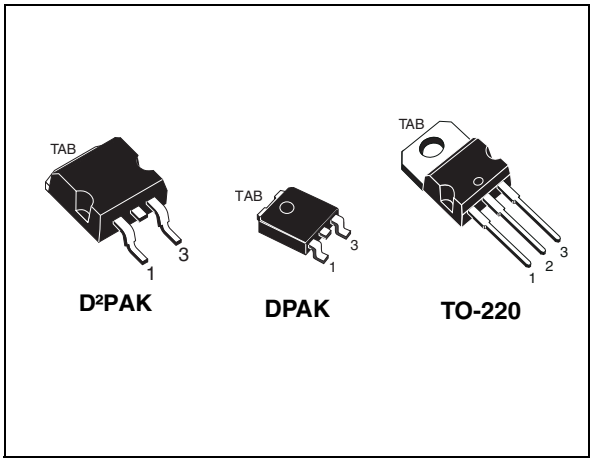
STB95N4F3, STD95N4F3 STP95N4F3

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	Pw
STB95N4F3	40 V	< 5.8 m Ω	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

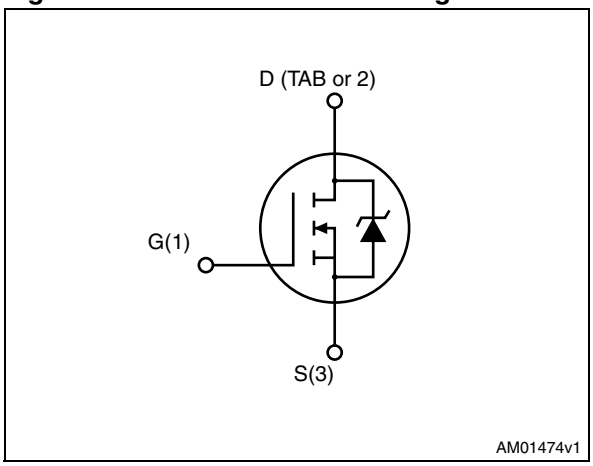


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB95N4F3	95N4F3	D²PAK	Tape and reel
STD95N4F3	95N4F3	DPAK	
STP95N4F3	95N4F3	TO-220	Tube

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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 °C	80	A
I_D	Drain current (continuous) at T_C = 100 °C	65	A
I_{DM} (2)	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at T_C = 25 °C	110	W
	Derating factor	0.73	W/°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	°C

1. Current limited by package.
2. Pulse width limited by safe operating area.
3. $I_{SD} \leq 80$ A, di/dt ≤ 400A/µs, $V_{DS} \leq V_{(BR)DSS}$, Tj $\leq$ Tjmax.
4. Starting Tj = 25 °C, I_D = 40 A, V_{DD} = 30 V.

Table 3. Thermal resistance

Symbol	Parameter	Value			Unit
		D²PAK	DPAK	TO-220	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.36			°C/W
$R_{thj\text{-}a}$	Thermal resistance junction-ambient max			62.5	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-ambient max	30	50		°C/W
T_l	Maximum lead temperature for soldering purpose			300	°C

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

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,Tc = 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} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25 V, f=1 MHz, V_{GS}=0	-	2200 580 40		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)*	-	40 11 8	54	nC nC nC

Table 6. 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 *(see Figure 16)*	-	15 50	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	V_{DD}=20 V, I_D= 40 A, R_G=4.7 Ω, V_{GS}=10 V *(see Figure 16)*	-	40 15	-	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)		-		80 320	A A
V_{SD} (2)	Forward on voltage	I_{SD}=80 A, V_{GS}=0	-		1.5	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}= 30 V, Tj=150 °C (see *Figure 15*)	-	45 60 2.8		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

