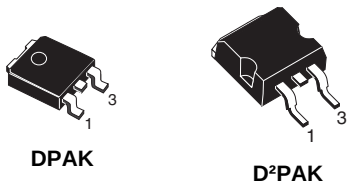
STB120N4LF6
STD120N4LF6

N-channel 40 V, 3.1 mΩ, 80 A DPAK, D²PAK STripFET™ VI DeepGATE™ Power MOSFET

Features

Order codes	V_{DSS}	$R_{DS(on)}$ max	I_D
STB120N4LF6	40 V	4.0 mΩ	80 A
STD120N4LF6	40 V	4.0 mΩ	80 A

- Logic level drive
- 100% avalanche tested



DPAK D²PAK

Application

- Switching applications
  - Automotive

Description

This product is a 40 V N-channel STripFET™ VI Power MOSFET based on the ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest RDS(on) in all packages.

Figure 1. Internal schematic diagram

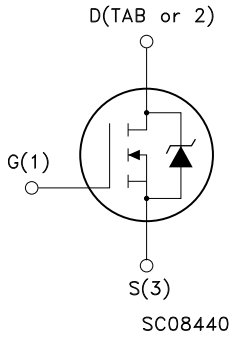


Table 1. Device summary

Order codes	Marking	Packages	Packaging
STB120N4LF6	120N4LF6	D²PAK	Tape and reel
STD120N4LF6		DPAK	

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Contents

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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 (1)	Drain current (continuous) at T_C = 25 °C	80	A
I_D	Drain current (continuous) at T_C = 100 °C	80	A
I_{DM} (2)	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at T_C = 25 °C	110	W
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Operating junction temperature		

1. Limited by wire bonding
2. Pulse width limited by safe operating area

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		DPAK	D²PAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.36		°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb max (1)	50	35	°C/W

1. When mounted on 1 inch^2 2 oz. Cu board.

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
I_{AV}	Not-repetitive avalanche current	40	A
E_{AS} (1)	Single pulse avalanche energy	394	mJ

1. Starting Tj = 25 °C, I_D = 40 A, V_{DD} = 25 V

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2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 5. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	I_D = 250 µA, V_{GS}= 0	40	-		V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 20 V V_{DS} = 20 V,Tc = 125 °C		-	1 10	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V		-	±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	-	3	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 5 V, I_D = 40 A		3.6	5.0	mΩ
		V_{GS} = 10 V, I_D = 40 A		3.1	4.0	mΩ

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f=1 MHz, V_{GS} = 0 V	-	4300 650 375	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 20 V, I_D = 80 A V_{GS} = 10 V *(see Figure 14)*	-	80 15 15	-	nC nC nC
R_G	Intrinsic gate resistance	f=1 MHz open drain		1.35		Ω

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Table 7. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 20 V, I_D = 40 A, R_G = 4.7 Ω, V_{GS} = 10 V *Figure 15*	-	15 95	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time		-	125 45	-	ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(1)	Source-drain current Source-drain current (pulsed)		-		80 320	A A
V_{SD}(2)	Forward on voltage	I_{SD} = 40 A, V_{GS} = 0	-		1.1	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 80 A, di/dt = 100 A/µs, V_{DD} = 32 V, T_J = 150 °C *Figure 17*	-	50 85 3.5		ns nC A

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

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2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

