



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	P _w
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

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.

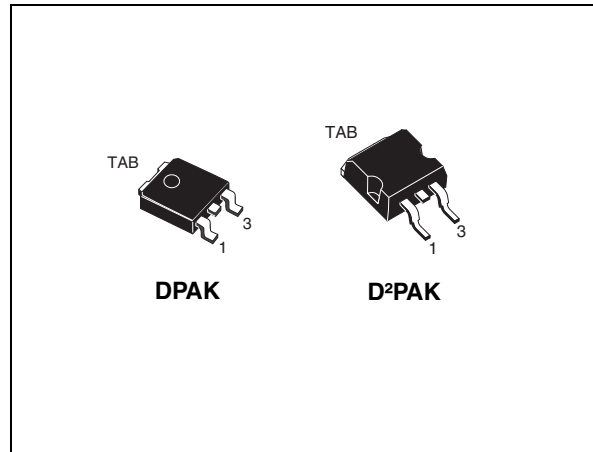
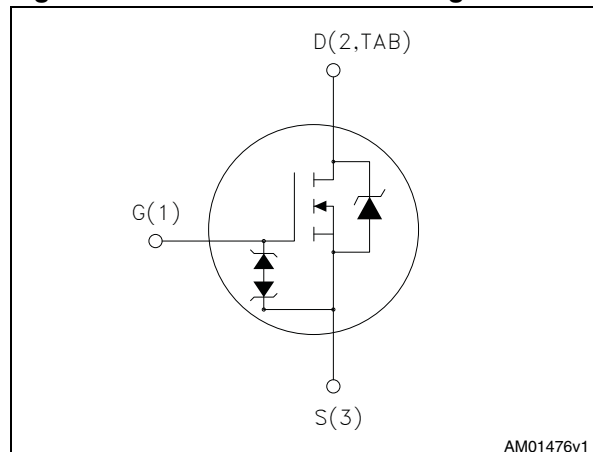


Figure 1. Internal schematic diagram



AM01476v1

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB4N62K3 STD4N62K3	4N62K3	D ² PAK DPAK	Tape and reel

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves)	6
3	Test circuits	9
4	Package mechanical data	10
5	Packaging mechanical data	14
6	Revision history	17

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK	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; T _C = 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}, V_{DS} peak ≤ V_{(BR)DSS}.

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		DPAK	D ² PAK	
R _{thj-case}	Thermal resistance junction-case max	1.79		°C/W
R _{thj-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

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

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 1\text{ mA}$	620			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 620\text{ V}$			1	μA
		$V_{GS} = 0, V_{DS} = 620\text{ V}, T_C = 125\text{ °C}$			50	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 50\text{ }\mu\text{A}$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 1.9\text{ A}$		1.7	2	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$	-	550	-	μF
C_{oss}	Output capacitance			42		μF
C_{rss}	Reverse transfer capacitance			7		μF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }496\text{ V}, V_{GS} = 0$	-	27	-	μF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz open drain}$	2	5	10	Ω
Q_g	Total gate charge	$V_{DD} = 496\text{ V}, I_D = 3.8\text{ A}, V_{GS} = 10\text{ V}$ (see Figure 18)	-	22	-	nC
Q_{gs}	Gate-source charge			4		nC
Q_{gd}	Gate-drain charge			13		nC

1. $C_{oss\text{ eq.}}$ 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
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}, I_D = 1.9\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ (see Figure 17)	-	10	-	ns
t_r	Rise time			9		ns
$t_{d(off)}$	Turn-off-delay time			29		ns
t_f	Fall time			19		ns

