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STB95N4F3, STD95N4F3 STP95N4F3

N-channel 40 V, 5.0 mΩ, 80 A STripFET™ III
Power MOSFET in D²PAK, DPAK, TO-220

Features

Order codes	V _{DSS}	R _{DS(on)} max.	I _D	P _w
STB95N4F3	40 V	< 5.8 mΩ	80 A	110 W
STD95N4F3				
STP95N4F3		< 6.2 mΩ		

- Standard threshold drive
- 100% avalanche tested

Applications

- Switching applications
 - Automotive

Description

These devices are N-channel enhancement mode Power MOSFETs produced using STMicroelectronics' STripFET™ III technology, which is specifically designed to minimize on-resistance and gate charge to provide superior switching performance.

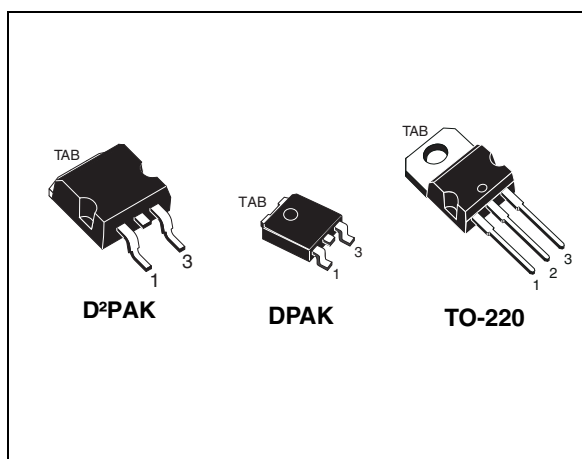


Figure 1. Internal schematic diagram

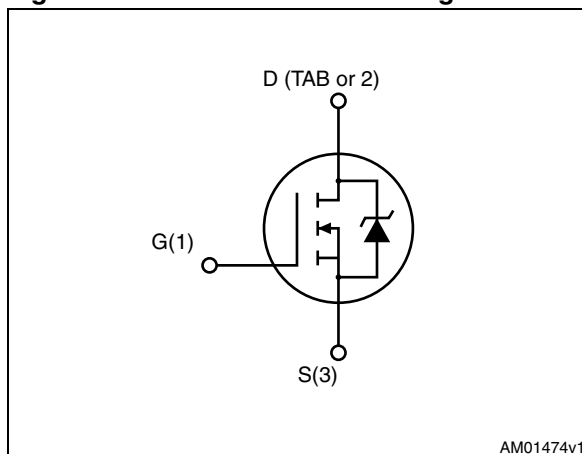


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB95N4F3	95N4F3	D ² PAK	Tape and reel
STD95N4F3	95N4F3	DPAK	
STP95N4F3	95N4F3	TO-220	Tube

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STB95N4F3, STD95N4F3, STP95N4F3

Electrical ratings

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	40	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	65	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	110	W
	Derating factor	0.73	W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	8	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	400	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

1. Current limited by package.
2. Pulse width limited by safe operating area.
3. $I_{SD} \leq 80\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS} \leq V_{(BR)DSS}$, $T_j \leq T_{jmax}$.
4. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 40\text{ A}$, $V_{DD} = 30\text{ V}$.

Table 3. Thermal resistance

Symbol	Parameter	Value			Unit
		D ² PAK	DPAK	TO-220	
$R_{thj-case}$	Thermal resistance junction-case max	1.36			$^\circ\text{C}/\text{W}$
R_{thj-a}	Thermal resistance junction-ambient max	62.5			$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-ambient max	30	50		$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300			$^\circ\text{C}$

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

Electrical characteristics

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2 Electrical characteristics

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

Table 4. 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} = 40 V, V _{DS} = 40 V, T _c = 125 °C			10 100	μA μA
I _{GSS}	Gate body leakage current (V _{DS} = 0)	V _{GS} = ±20 V			±200	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250 μA	2		4	V
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10 V, I _D = 40 A		5.0	5.8	mΩ
		V _{GS} = 10 V, I _D = 40 A for TO-220		5.4	6.2	mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = 25 V, f = 1 MHz, V _{GS} = 0	-	2200		pF
C _{oss}	Output capacitance			580		pF
C _{rss}	Reverse transfer capacitance			40		pF
Q _g	Total gate charge	V _{DD} = 20 V, I _D = 80 A	-	40	54	nC
Q _{gs}	Gate-source charge	V _{GS} = 10 V		11		nC
Q _{gd}	Gate-drain charge	(see Figure 14)		8		nC

STB95N4F3, STD95N4F3, STP95N4F3

Electrical characteristics

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=20\text{ V}$, $I_D=40\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (see Figure 16)	-	15	-	ns
t_r	Rise time			50		ns
$t_{d(off)}$	Turn-off delay time	$V_{DD}=20\text{ V}$, $I_D=40\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (see Figure 16)	-	40	-	ns
t_f	Fall time			15		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=80\text{ A}$, $V_{GS}=0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD}=80\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=30\text{ V}$, $T_j=150\text{ }^\circ\text{C}$ (see Figure 15)	-	45		ns
Q_{rr}	Reverse recovery charge			60		nC
I_{RRM}	Reverse recovery current			2.8		A