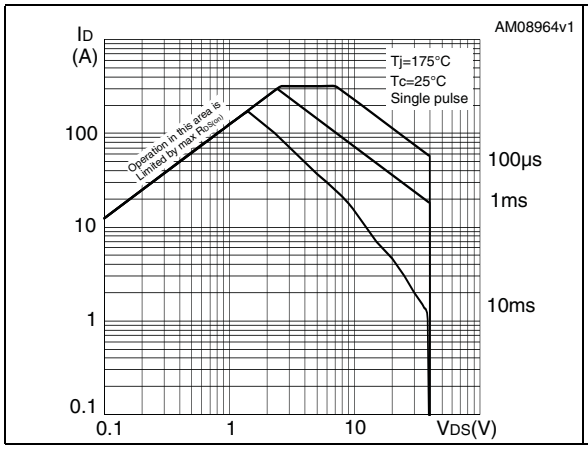

Figure 3. Thermal impedance

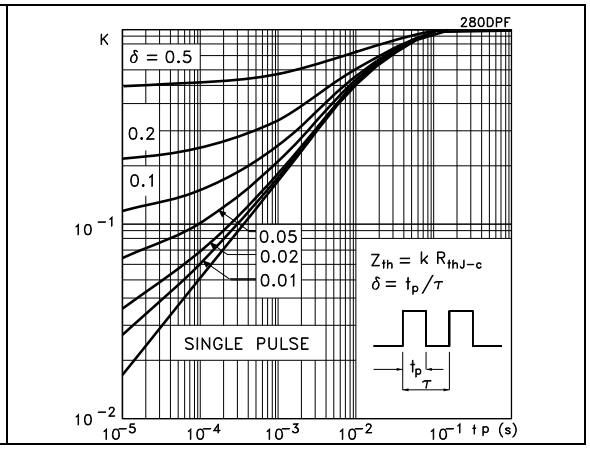

Figure 4. Output characteristics

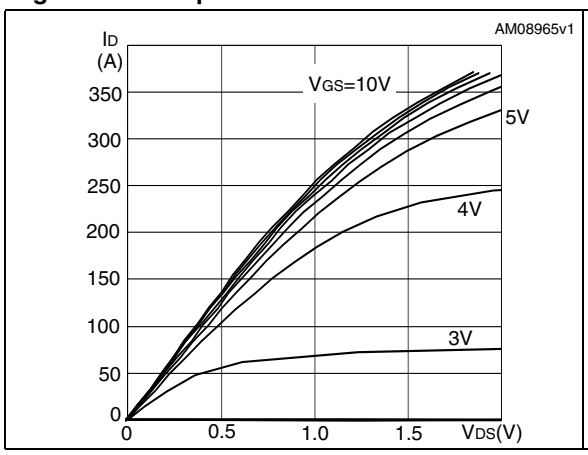

Figure 5. Transfer characteristics

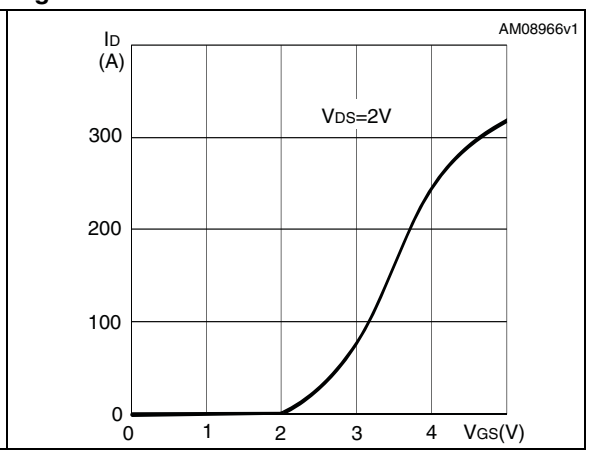