Table 7. Source drain diode

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

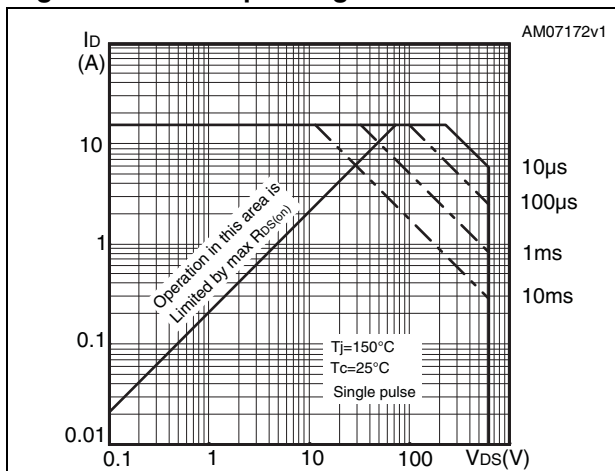


Figure 3. Thermal impedance for D²PAK

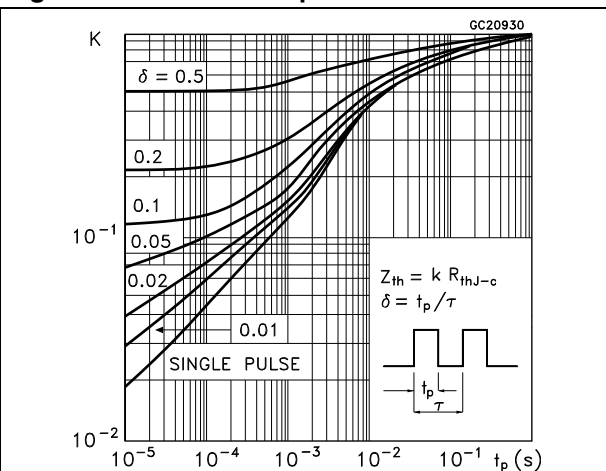


Figure 4. Safe operating area for DPAK

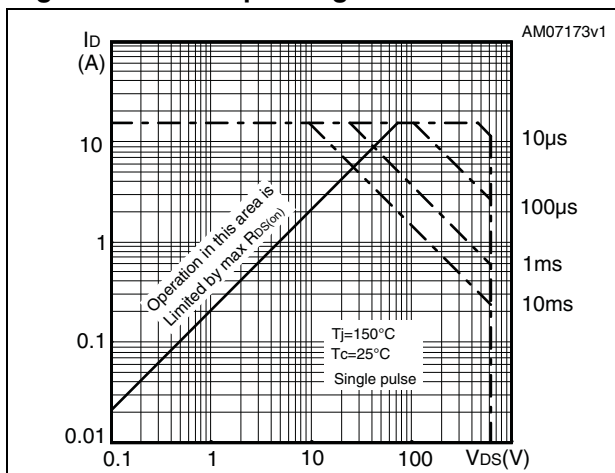


