



STB18N65M5, STD18N65M5

N-channel 650 V, 0.198 Ω typ., 15 A MDmesh™ V Power MOSFET in D²PAK and DPAK packages

Datasheet — production data

Features

Order codes	V _{DSS} @ T _{Jmax}	R _{DS(on)} max	I _D
STB18N65M5	710 V	< 0.22 Ω	15 A
STD18N65M5			

- Worldwide best R_{DS(on)} * area
- Higher V_{DSS} rating and high dv/dt capability
- Excellent switching performance
- 100% avalanche tested

Applications

- Switching applications

Description

These devices are N-channel MDmesh™ V Power MOSFETs 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.

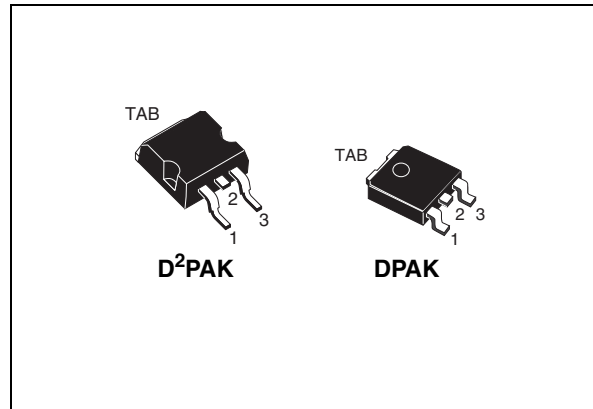


Figure 1. Internal schematic diagram

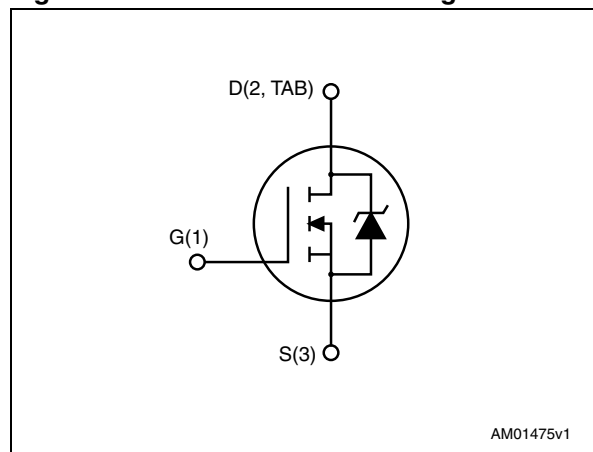


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB18N65M5	18N65M5	D ² PAK	Tape and reel
STD18N65M5		DPAK	

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK	DPAK	
V _{GS}	Gate-source voltage	± 25		V
I _D	Drain current (continuous) at T _C = 25 °C	15		A
I _D	Drain current (continuous) at T _C = 100 °C	9.4		A
I _{DM} ⁽¹⁾	Drain current (pulsed)	60		A
P _{TOT}	Total dissipation at T _C = 25 °C	110		W
dv/dt ⁽¹⁾	Peak diode recovery voltage slope	15		V/ns
T _{stg}	Storage temperature	- 55 to 150		°C
T _j	Max. operating junction temperature	150		°C

1. I_{SD} ≤ 15 A, di/dt ≤ 400 A/μs; V_{DSPeak} < V_{(BR)DSS}, V_{DD} = 400 V

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		D ² PAK	DPAK	
R _{thj-case}	Thermal resistance junction-case max	1.14		°C/W
R _{thj-pcb} ⁽¹⁾	Thermal resistance junction-pcb max	30	50	°C/W

1. When mounted on 1 inch² FR-4, 2 Oz copper board.

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T _{jmax})	4	A
E _{AS}	Single pulse avalanche energy (starting T _J = 25 °C, I _D = I _{AR} ; V _{DD} = 50 V)	210	mJ

2 Electrical characteristics

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

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	650			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 650\text{ V}$ $V_{DS} = 650\text{ V}$, $T_C = 125\text{ °C}$			1 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 25\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 7.5\text{ A}$		0.198	0.22	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	1240	-	pF
C_{oss}	Output capacitance			32		
C_{rss}	Reverse transfer capacitance			3.2		
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{DS} = 0\text{ to }520\text{ V}$, $V_{GS} = 0$	-	99	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related			30		
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	3	-	Ω
Q_g	Total gate charge	$V_{DD} = 520\text{ V}$, $I_D = 7.5\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 18)	-	31	-	nC
Q_{gs}	Gate-source charge			8		
Q_{gd}	Gate-drain charge			14		