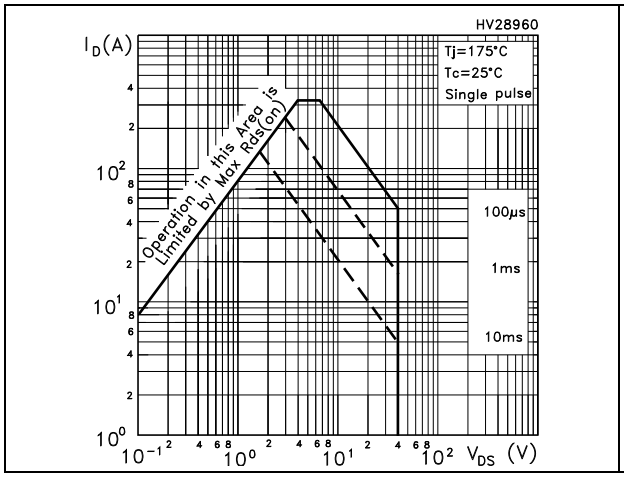


Figure 3. Thermal impedance

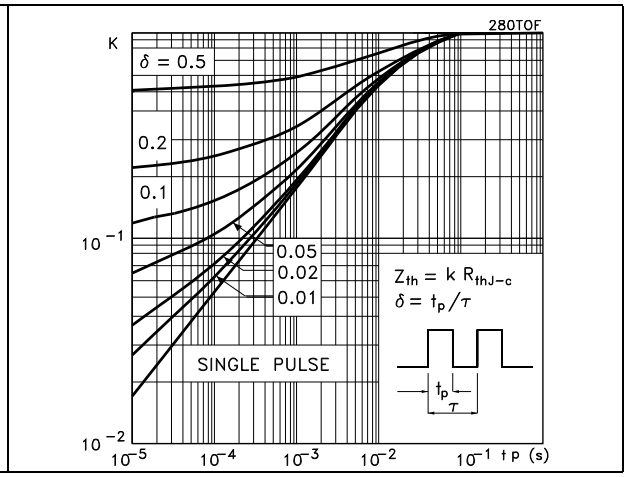


Figure 4. Output characteristics

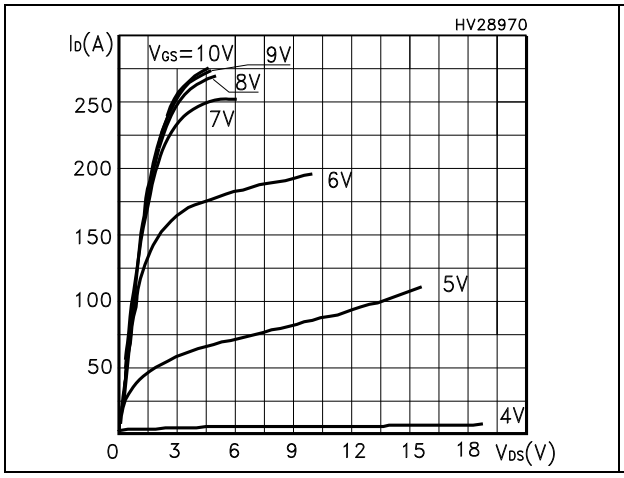


Figure 5. Transfer characteristics

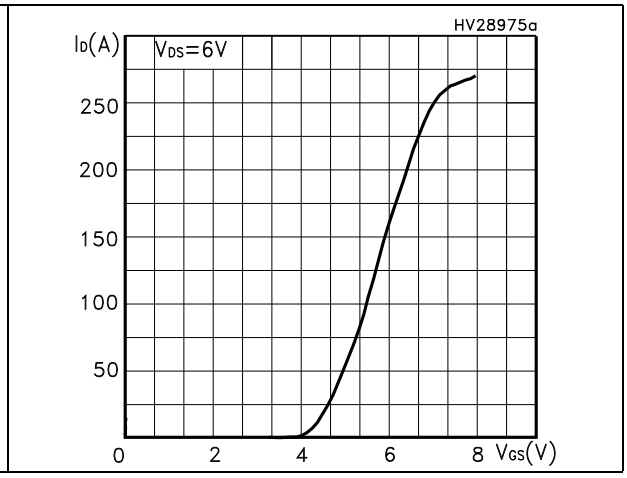


Figure 6. Static drain-source on resistance

