STB4N62K3, STD4N62K3

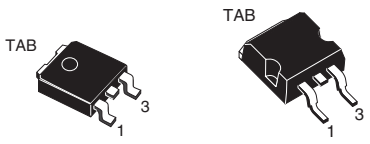
N-channel 620 V, 1.7 Ω, 3.8 A SuperMESH3™ Power MOSFET in D²PAK and DPAK packages

Datasheet — production data

Features

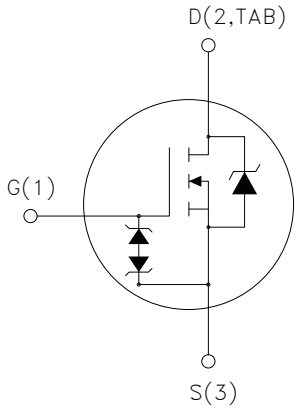
Order codes	V_{DSS}	$R_{DS(on)}$ max	I_D	Pw
STB4N62K3 STD4N62K3	620 V	< 2 Ω	3.8 A	70 W

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected



DPAK D²PAK

Figure 1. Internal schematic diagram



Application

- Switching applications

Description

These devices are made using the SuperMESH3™ Power MOSFET technology that is obtained via improvements applied to STMicroelectronics' SuperMESH™ technology combined with a new optimized vertical structure. The resulting product has an extremely low on resistance, superior dynamic performance and high avalanche capability, making it especially suitable for the most demanding applications.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB4N62K3 STD4N62K3	4N62K3	D²PAK DPAK	Tape and reel

This is information on a product in full production. www.st.com

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D²PAK	DPAK	
V_{DS}	Drain-source voltage	620		V
V_{GS}	Gate- source voltage	± 30		V
I_D	Drain current (continuous) at T_C = 25 °C	3.8		A
I_D	Drain current (continuous) at T_C = 100 °C	2		A
I_{DM} (1)	Drain current (pulsed)	15.2		A
P_{TOT}	Total dissipation at T_C = 25 °C	70		W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	3.8		A
E_{AS}	Single pulse avalanche energy (starting T_j = 25°C, I_D = I_{AR}, V_{DD} = 50V)	115		mJ
$V_{ESD(G-S)}$	Gate source ESD(HBM-C = 100 pF, R = 1.5 kΩ)	2500		V
dv/dt (2)	Peak diode recovery voltage slope	12		V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; Tc = 25 °C)			V
T_{stg}	Storage temperature	- 55 to 150		°C
T_j	Max. operating junction temperature	150		°C

1. Pulse width limited by safe operating area.
2. I_{SD} ≤ 3.8 A, di/dt = 400 A/µs, V_{DD} = 80% $V_{(BR)DSS}$, VDS peak ≤V(BR)DSS.

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		DPAK	D²PAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.79		°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb max	50	30	°C/W

1. When mounted on 1inch² FR-4 board, 2 oz Cu.

2 Electrical characteristics

(T_C = 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	V_{GS} = 0, I_D = 1 mA	620			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0, V_{DS} = 620V			1	µA
		V_{GS} = 0 V_{DS} = 620V, T_C=125 °C			50	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0, V_{GS} = ± 20 V			± 10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 50 µA	3	3.75	4.5	V
$R_{DS(on}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 1.9 A		1.7	2	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	-	550 42 7	-	pF pF pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 496 V, V_{GS} = 0	-	27	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	2	5	10	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 496 V, I_D = 3.8 A, V_{GS} = 10 V (see *Figure 18*)	-	22 4 13	-	nC nC nC

1. $C_{oss\ eq.}$ 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}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off-delay time Fall time	V_{DD} = 300 V, I_D = 1.9 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 17*)	-	10 9 29 19	-	ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		3.8 15.2	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 3.8 A, V_{GS} = 0	-		1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 3.8 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 22*)	-	220 1.4 13		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 3.8 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 22*)	-	270 1.9 14		ns µC A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

Table 8. Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
BV_{GSO}	Gate-source breakdown voltage	Igs=± 1 mA (open drain)	30	-		V