1. Time related is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}
2. Energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
t_d (V)	Voltage delay time	$V_{DD} = 400$ V, $I_D = 9.5$ A,		36		ns
t_r (V)	Voltage rise time	$R_G = 4.7$ Ω , $V_{GS} = 10$ V	-	7	-	ns
$t_{f(i)}$	Current fall time	(see Figure 19 and		9		ns
$t_{c(off)}$	Crossing time	Figure 22)		11		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		15	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		60	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 15$ A, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 15$ A, $di/dt = 100$ A/ μ s	-	290		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 100$ V (see Figure 22)		3.4		μ C
I_{RRM}	Reverse recovery current			23.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 15$ A, $di/dt = 100$ A/ μ s	-	352		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 100$ V, $T_j = 150$ °C		4		μ C
I_{RRM}	Reverse recovery current	(see Figure 22)		24		A

1. Pulse width limited by safe operating area.

2. Pulsed: pulse duration = 300 μ s, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for D²PAK

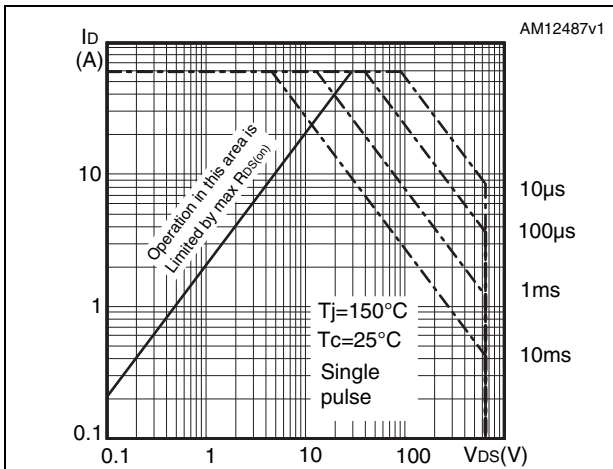


Figure 3. Thermal impedance for D²PAK

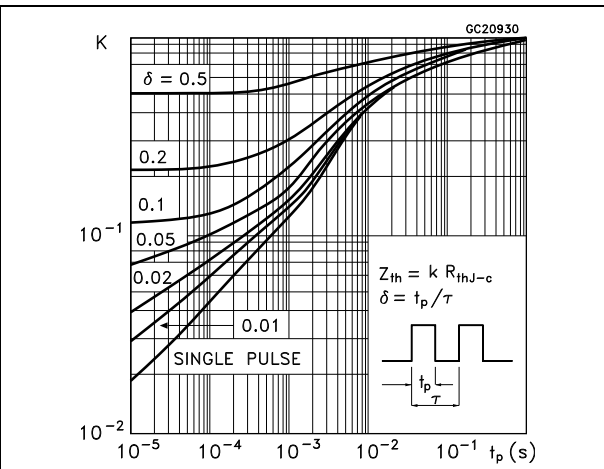


Figure 4. Safe operating area for DPAK

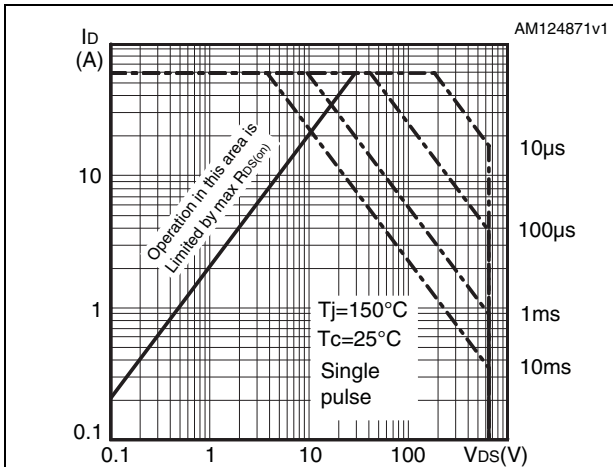


Figure 5. Thermal impedance for DPAK

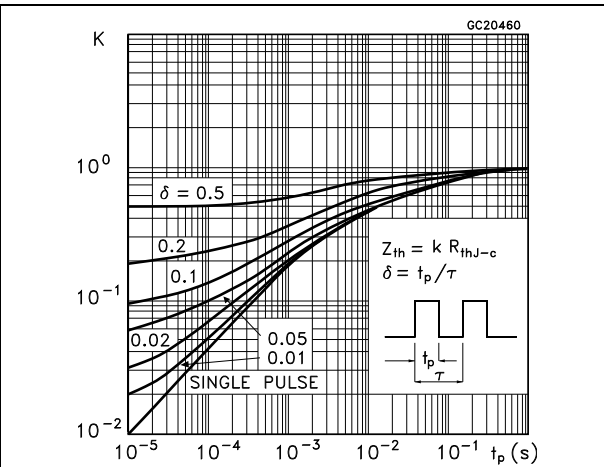


Figure 6. Output characteristics

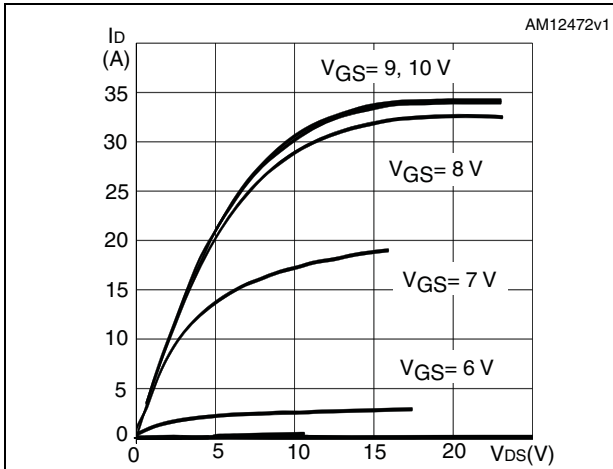


Figure 7. Transfer characteristics

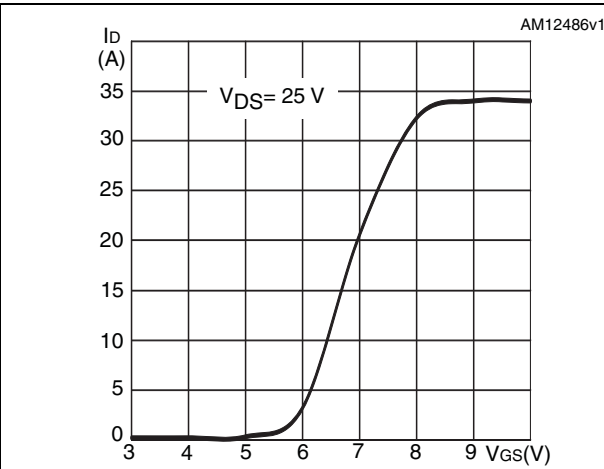


Figure 8. Gate charge vs gate-source voltage Figure 9. Static drain-source on-resistance