Figure 5. Thermal impedance for DPAK

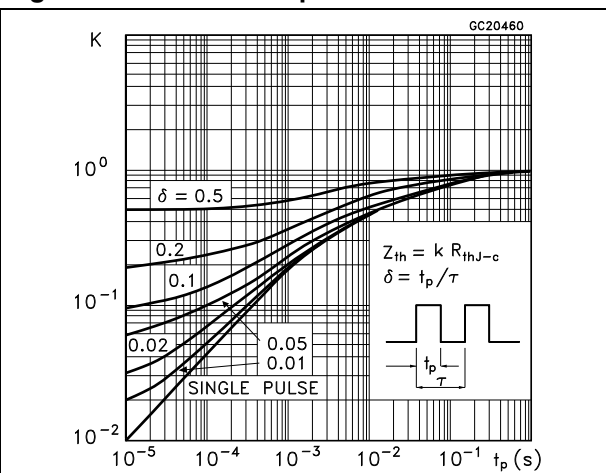


Figure 6. Output characteristics

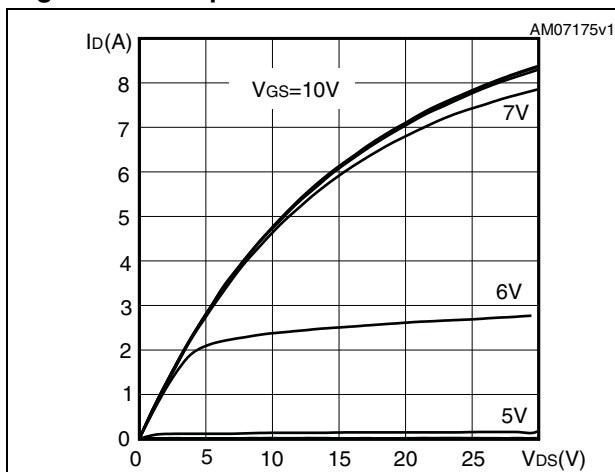


Figure 7. Transfer characteristics

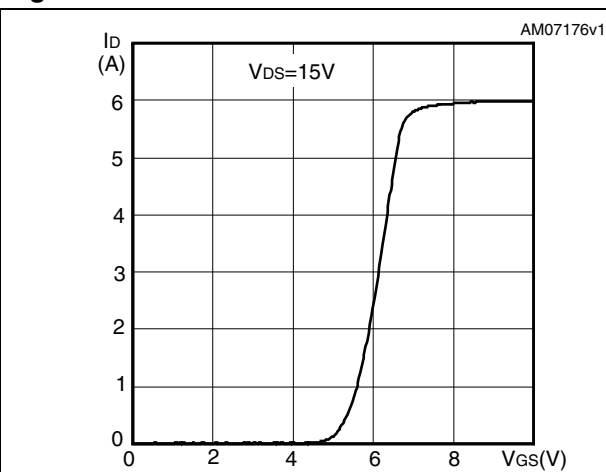


Figure 8. Gate charge vs gate-source voltage Figure 9. Static drain-source on resistance