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for D²PAK

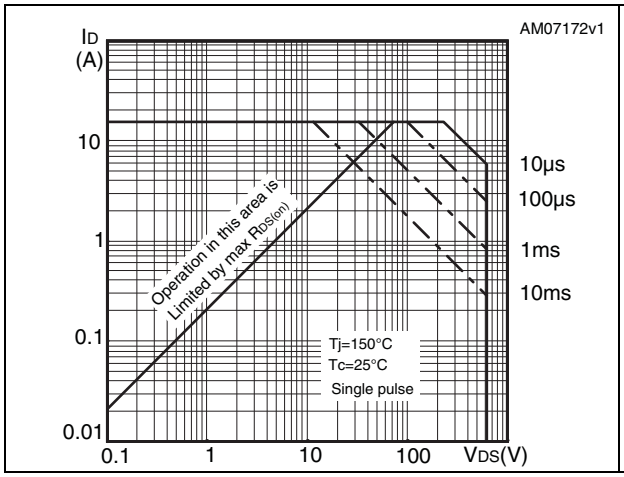


Figure 3. Thermal impedance for D²PAK

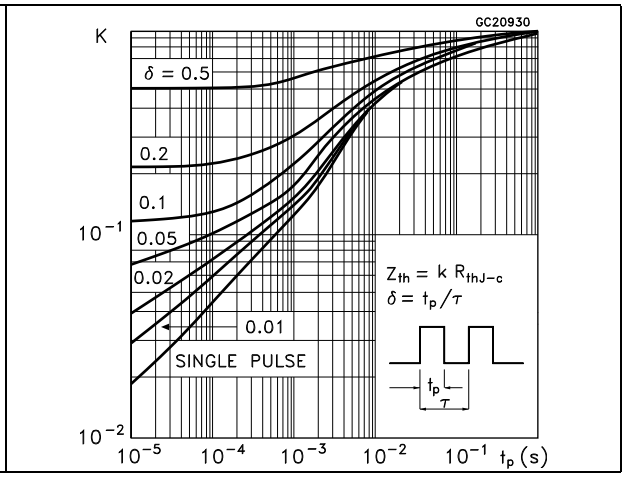


Figure 4. Safe operating area for DPAK

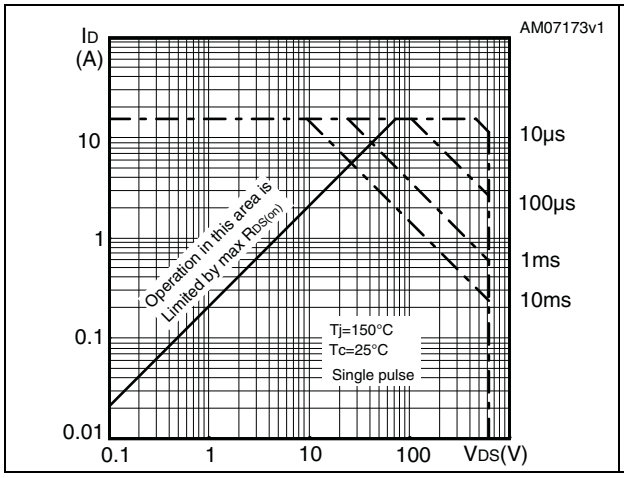


Figure 5. Thermal impedance for DPAK

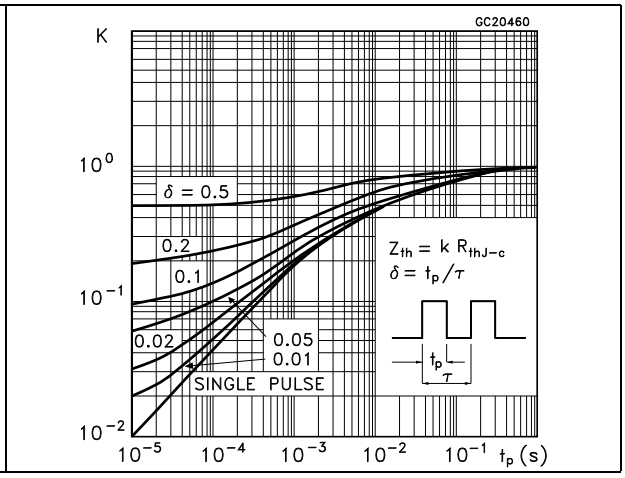


Figure 6. Output characteristics

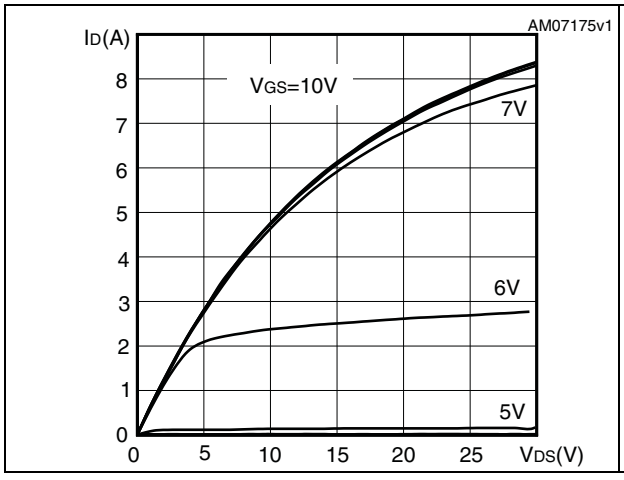