1. Pulse width limited by safe operating area

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

Electrical characteristics

STB95N4F3, STD95N4F3, STP95N4F3

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

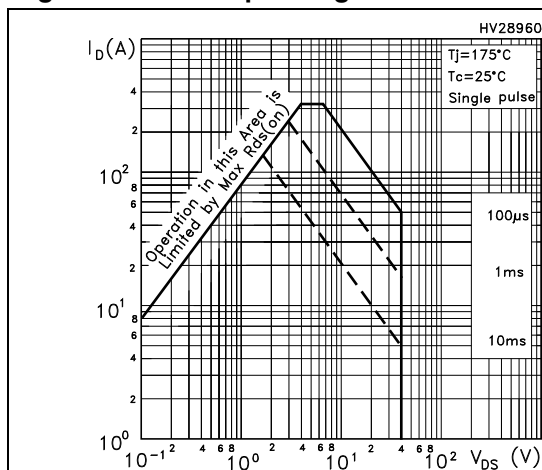


Figure 3. Thermal impedance

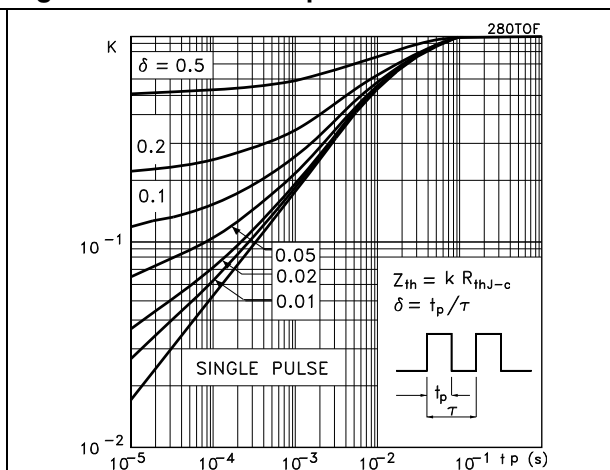


Figure 4. Output characteristics

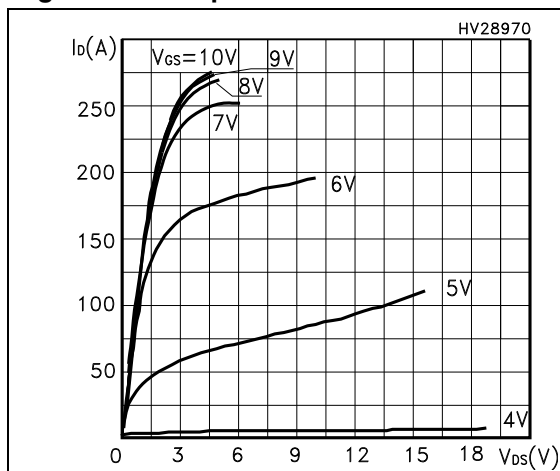


Figure 5. Transfer characteristics

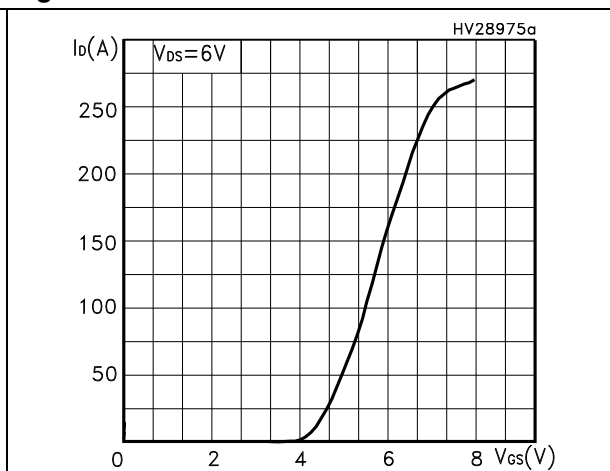


Figure 6. Static drain-source on resistance

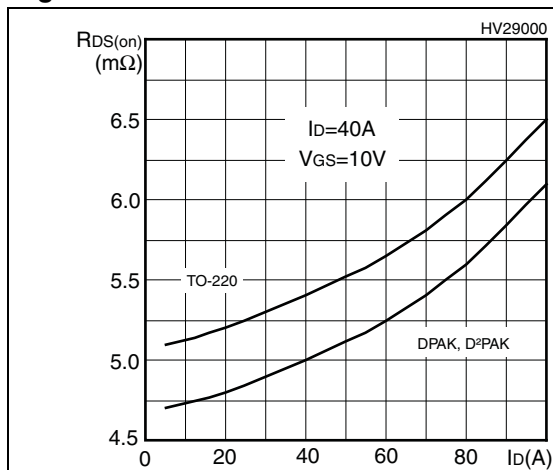
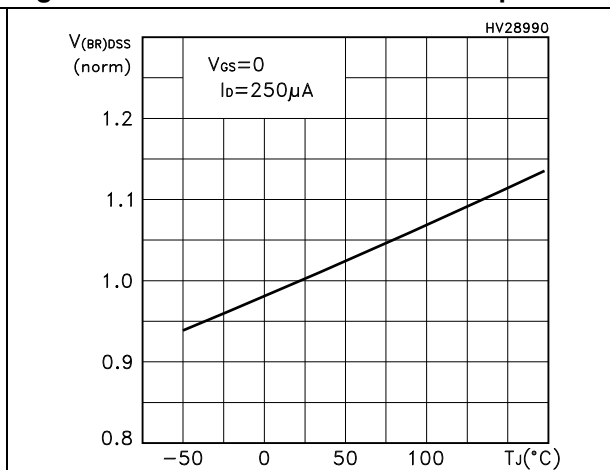