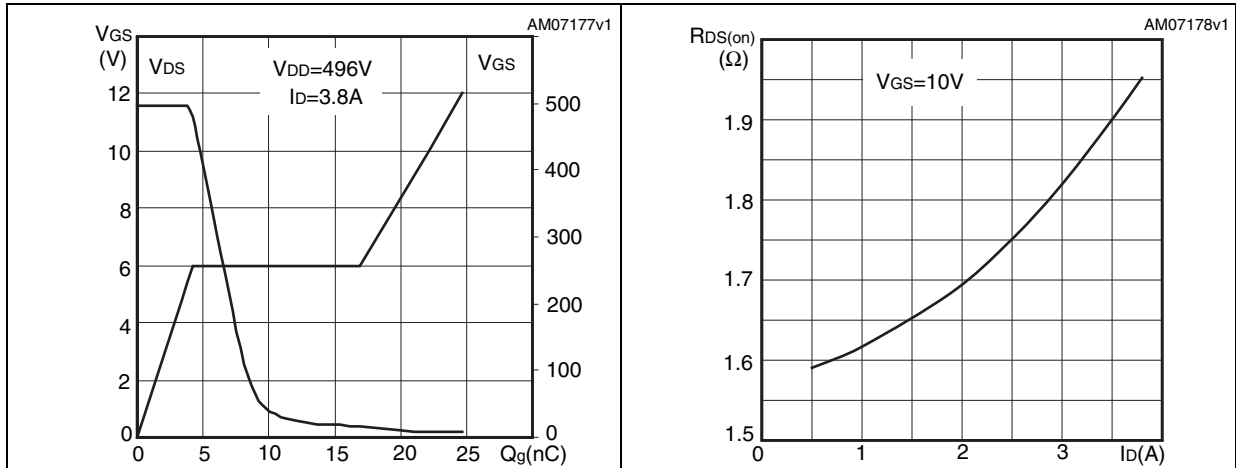


Figure 10. Capacitance variations Figure 11. Output capacitance stored energy

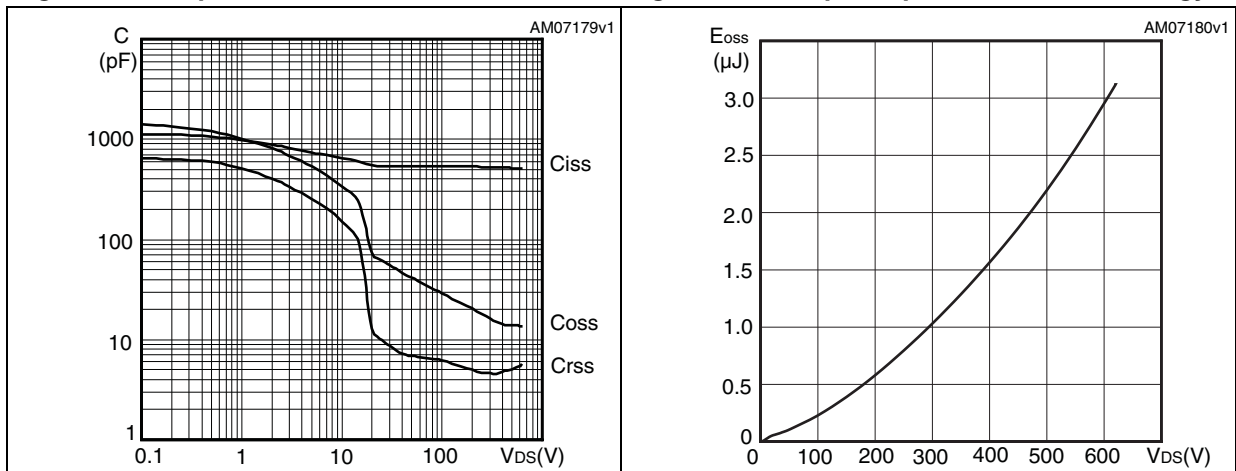


Figure 12. Normalized gate threshold voltage vs temperature Figure 13. Normalized on-resistance vs temperature