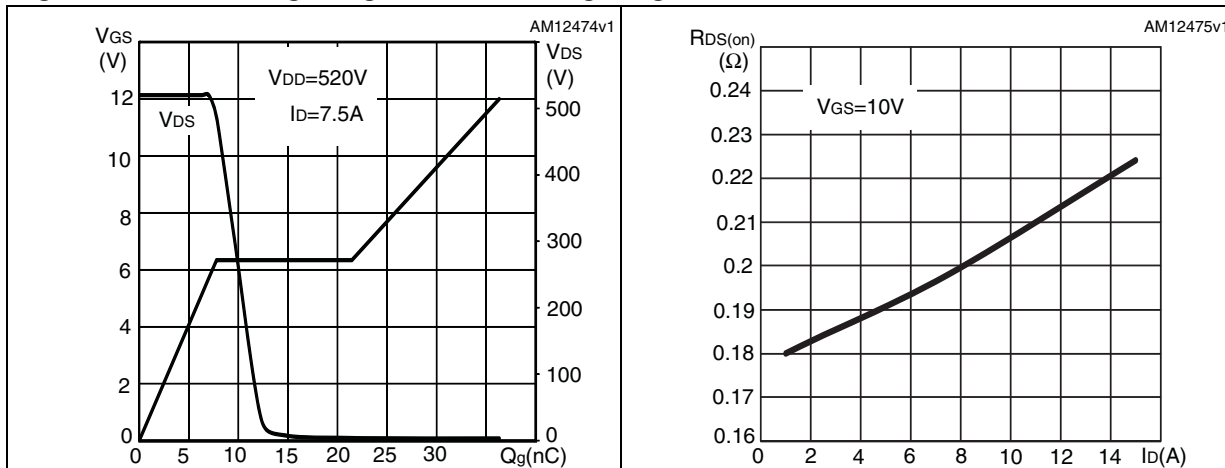


Figure 10. Capacitance variations Figure 11. Output capacitance stored energy

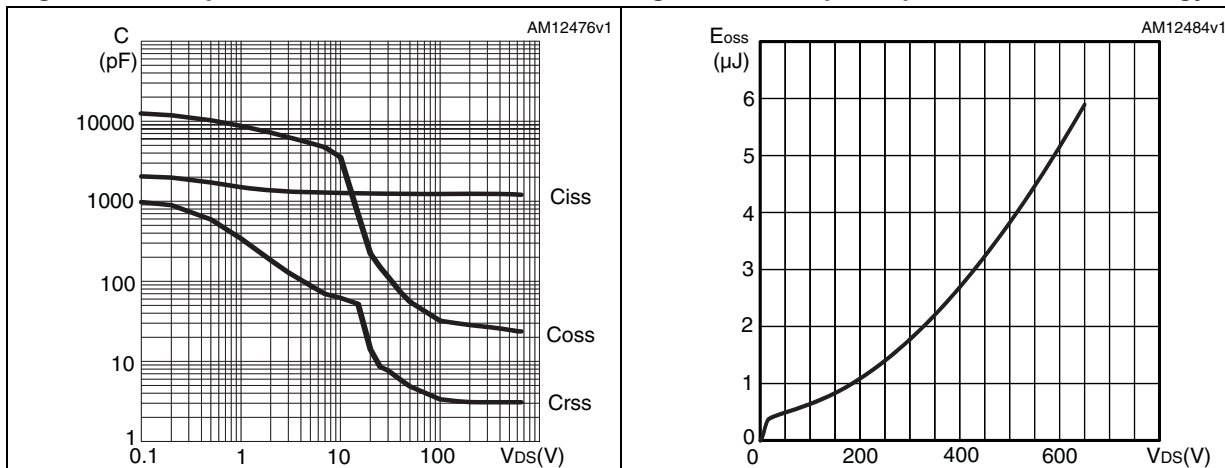


Figure 12. Normalized gate threshold voltage vs temperature Figure 13. Normalized on-resistance vs temperature