Figure 7. Normalized BVDSS vs temperature



STB95N4F3, STD95N4F3, STP95N4F3

Electrical characteristics

Figure 8. Gate charge vs gate-source voltage **Figure 9. Capacitance variations**

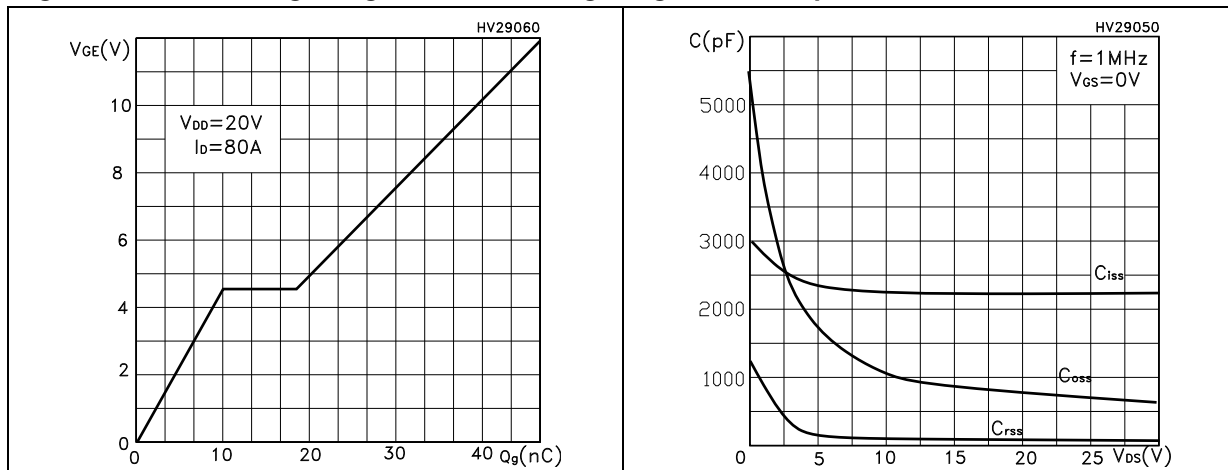


Figure 10. Normalized gate threshold voltage vs temperature **Figure 11. Normalized on resistance vs temperature**

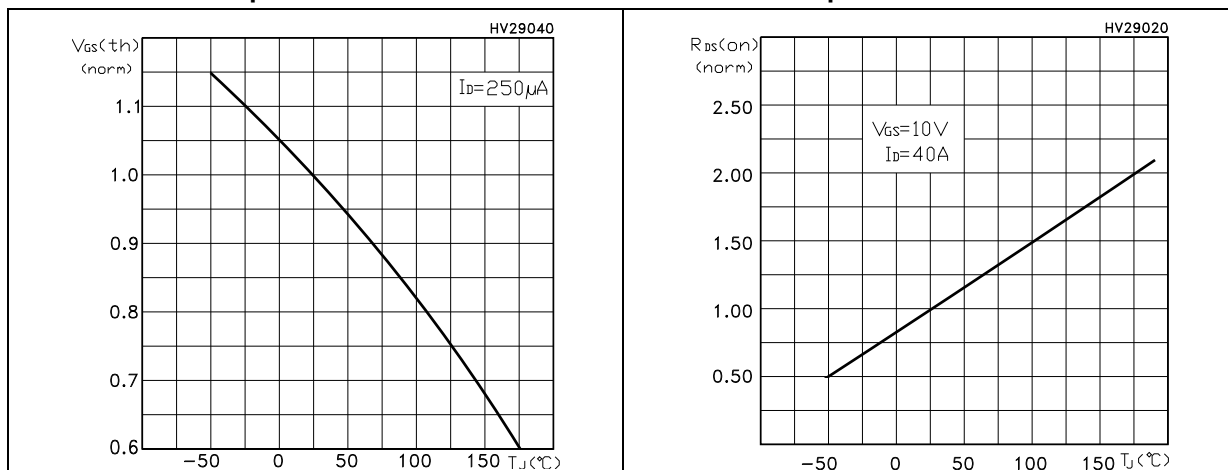
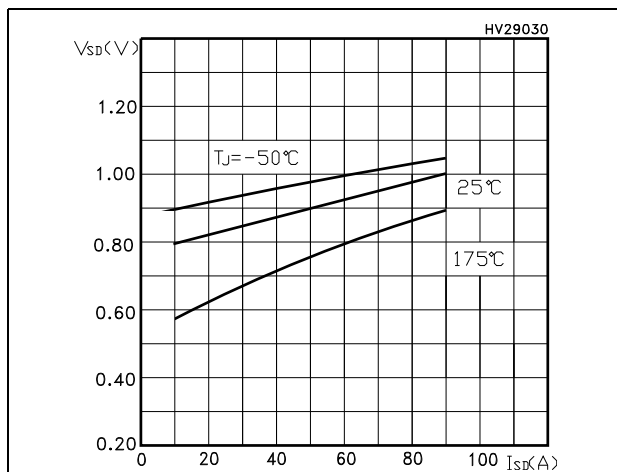