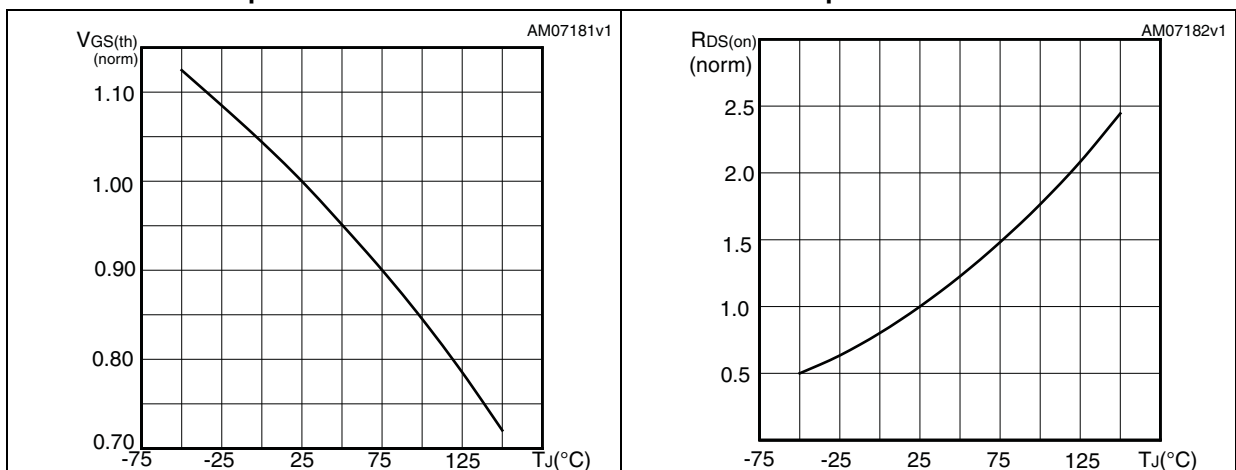


Figure 14. Maximum avalanche energy vs starting Tj

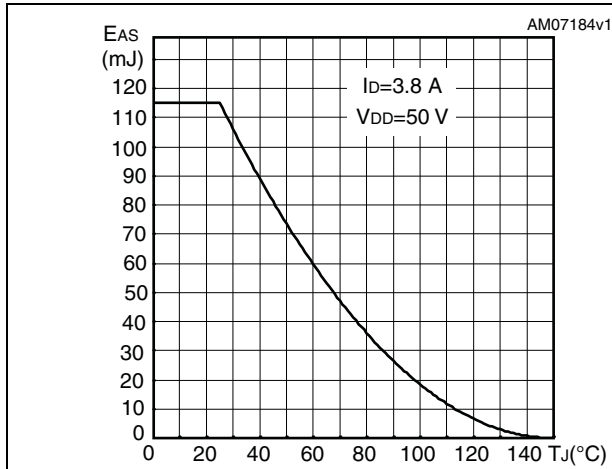


Figure 15. Normalized BV_{DSS} vs temperature

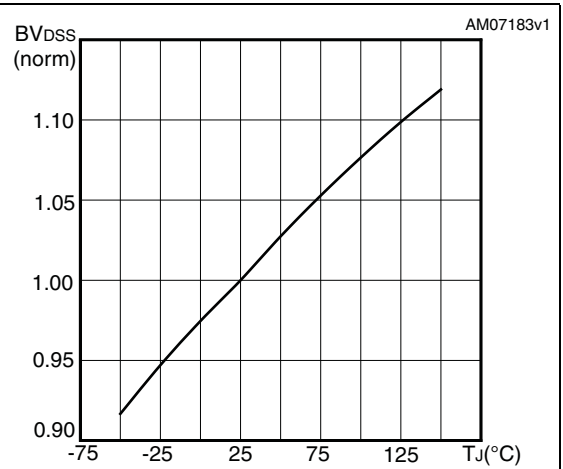
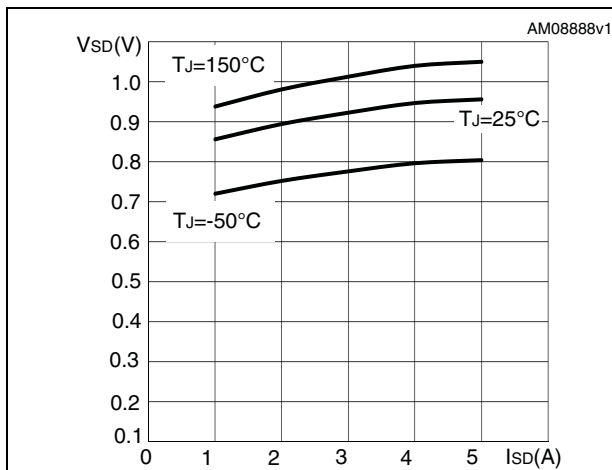


Figure 16. Source-drain diode forward characteristics



3 Test circuits

Figure 17. Switching times test circuit for resistive load



AM01468v1