Figure 7. Transfer characteristics

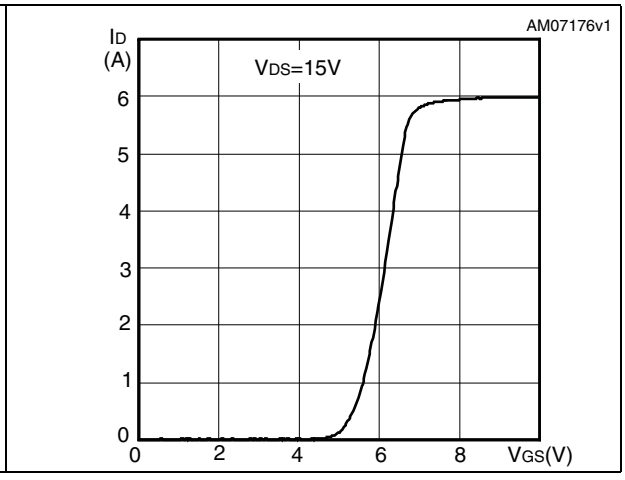


Figure 8. Gate charge vs gate-source voltage

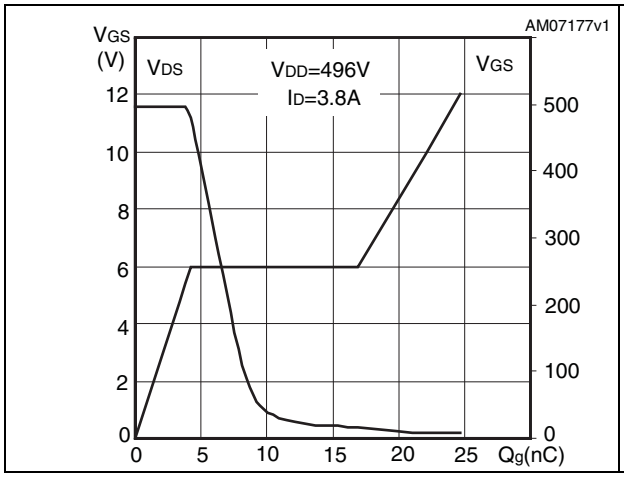


Figure 9. Static drain-source on resistance

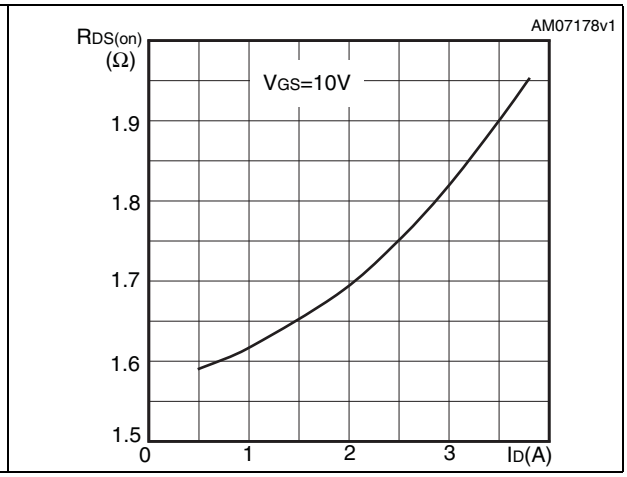


Figure 10. Capacitance variations

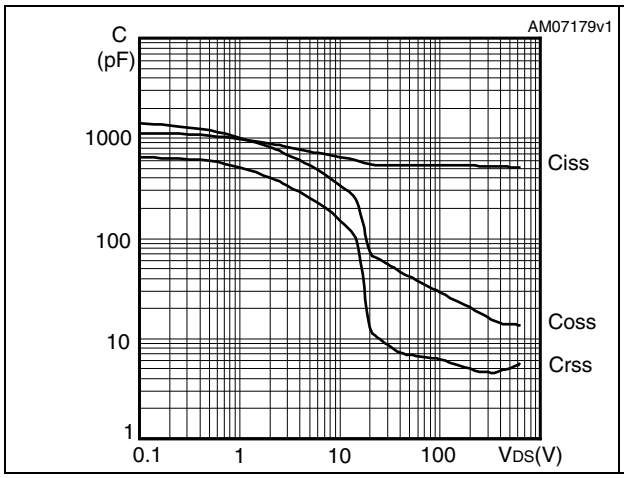


Figure 11. Output capacitance stored energy

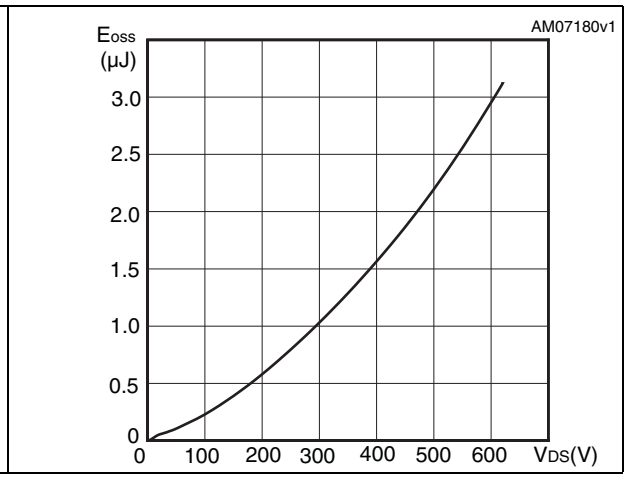