Figure 12. Source-drain diode forward characteristics



Test circuits

STB95N4F3, STD95N4F3, STP95N4F3

3 Test circuits

Figure 13. Switching times test circuit for resistive load

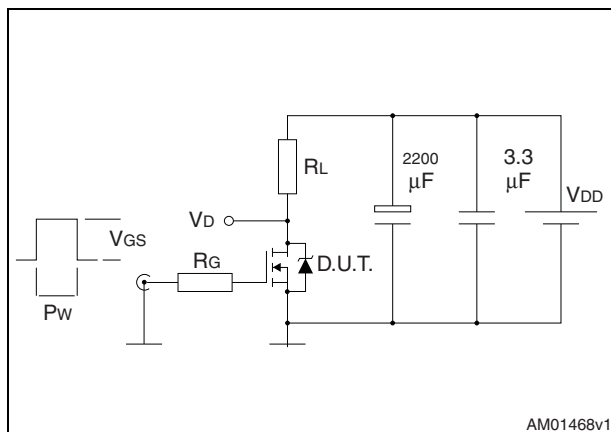


Figure 14. Gate charge test circuit

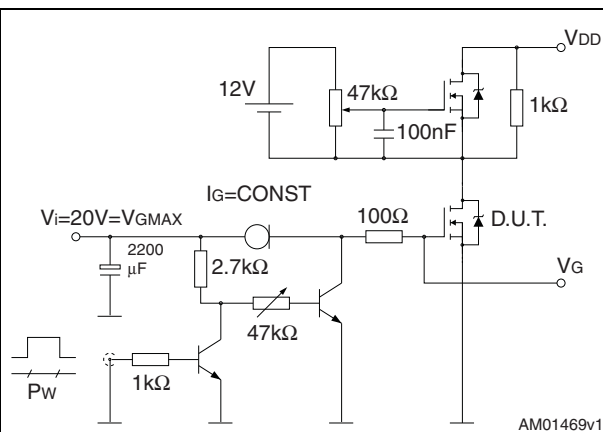


Figure 15. Test circuit for inductive load switching and diode recovery times

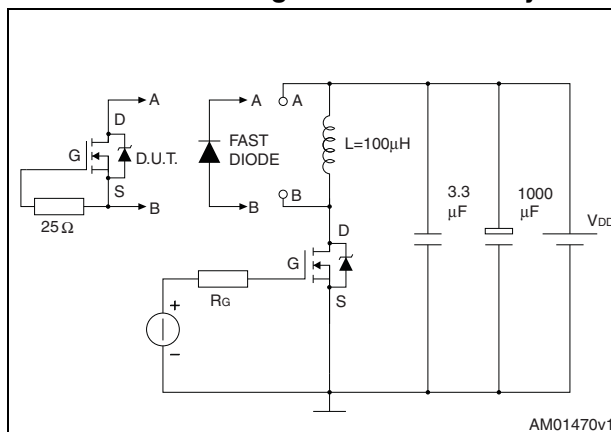


Figure 16. Unclamped inductive load test circuit

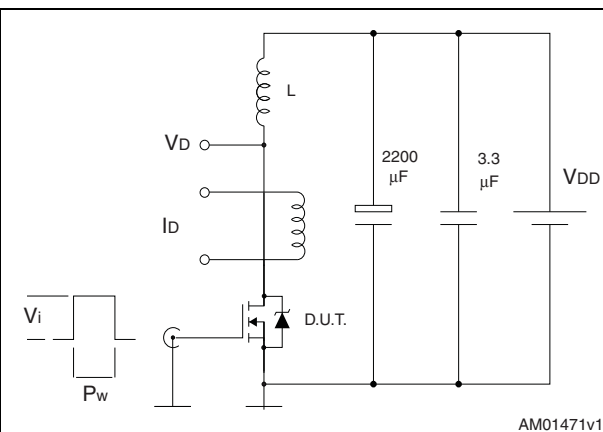


Figure 17. Unclamped inductive waveform

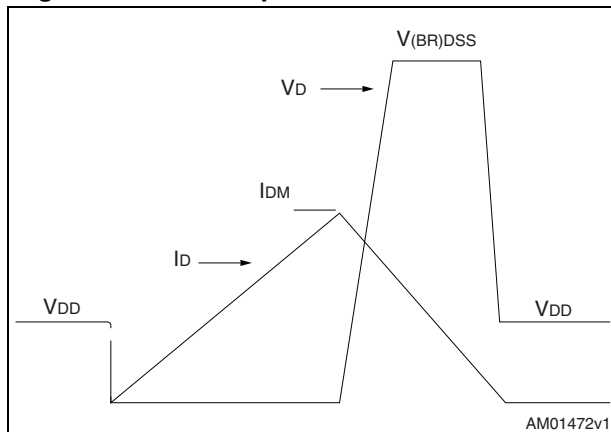
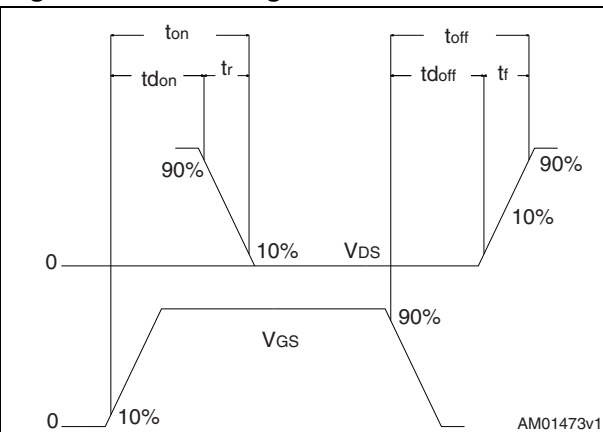


Figure 18. Switching time waveform



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.