Figure 6. Normalized B_{VDSS} vs temperature

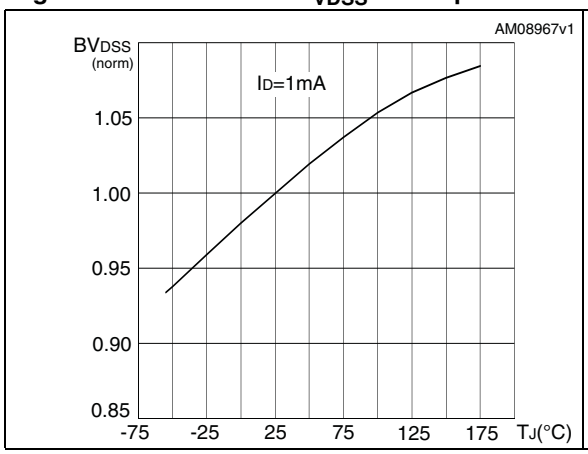

Figure 7. Static drain-source on resistance

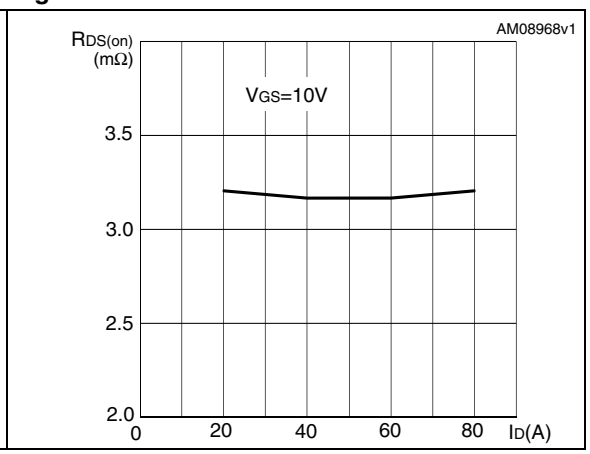

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Figure 8. Gate charge vs gate-source voltage