Figure 12. Normalized gate threshold voltage vs temperature

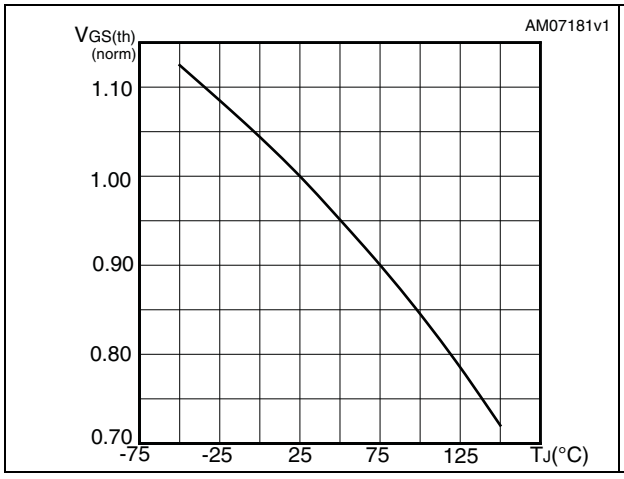


Figure 13. Normalized on-resistance vs temperature

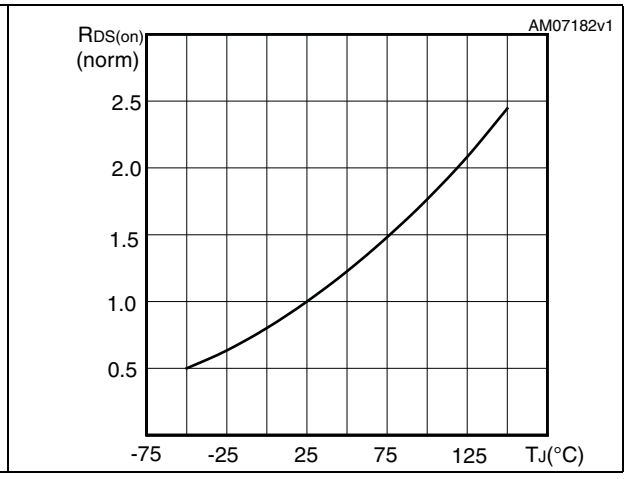


Figure 14. Maximum avalanche energy vs starting Tj

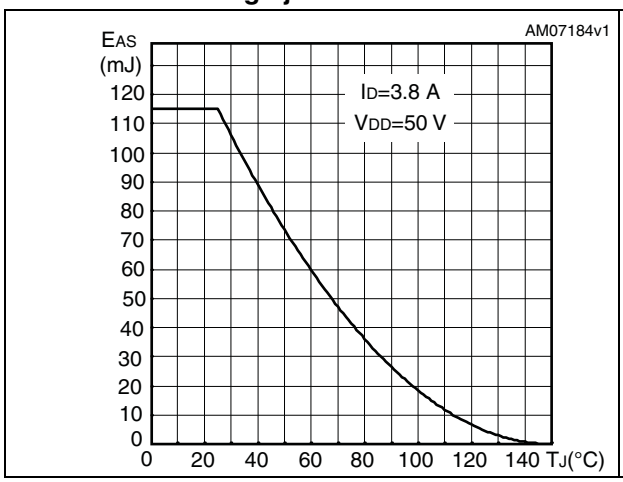


Figure 15. Normalized B_{VDSS} vs temperature

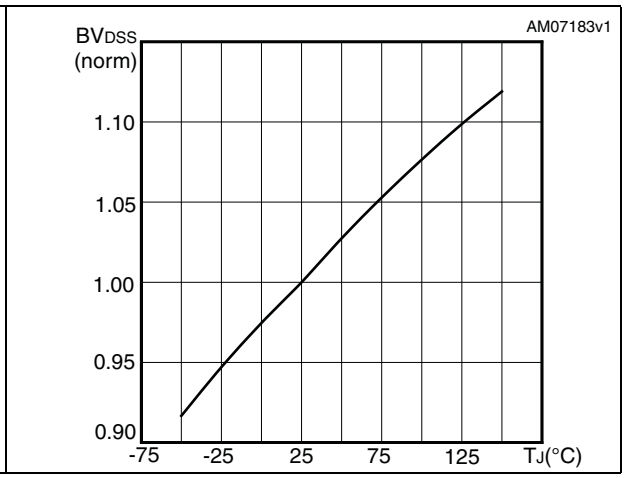
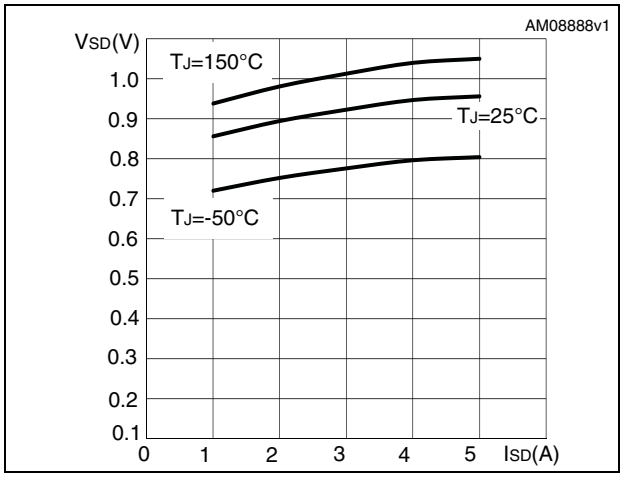