Package mechanical data

STB95N4F3, STD95N4F3, STP95N4F3

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°

STB95N4F3, STD95N4F3, STP95N4F3

Package mechanical data

Figure 19. D²PAK (TO-263) drawing

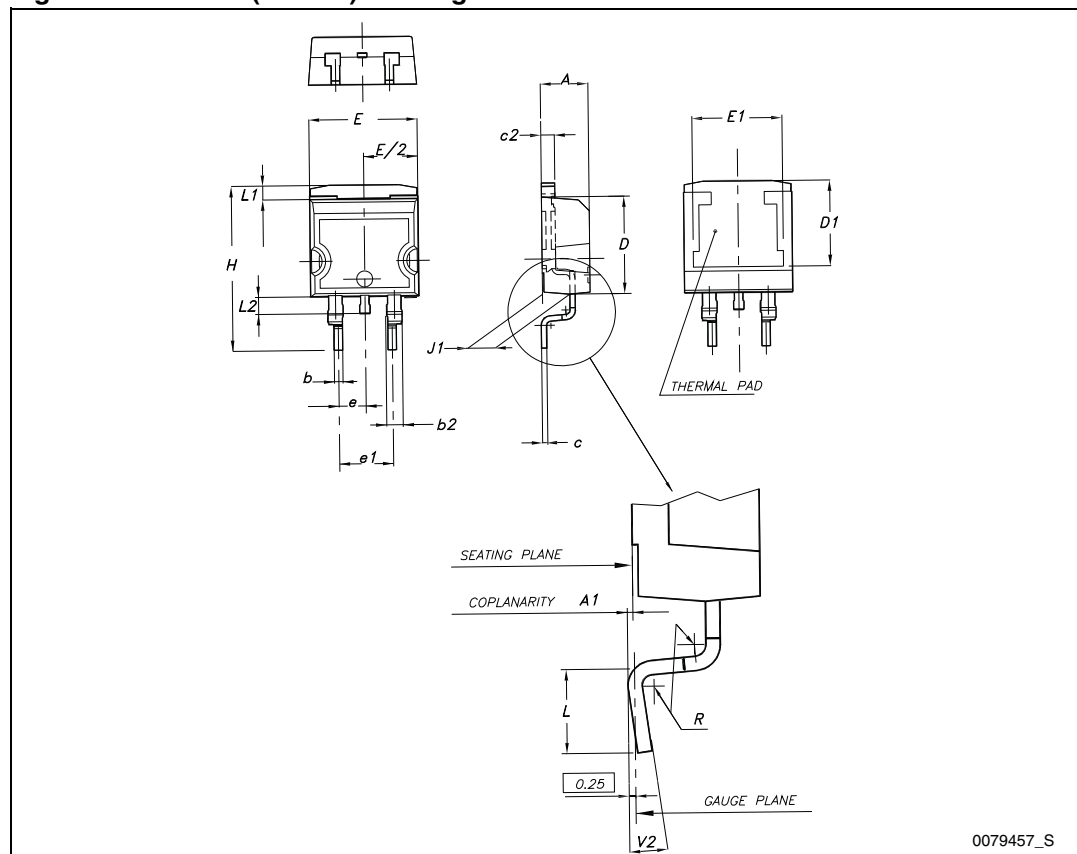
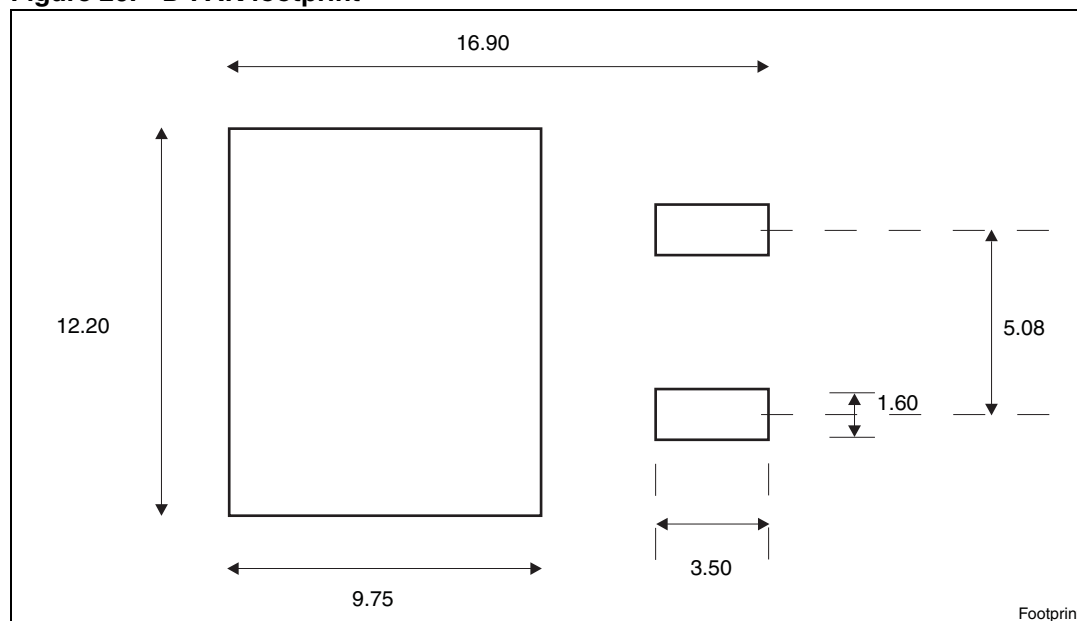