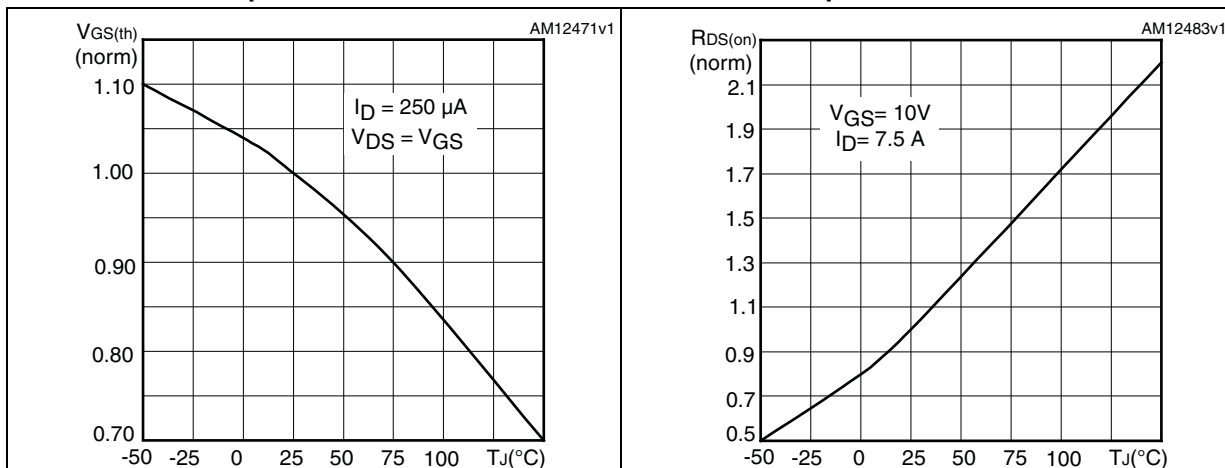


Figure 14. Drain-source diode forward characteristics

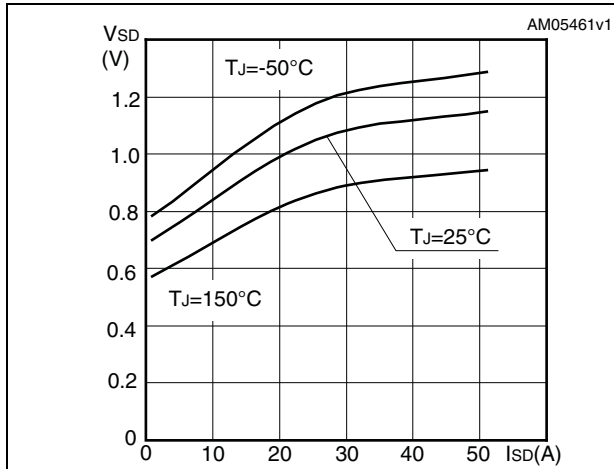


Figure 15. Normalized B_{VDSS} vs temperature

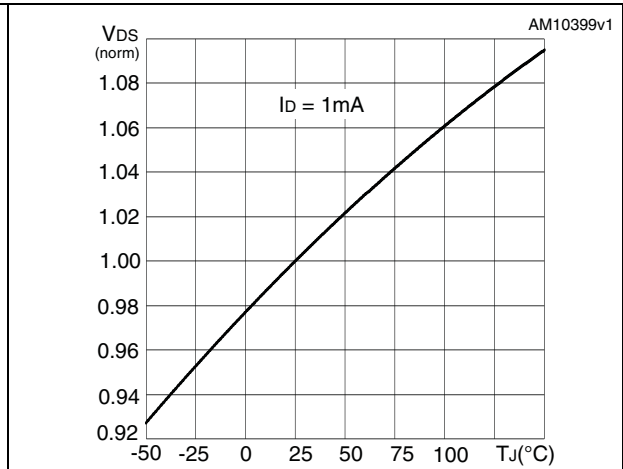
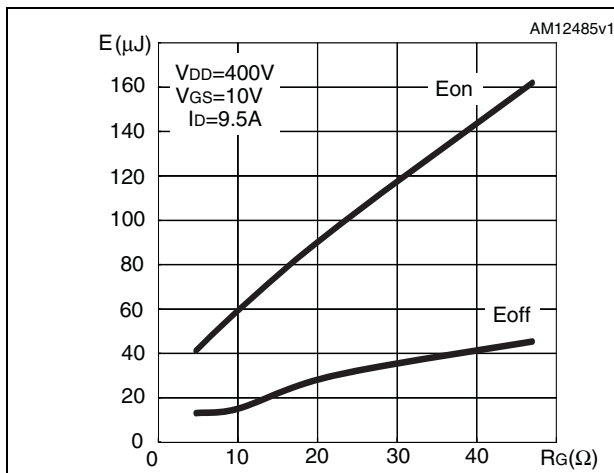


Figure 16. Switching losses vs gate resistance (1)