Figure 16. Source-drain diode forward characteristics



3 Test circuits

Figure 17. Switching times test circuit for resistive load

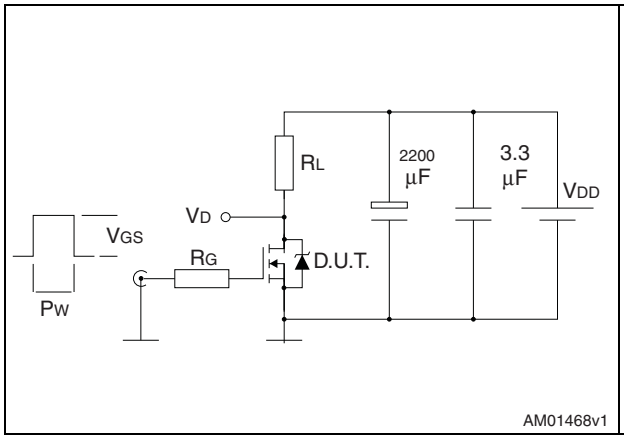


Figure 18. Gate charge test circuit

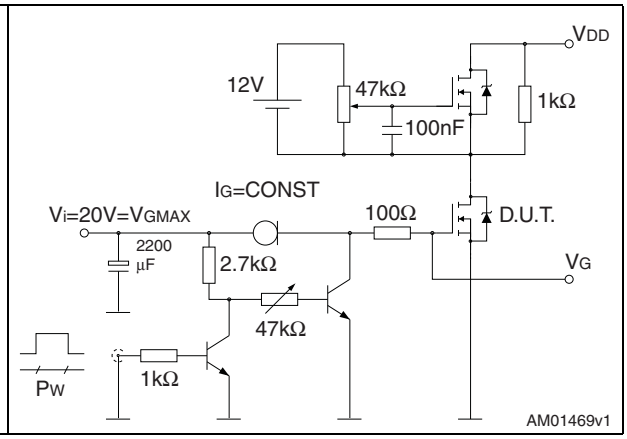


Figure 19. Test circuit for inductive load switching and diode recovery times

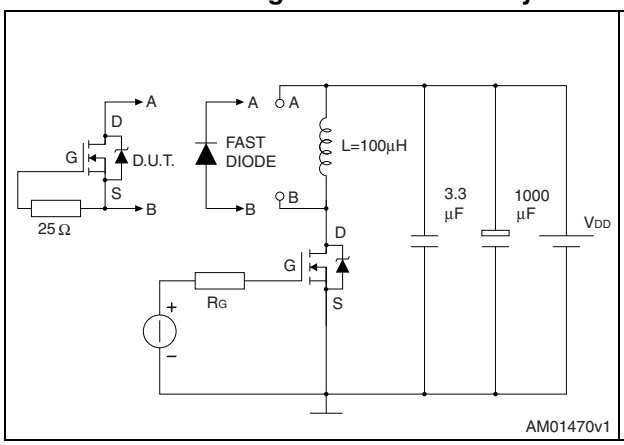


Figure 20. Unclamped Inductive load test circuit

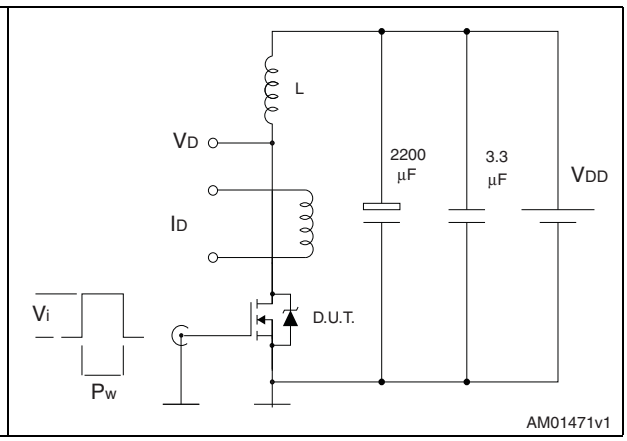


Figure 21. Unclamped inductive waveform

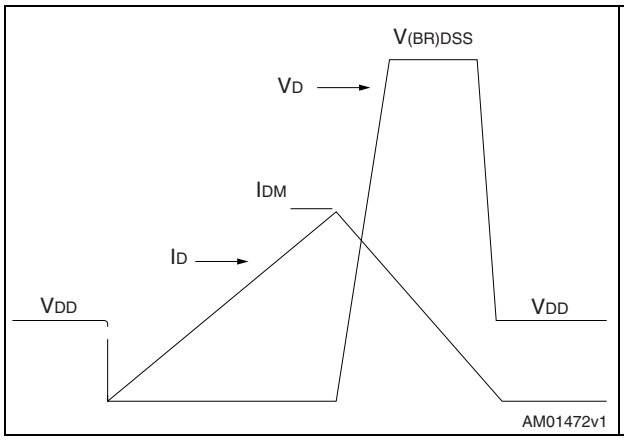
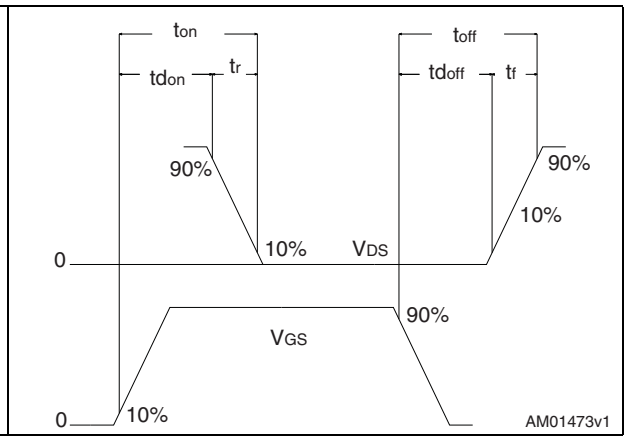


Figure 22. Switching time waveform



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. 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 23. DPAK (TO-252) drawing