Figure 20. D²PAK footprint^(a)



a. All dimension are in millimeters

Package mechanical data

STB95N4F3, STD95N4F3, STP95N4F3

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°

STB95N4F3, STD95N4F3, STP95N4F3

Package mechanical data

Figure 21. DPAK (TO-252) drawing

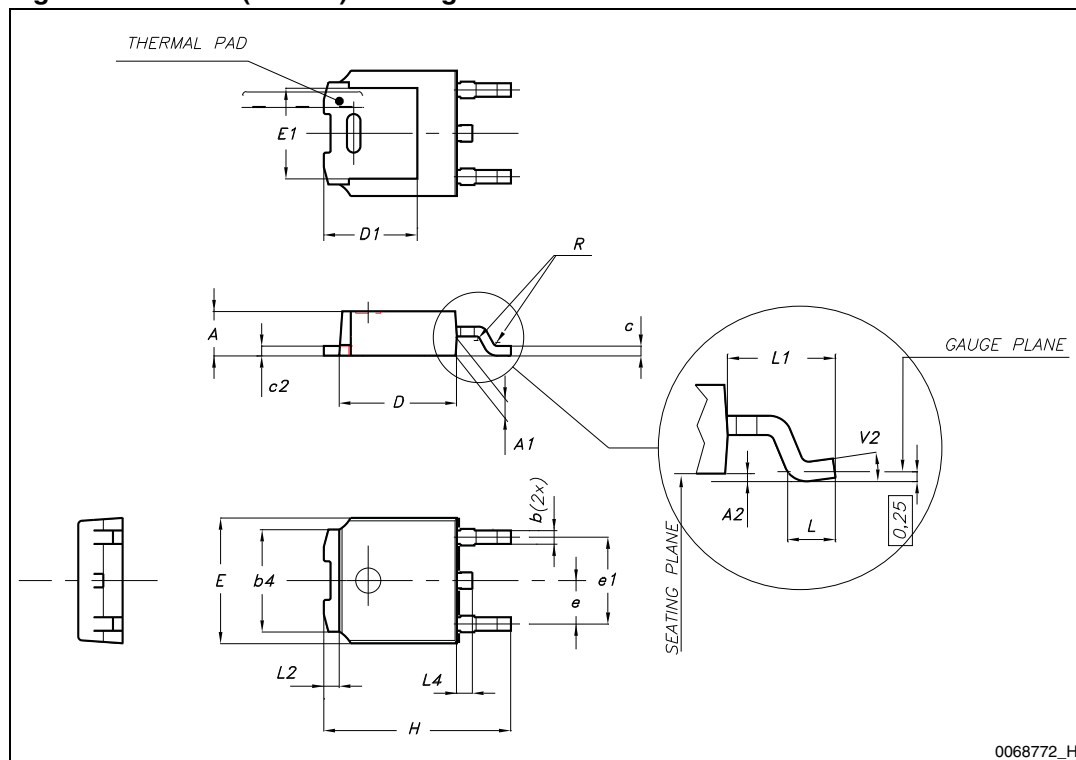
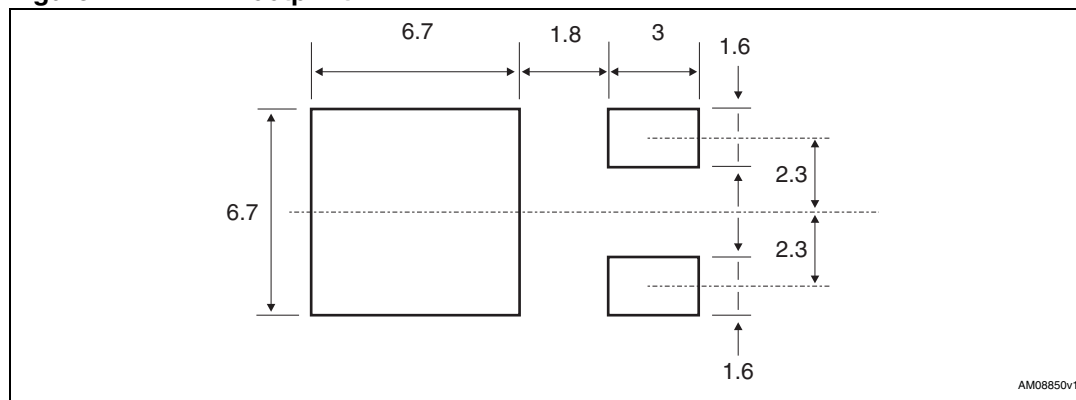