Figure 18. Gate charge test circuit



AM01469v1

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



AM01470v1

Figure 20. Unclamped Inductive load test circuit



AM01471v1

Figure 21. Unclamped inductive waveform



AM01472v1

Figure 22. 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 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

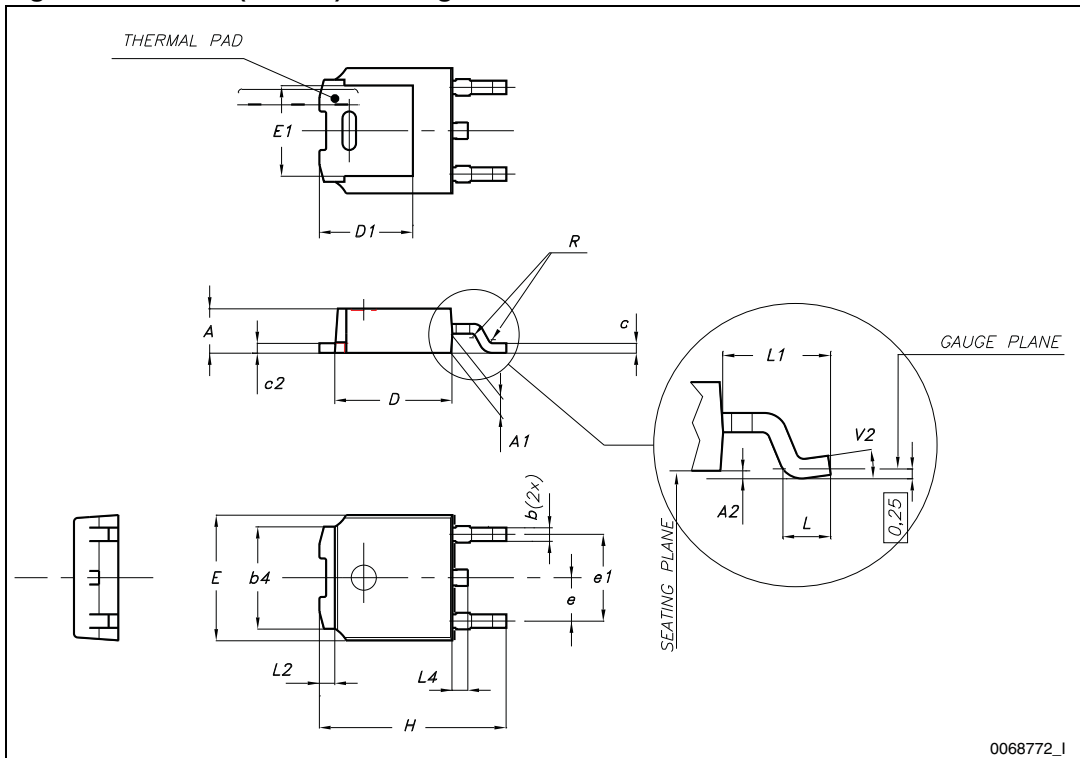
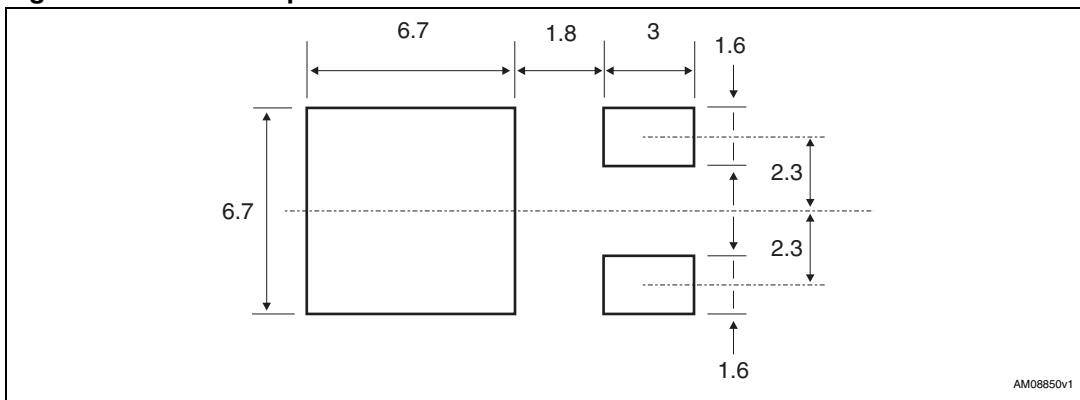