1. Eon including reverse recovery of a SiC diode

3 Test circuits

Figure 17. Switching times test circuit for resistive load

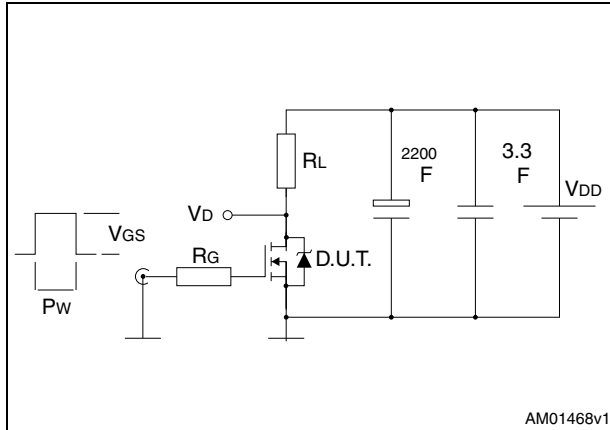


Figure 18. Gate charge test circuit

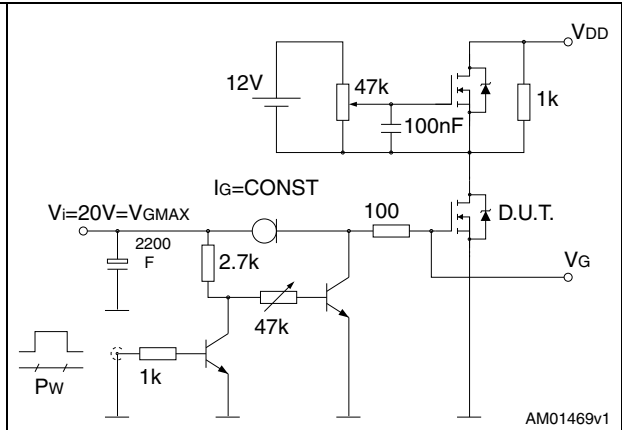


Figure 19. Test circuit for inductive load switching and diode recovery times

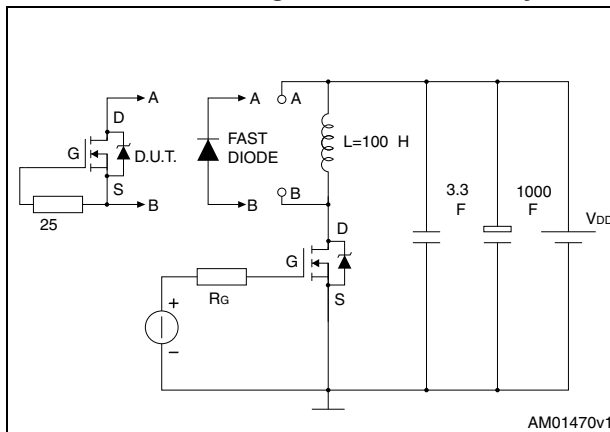


Figure 20. Unclamped inductive load test circuit

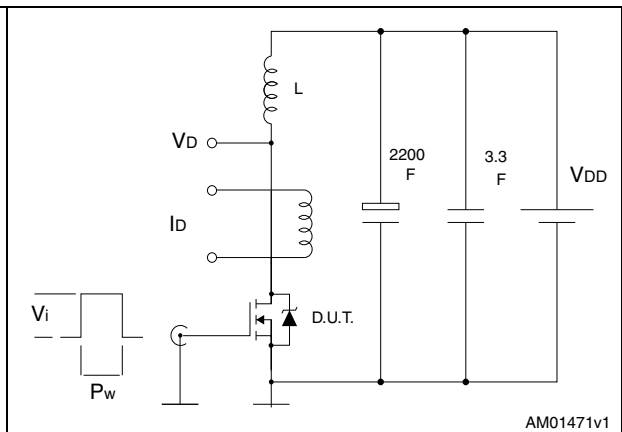


Figure 21. Unclamped inductive waveform

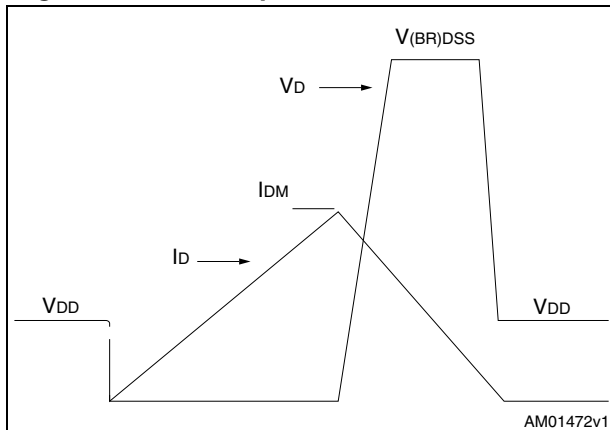
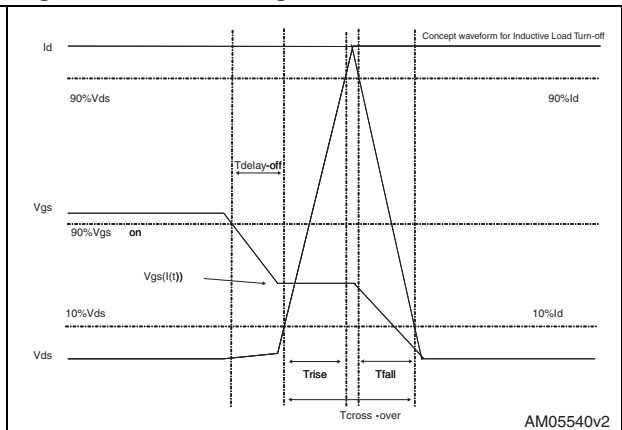


Figure 22. Switching time waveform



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 9. 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 23. D²PAK (TO-263) drawing



Figure 24. D²PAK footprint^(a)



a. All dimensions are in millimeters

Table 10. 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 25. DPAK (TO-252) drawing