Figure 22. DPAK footprint^(b)



b. All dimension are in millimeters

Package mechanical data

STB95N4F3, STD95N4F3, STP95N4F3

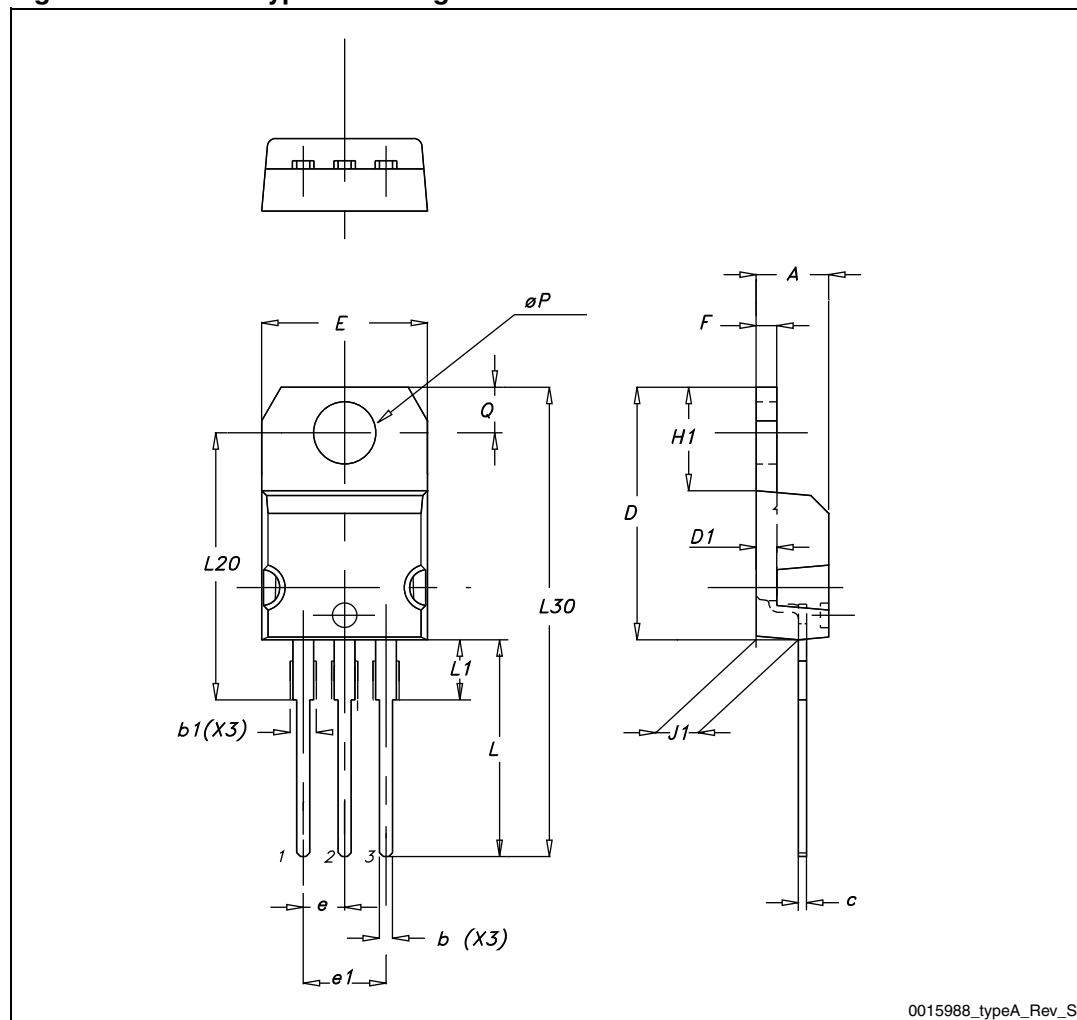
Table 10. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