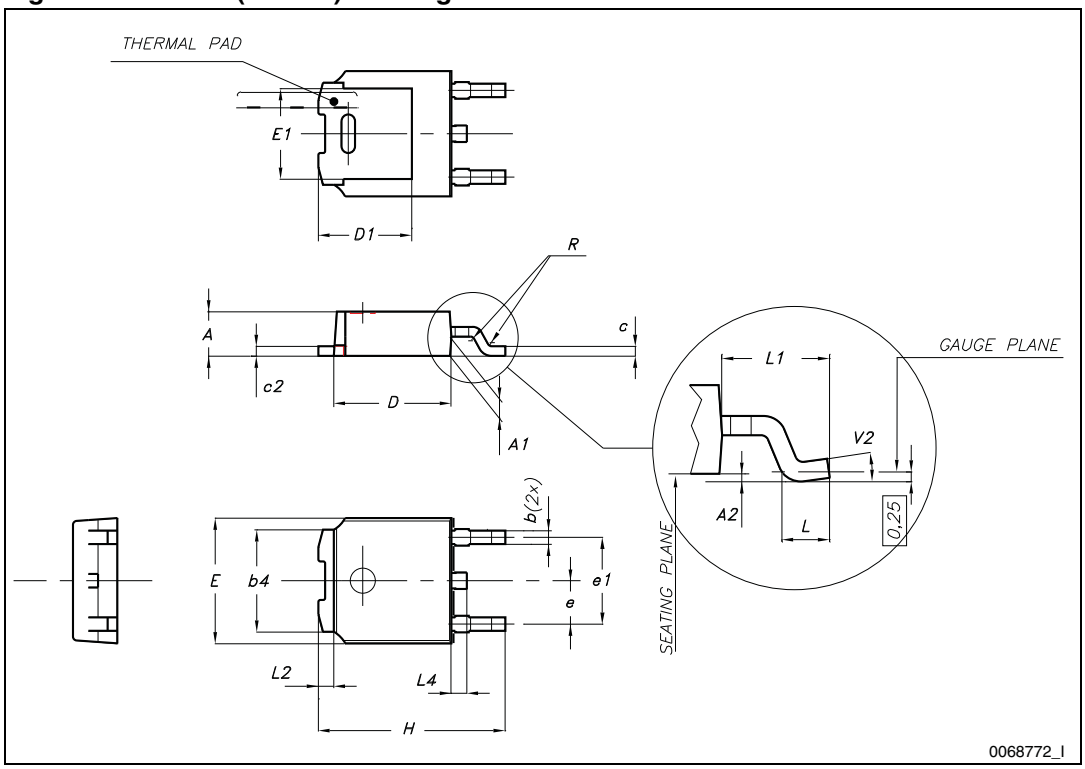
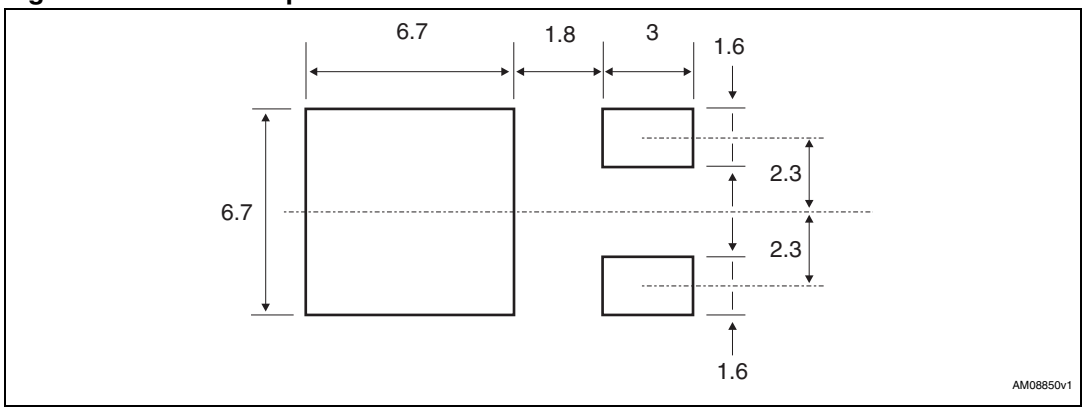


Figure 24. DPAK footprint[a]



a. All dimension are in millimeters

Table 10. 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 25. D²PAK (TO-263) drawing