Figure 24. DPAK footprint^(a)

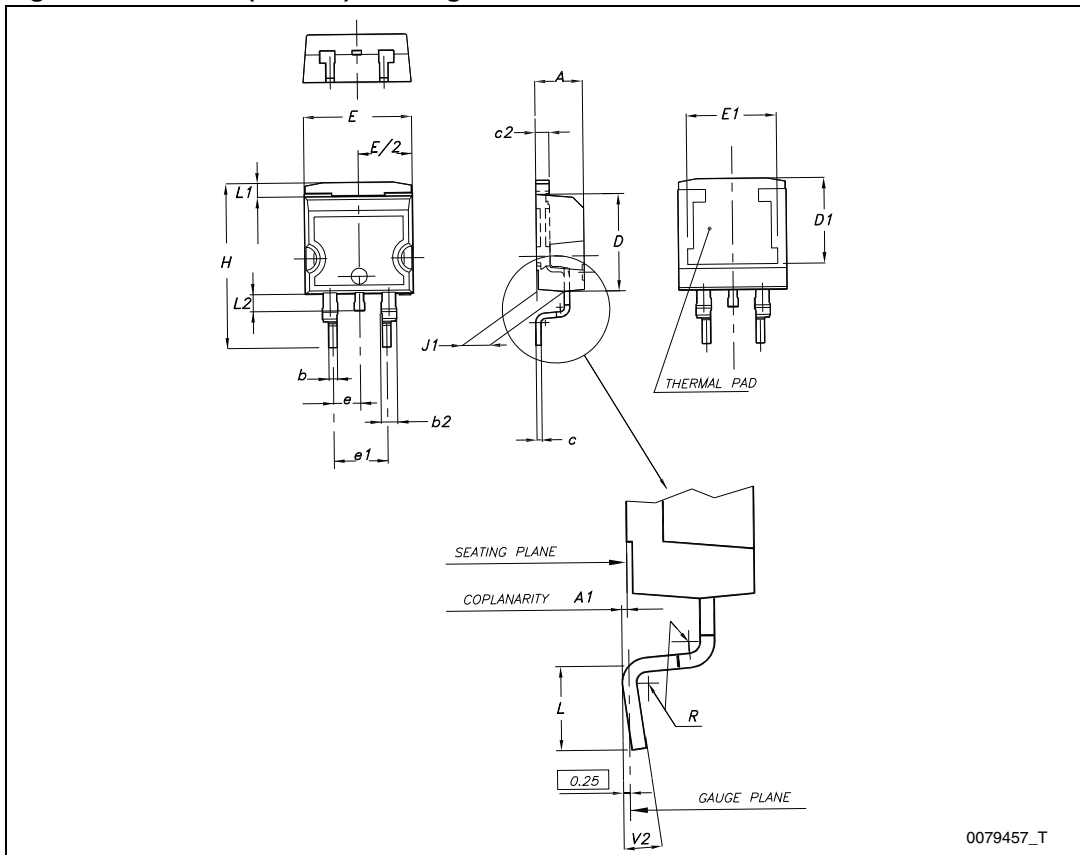


a. All dimension are in millimeters

Table 10. D²PAK (TO-263) mechanical data

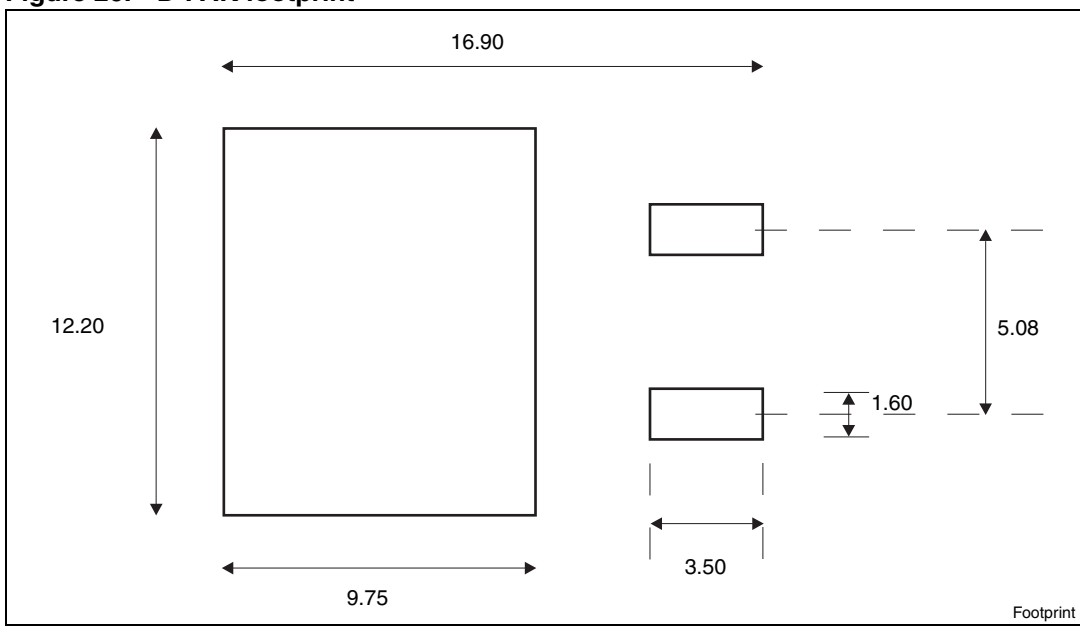
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 25. D²PAK (TO-263) drawing



0079457_T

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)

