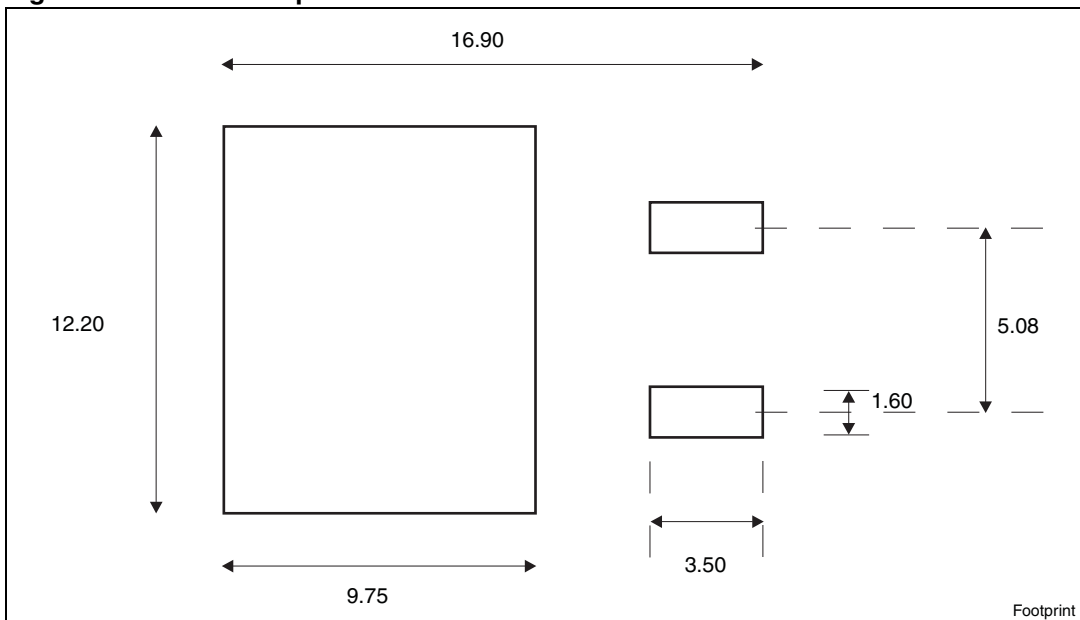


Figure 21. D²PAK footprint^(a)



a. All dimensions are in millimeters

5 Packaging mechanical data

Table 9. D²PAK (TO-263) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1		Base qty	1000
P2	1.9	2.1		Bulk qty	1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 22. Tape for D²PAK (TO-263)