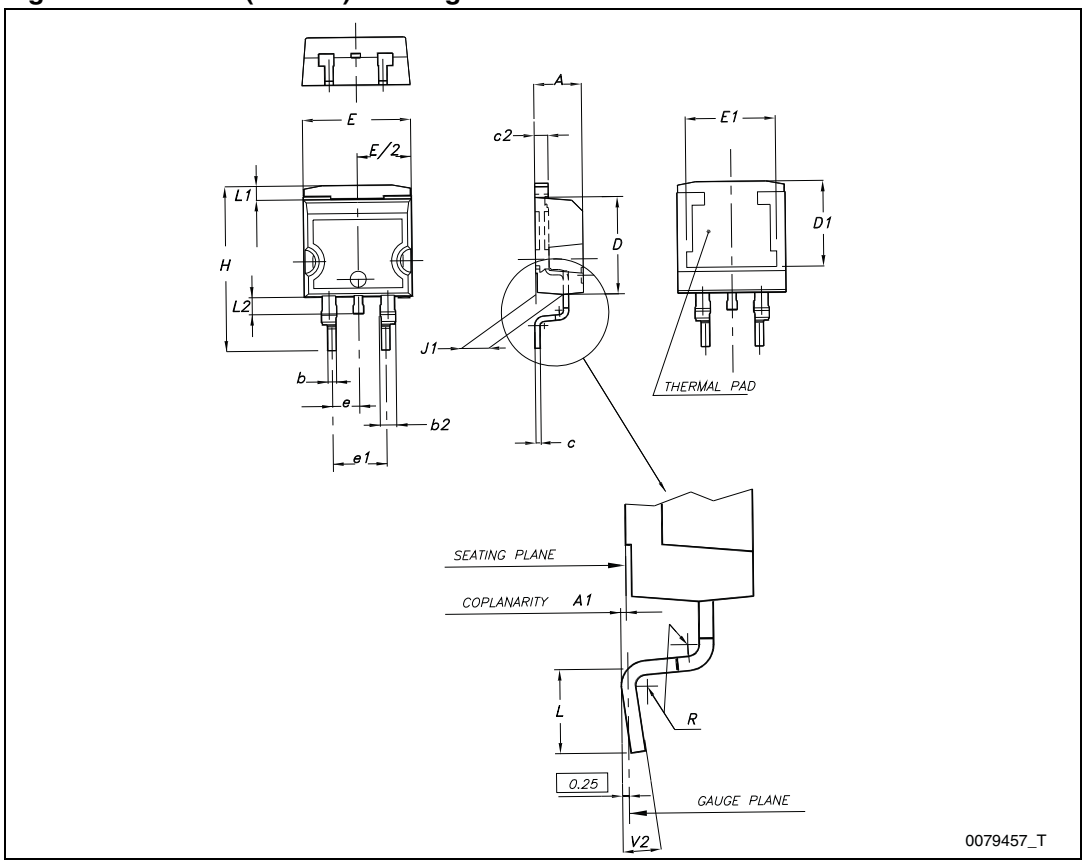
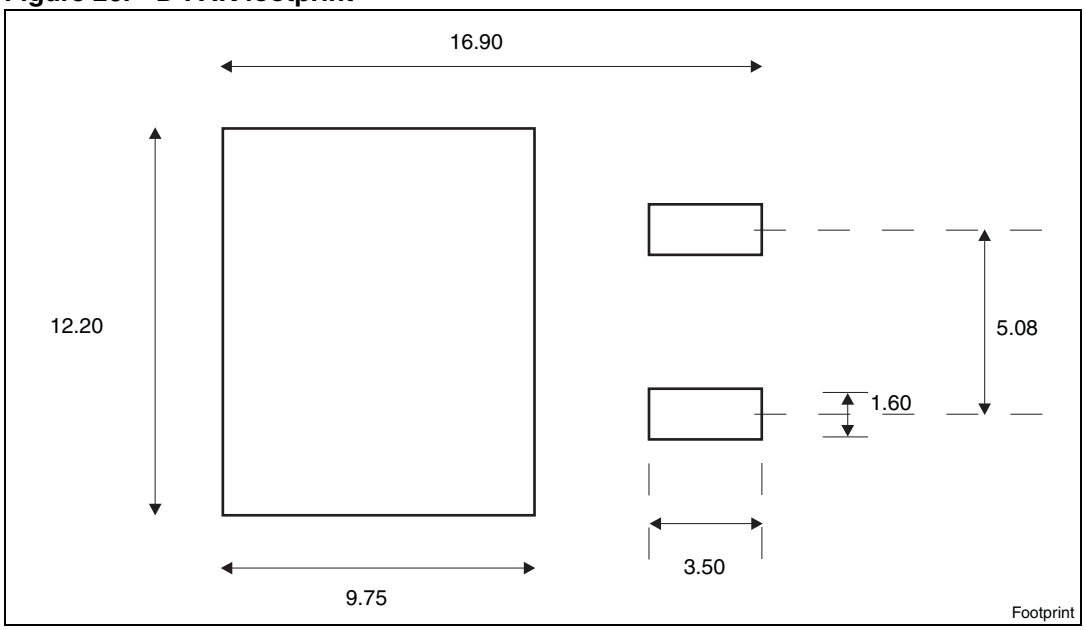


Figure 26. D²PAK footprint[b]



b. All dimension 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 DPAK (TO-252) and D²PAK (TO-263)