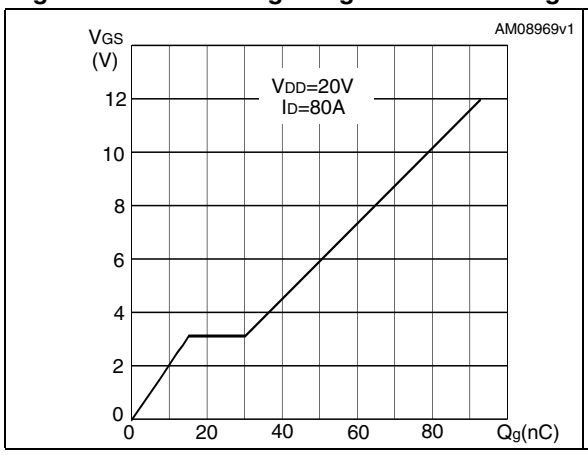


Figure 9. Capacitance variations

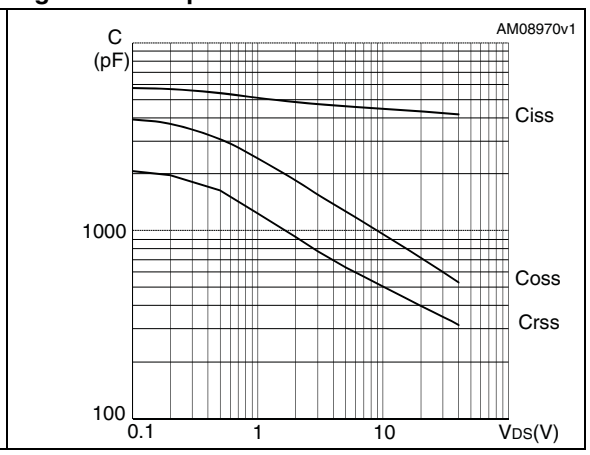


Figure 10. Normalized gate threshold voltage vs temperature

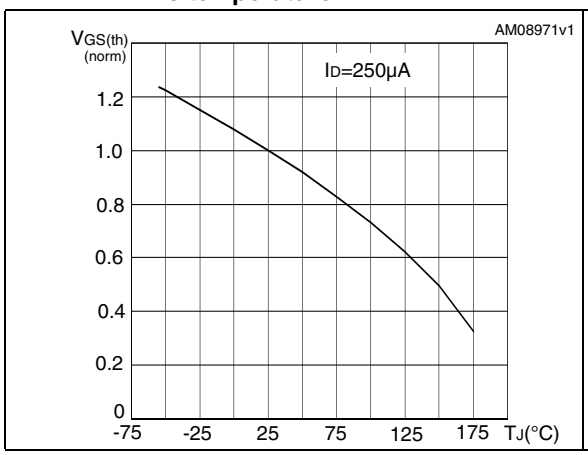


Figure 11. Normalized on resistance vs temperature

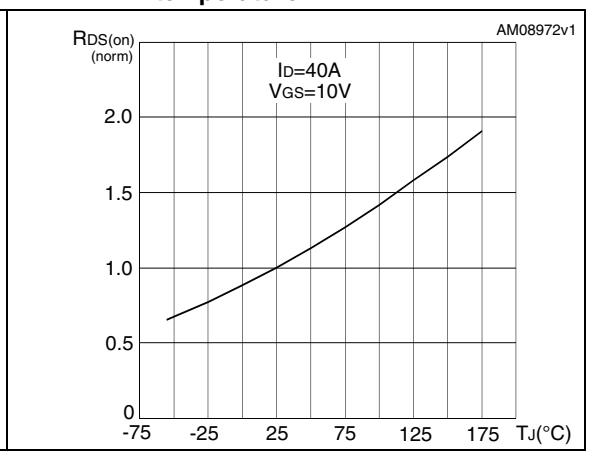
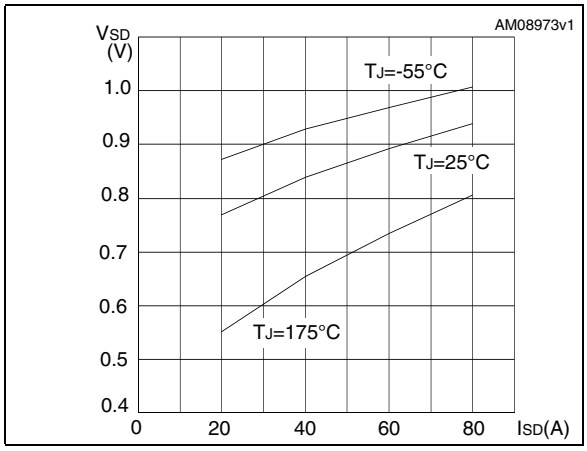