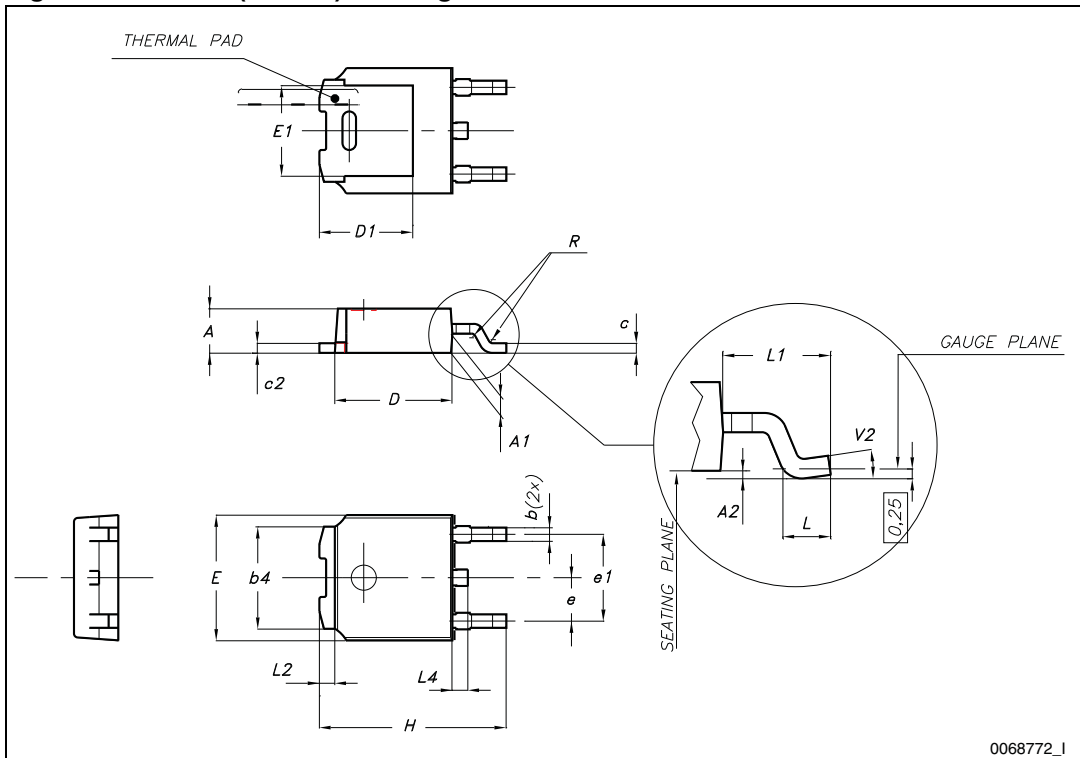
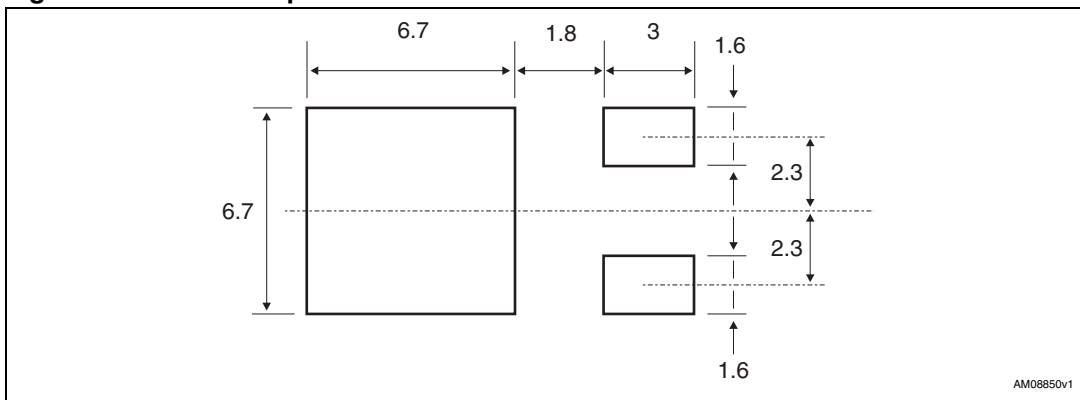


Figure 26. DPAK footprint^(b)



b. All dimensions are in millimeters

5 Packaging mechanical data

Table 11. 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			

Table 12. 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

Table 12. D²PAK (TO-263) tape and reel mechanical data (continued)

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 27. Tape for D²PAK (TO-263) and DPAK (TO-252)