STB95N4F3, STD95N4F3, STP95N4F3

Package mechanical data

Figure 23. TO-220 type A drawing



Packaging mechanical data

STB95N4F3, STD95N4F3, STP95N4F3

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			

STB95N4F3, STD95N4F3, STP95N4F3

Packaging mechanical data

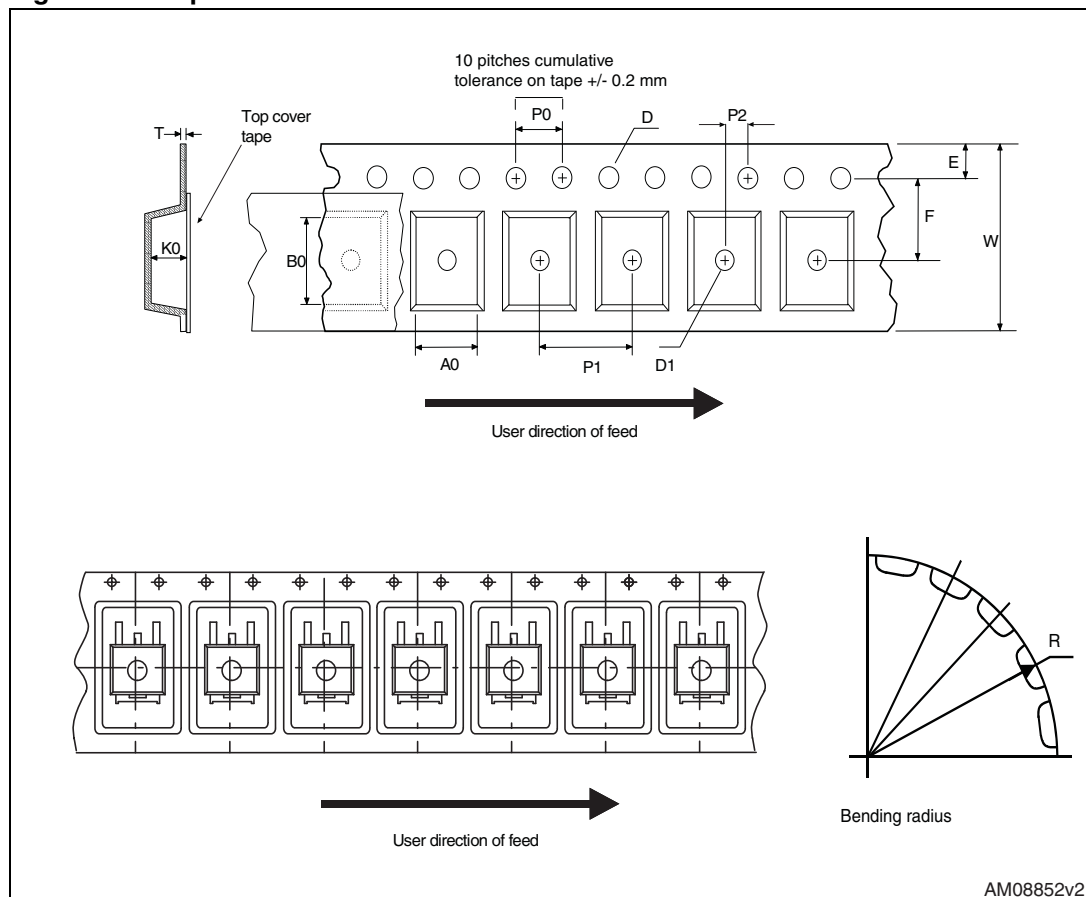
Table 12. DPAK (TO-252) tape and reel mechanical data

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			

Packaging mechanical data

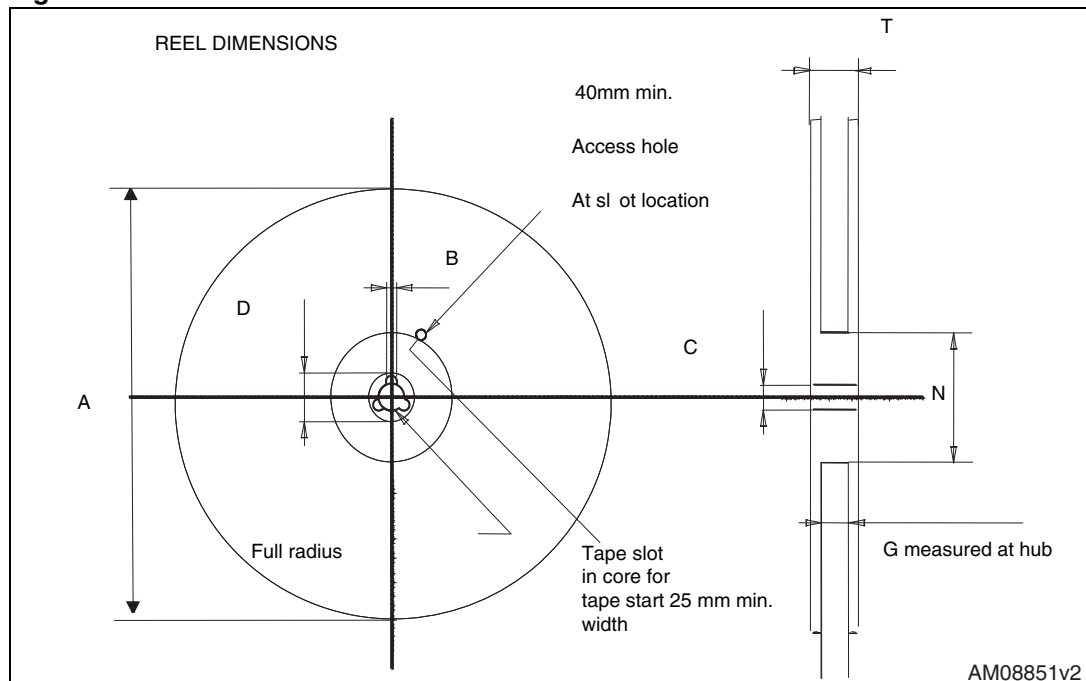
STB95N4F3, STD95N4F3, STP95N4F3

Figure 24. Tape



AM08852v2

Figure 25. Reel



AM08851v2

6 Revision history

Table 13. Document revision history

Date	Revision	Changes
22-Feb-2007	1	First release
15-May-2007	2	Changes on applications
10-Sep-2009	3	Removed package, mechanical data: IPAK
13-Dec-2011	4	New package and mechanical data have been added: – Table 8: D²PAK (TO-263) mechanical data, Figure 19: D²PAK (TO-263) drawing, Figure 20: D²PAK footprint Section 5: Packaging mechanical data has been updated: – Table 11: D²PAK (TO-263) tape and reel mechanical data, Figure 24: Tape, Figure 25: Reel. Minor text changes.

STB95N4F3, STD95N4F3, STP95N4F3

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