Figure 12. Source-drain diode forward characteristics



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3 Test circuits

Figure 13. Switching times test circuit for resistive load

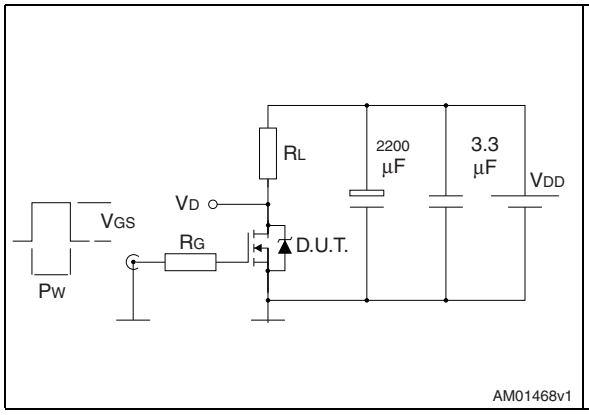


Figure 14. Gate charge test circuit

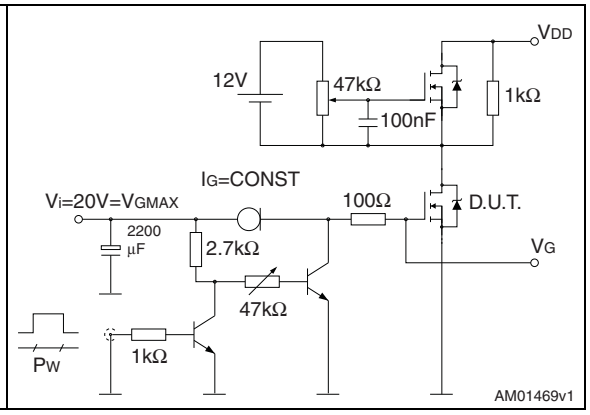


Figure 15. Test circuit for inductive load switching and diode recovery times

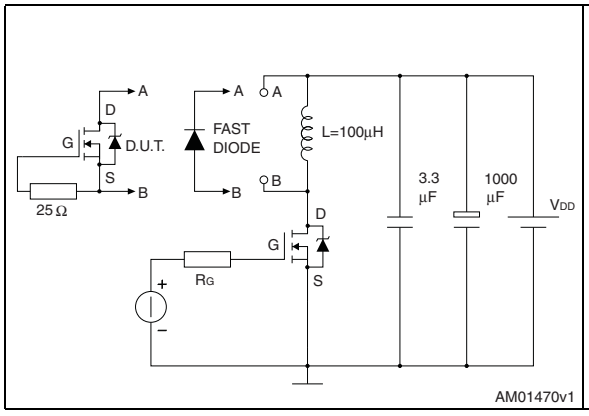


Figure 16. Unclamped inductive load test circuit

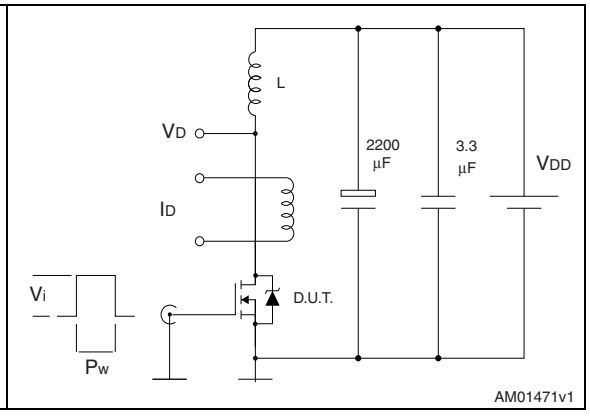


Figure 17. Unclamped inductive waveform

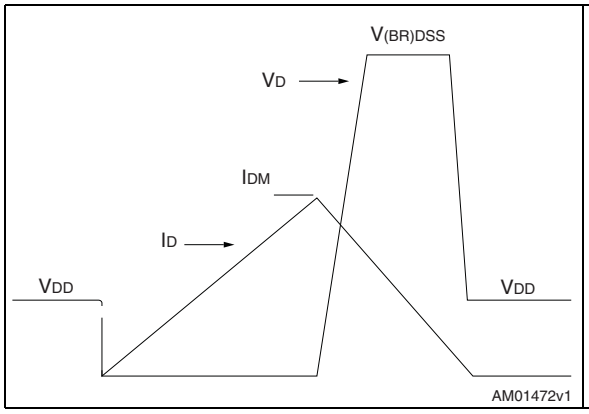
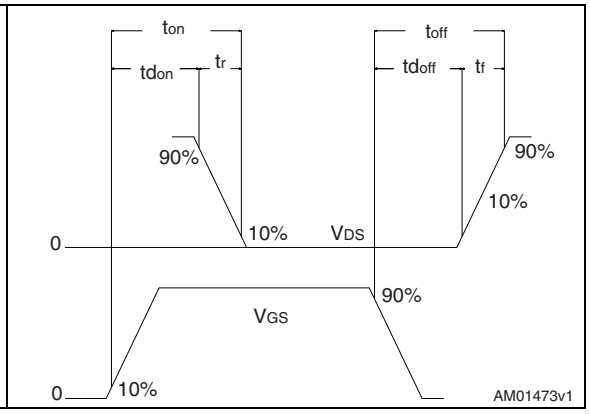


Figure 18. Switching time waveform



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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.

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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°

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Figure 19. D²PAK (TO-263) drawing