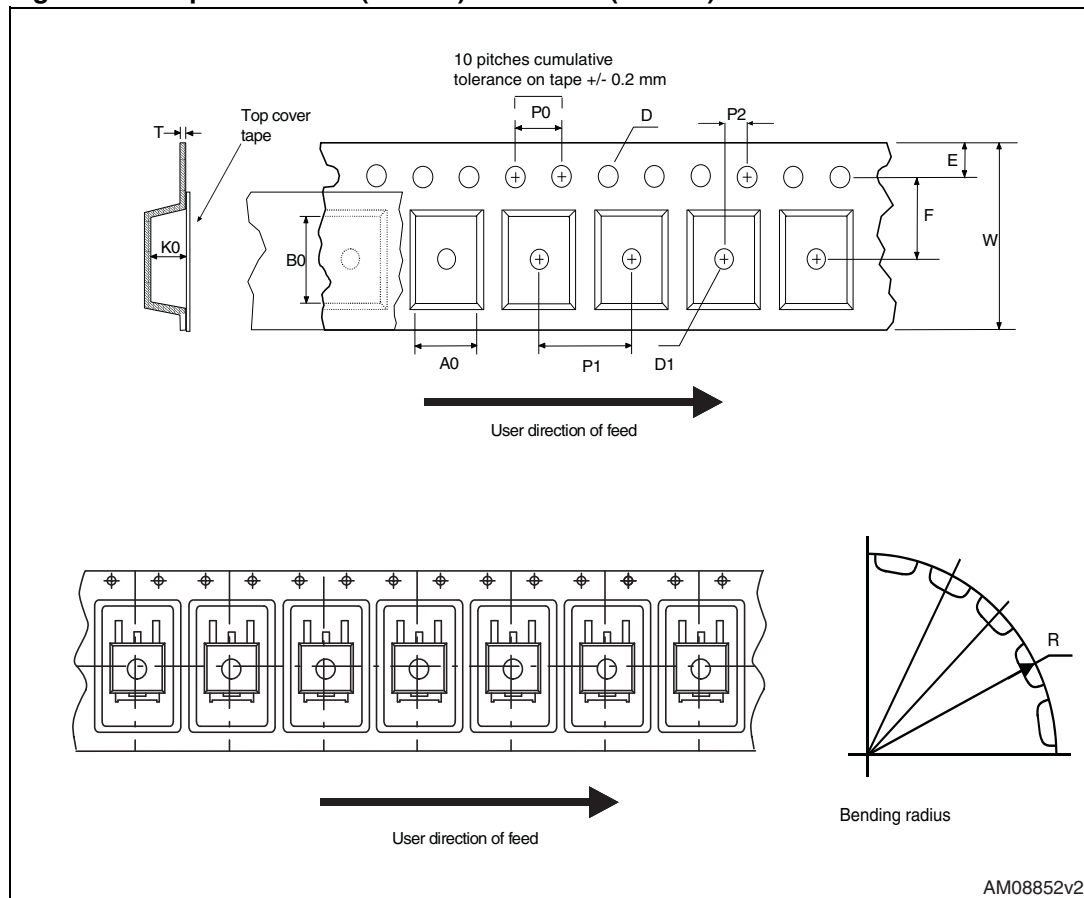
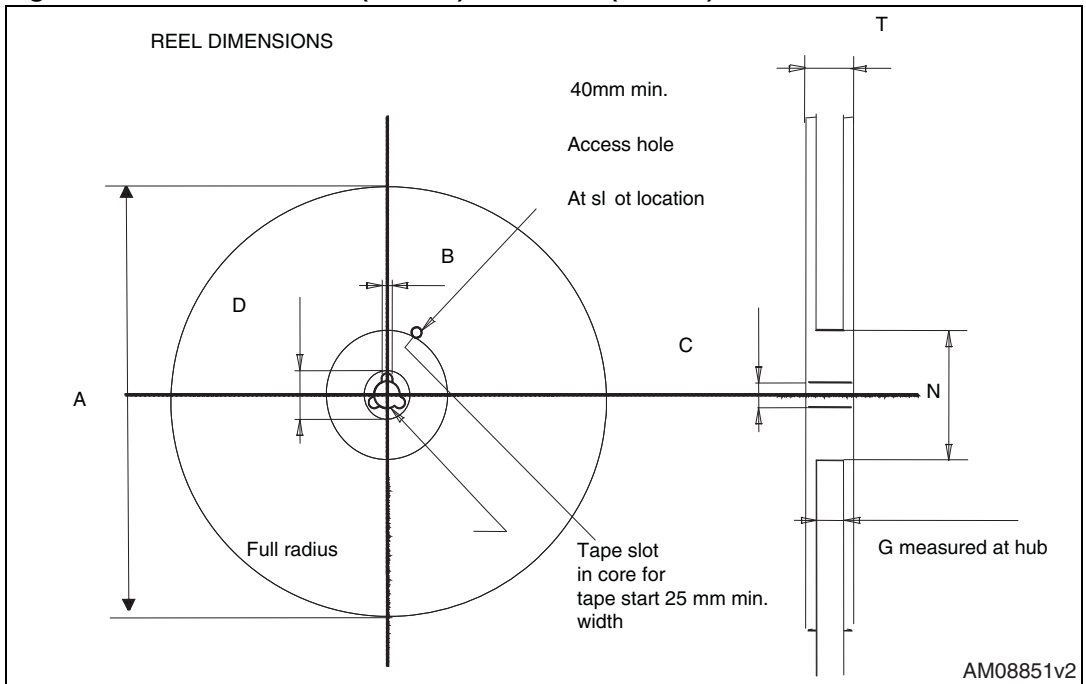


Figure 28. Reel for D²PAK (TO-263) and DPAK (TO-252)



6 Revision history

Table 13. Document revision history

Date	Revision	Changes
18-Jul-2012	1	First release.

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