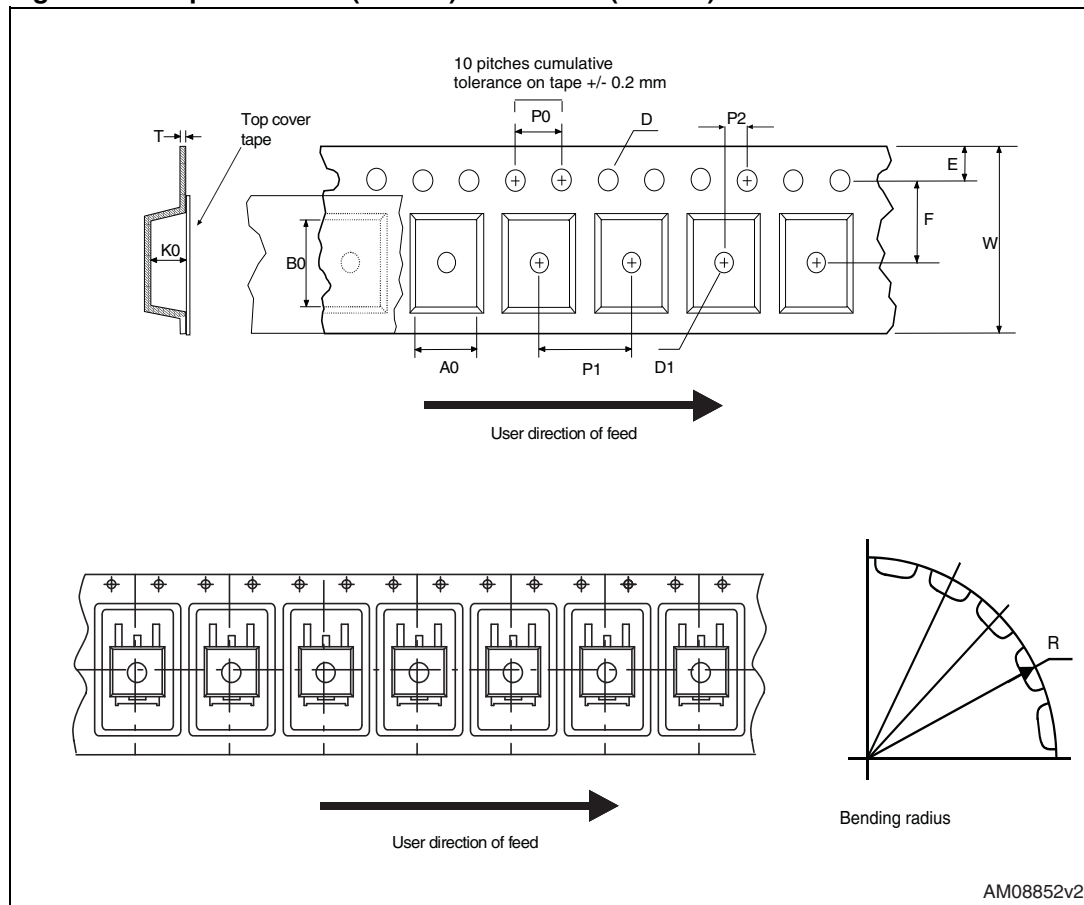
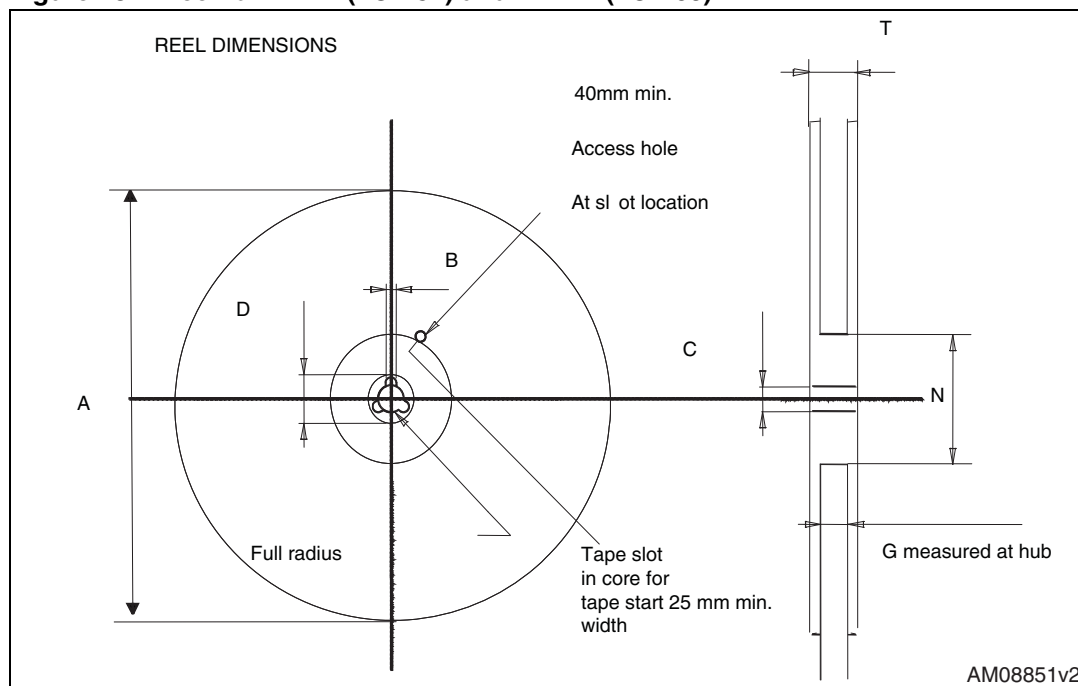


Figure 28. Reel for DPAK (TO-252) and D²PAK (TO-263)



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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