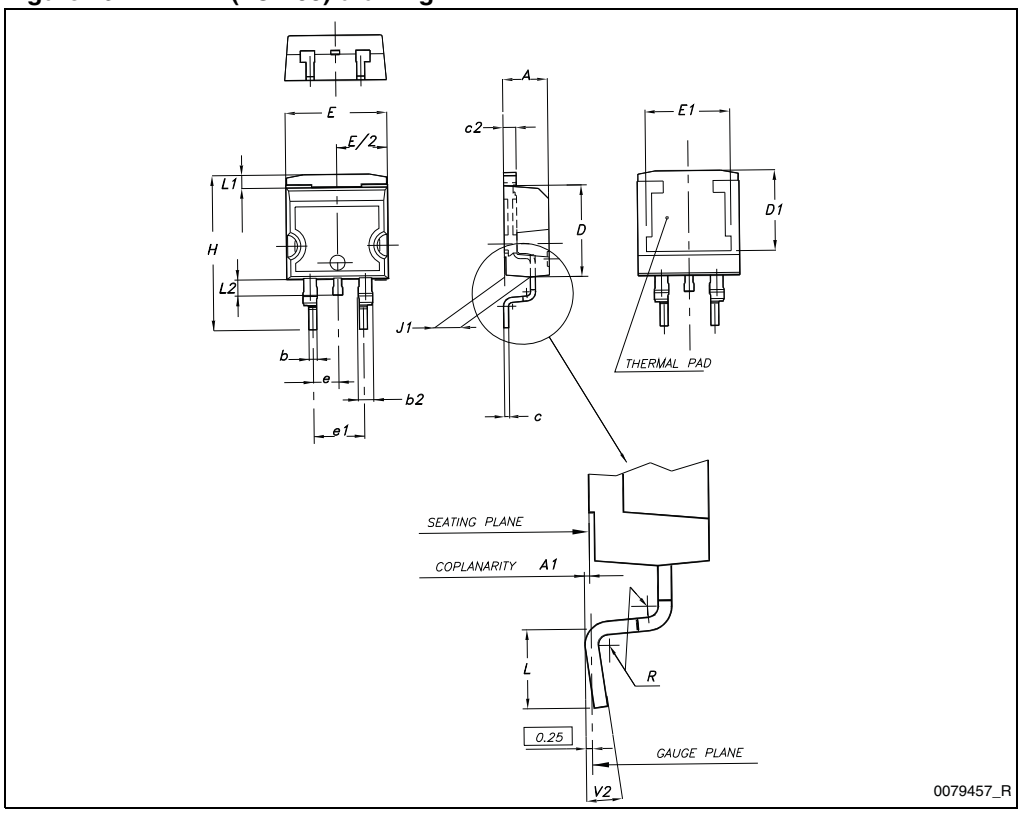
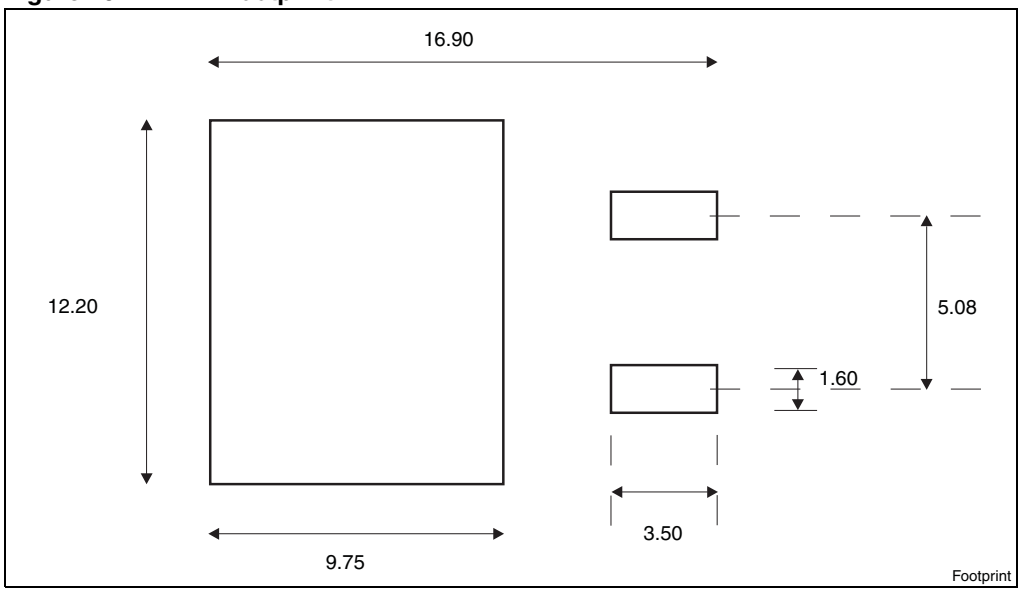


Figure 20. D²PAK footprint[a]



a. All dimension are in millimeters

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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		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

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Figure 21. DPAK (TO-252) drawing