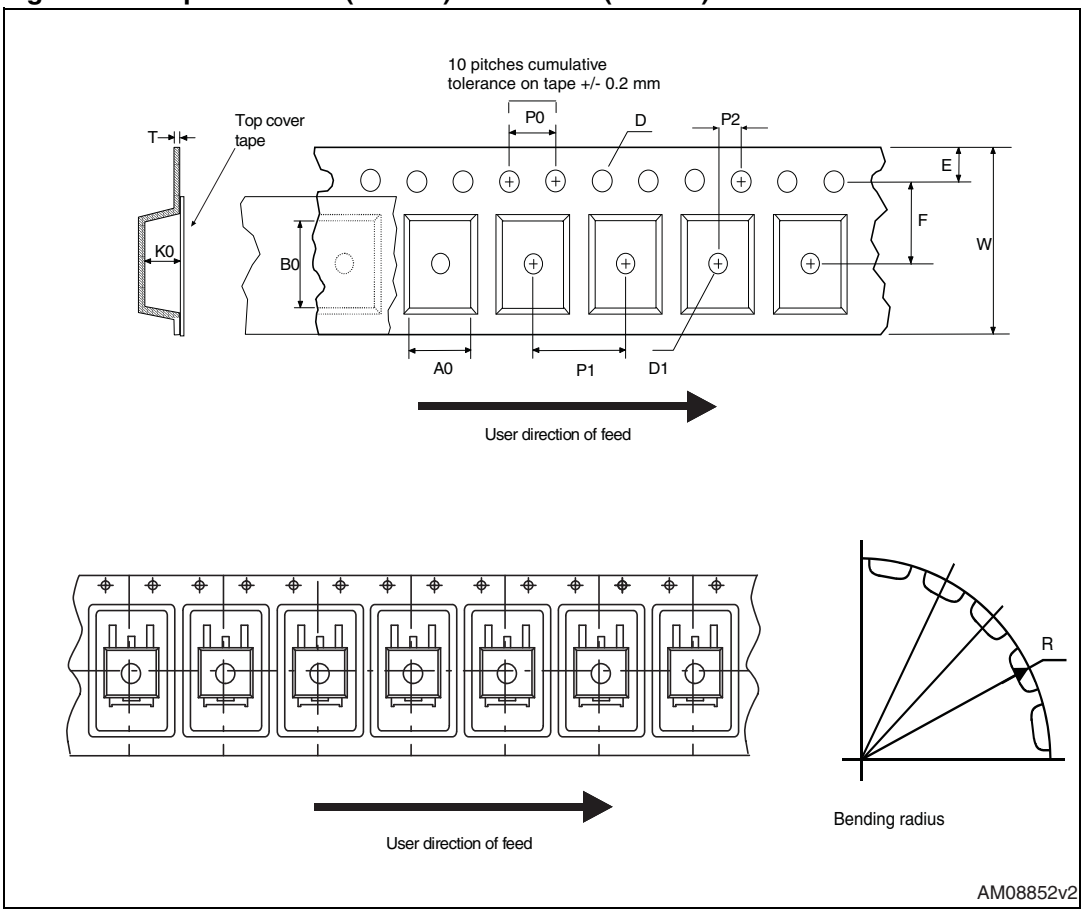
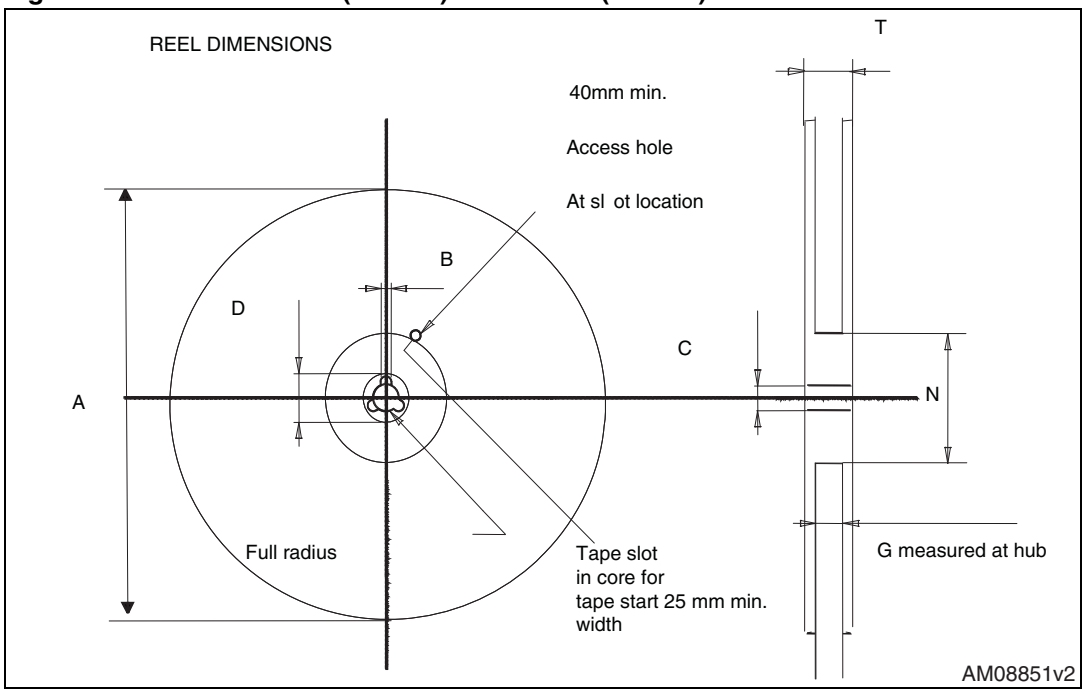


Figure 28. Reel for DPAK (TO-252) and D²PAK (TO-263)



6 Revision history

Table 13. Document revision history

Date	Revision	Changes
16-Dec-2010	1	First release.
26-Apr-2012	2	Added min and max values for R_G in *Table 5: Dynamic* and *Section 5: Packaging mechanical data*. Updated *Section 4: Package mechanical data*. Minor text changes.

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