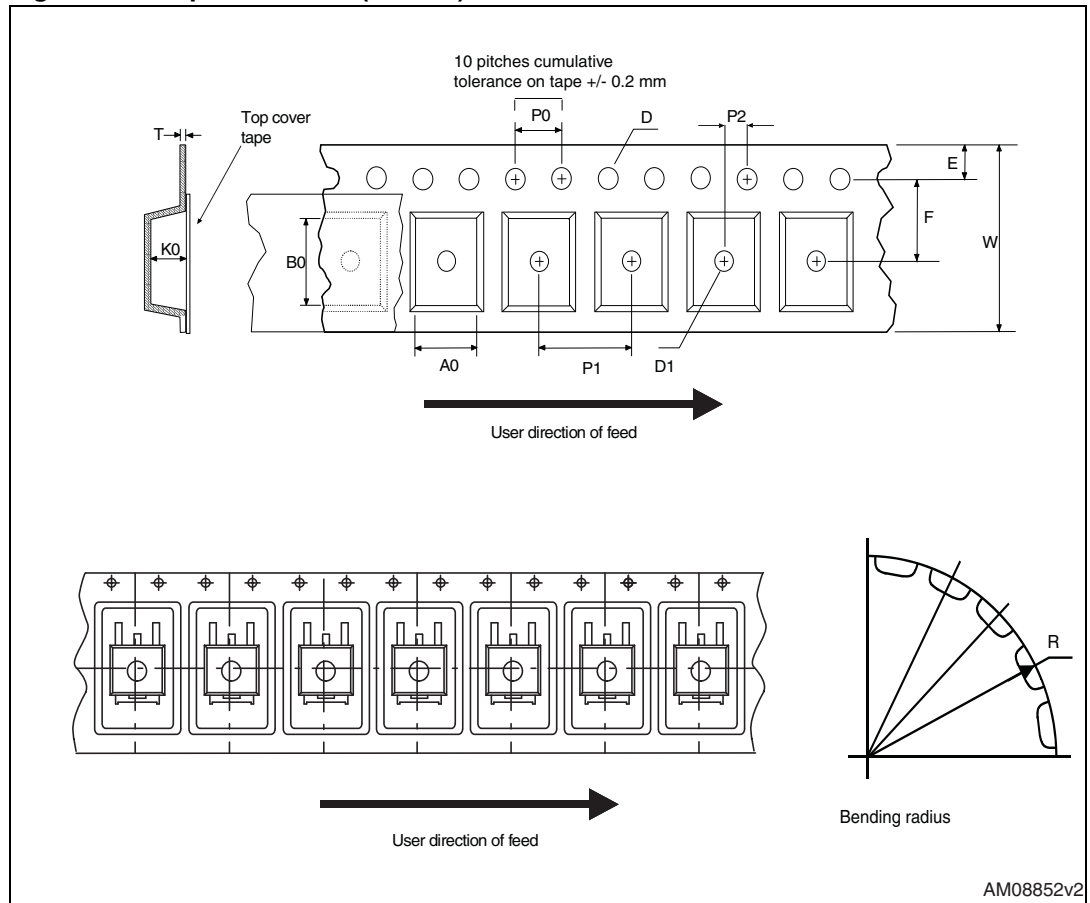
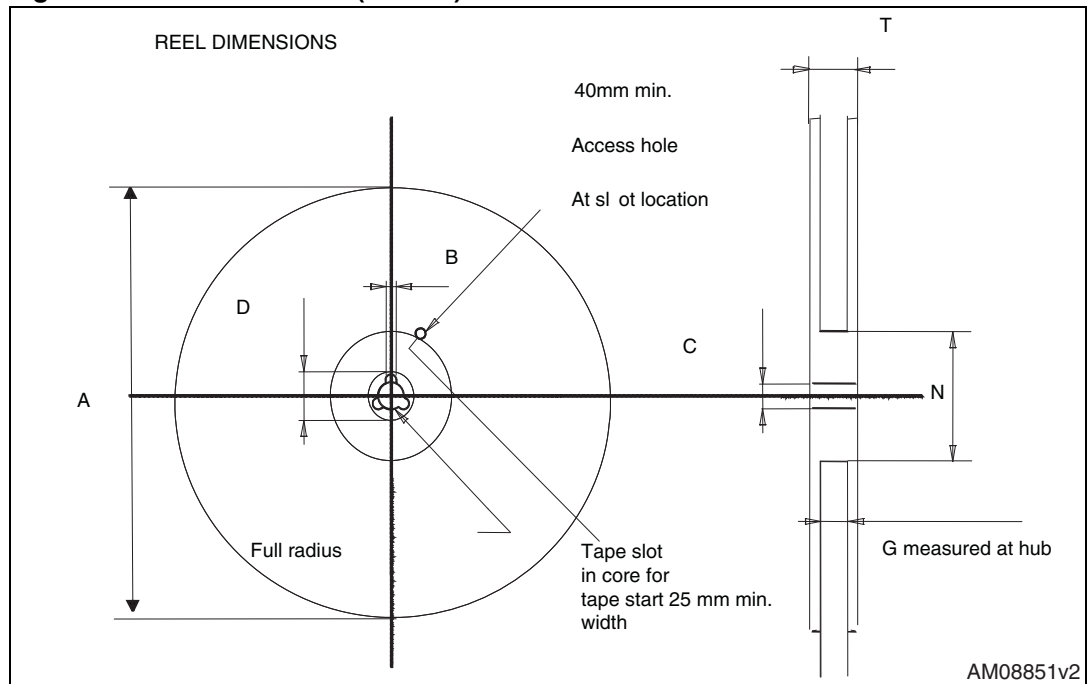


Figure 23. Reel for D²PAK (TO-263)



6 Revision history

Table 10. Document revision history

Date	Revision	Changes
23-Jun-2009	1	First release
15-Mar-2012	2	<i>Section 4: Package mechanical data</i> has been updated. Minor text changes.
28-Mar-2012	3	<i>Figure 7: Static drain-source on-resistance</i> has been updated.

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