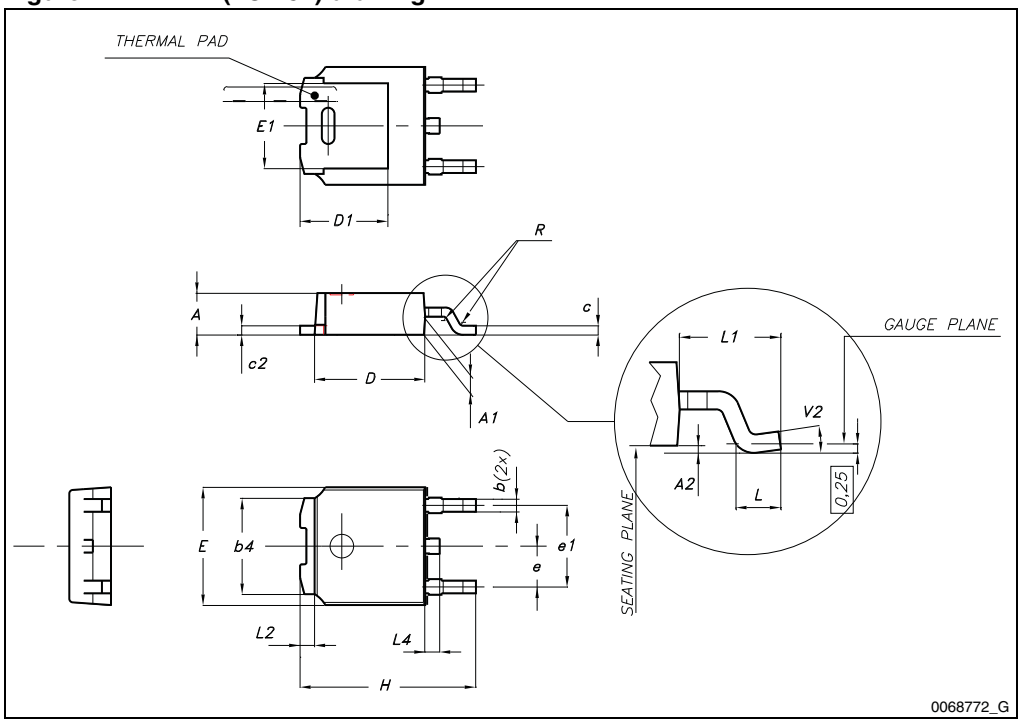
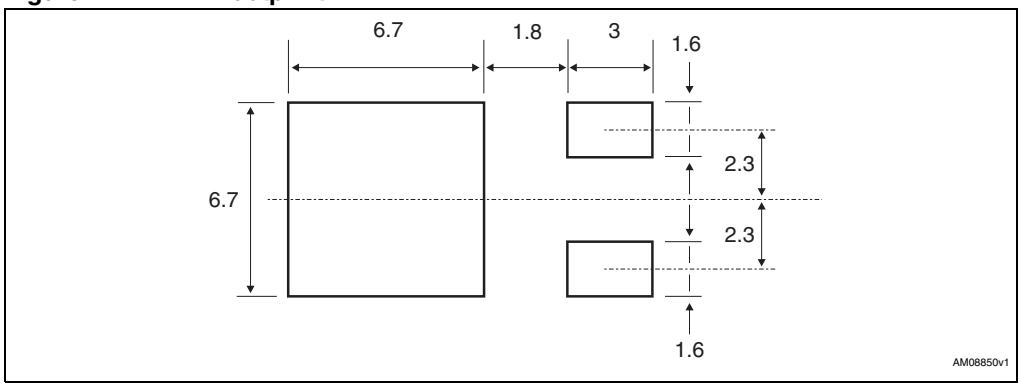


Figure 22. DPAK footprint[b]



b. All dimension are in millimeters

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5 Packaging mechanical data

Table 11. 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			

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Table 12. 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			

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Figure 23. Tape for D²PAK(TO-263) and DPAK (TO-252)

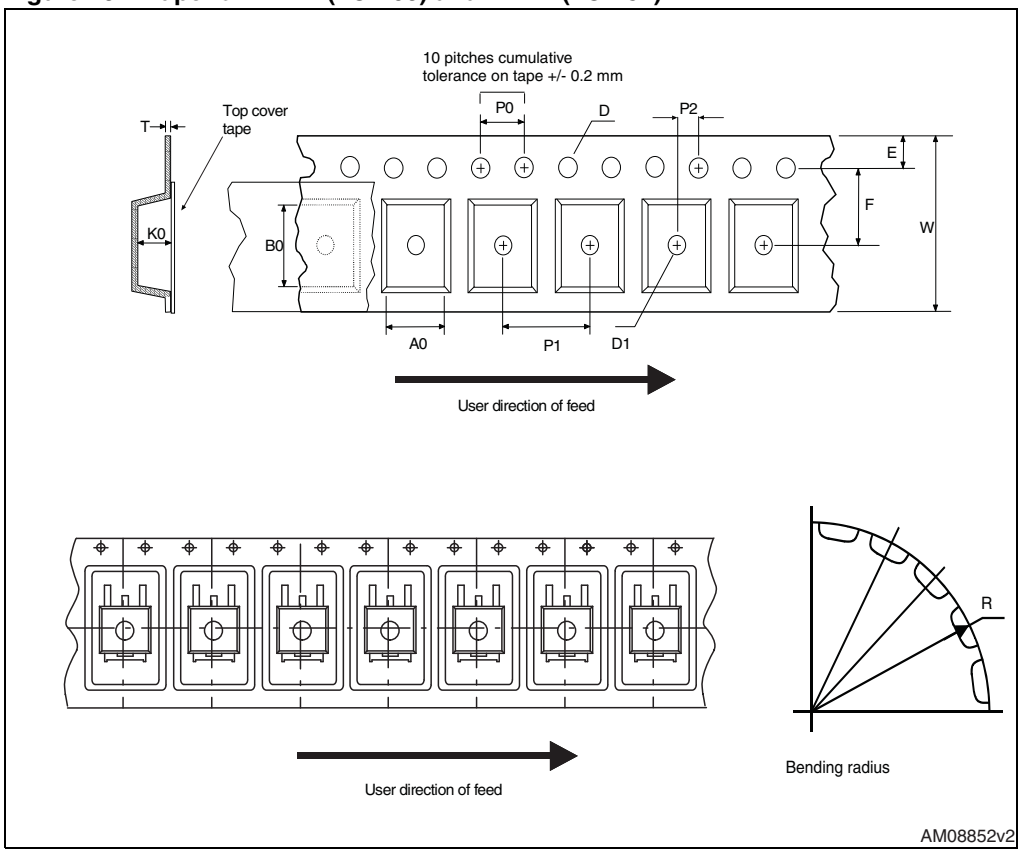
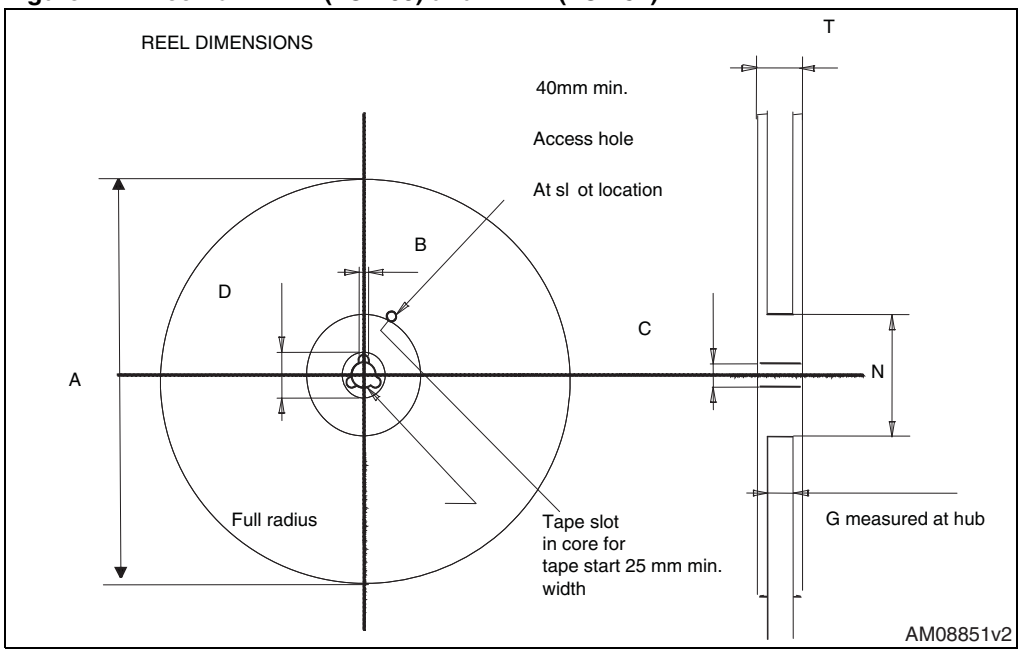


Figure 24. Reel for D²PAK(TO-263) and DPAK (TO-252)



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6 Revision history

Table 13. Document revision history

Date	Revision	Changes
14-Dec-2009	1	First release
23-Feb-2011	2	Document status promoted from preliminary data to datasheet.

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