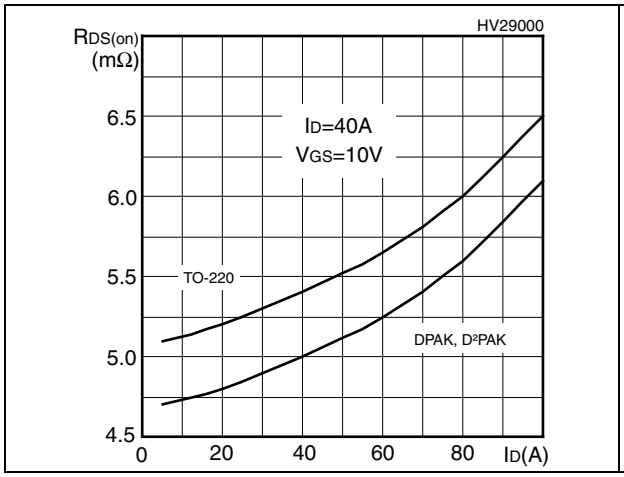


Figure 7. Normalized BVDSS vs temperature

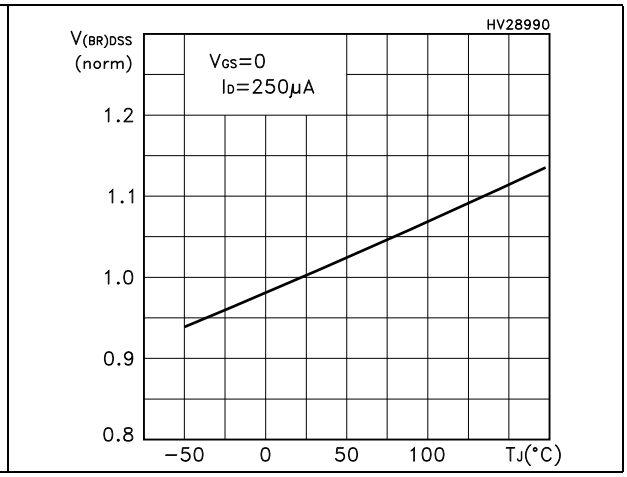


Figure 8. Gate charge vs gate-source voltage

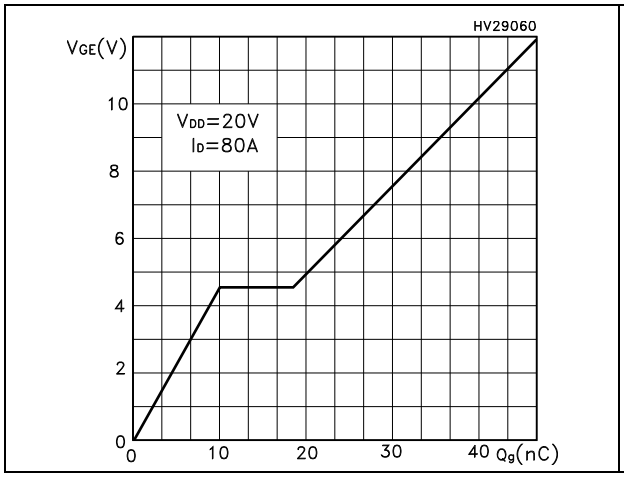


Figure 9. Capacitance variations

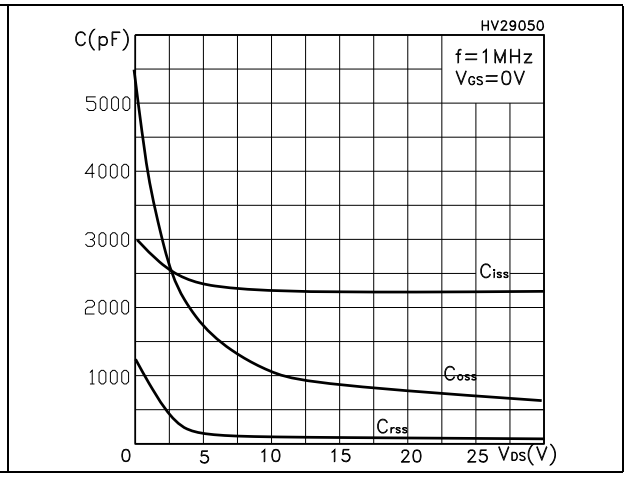


Figure 10. Normalized gate threshold voltage vs temperature

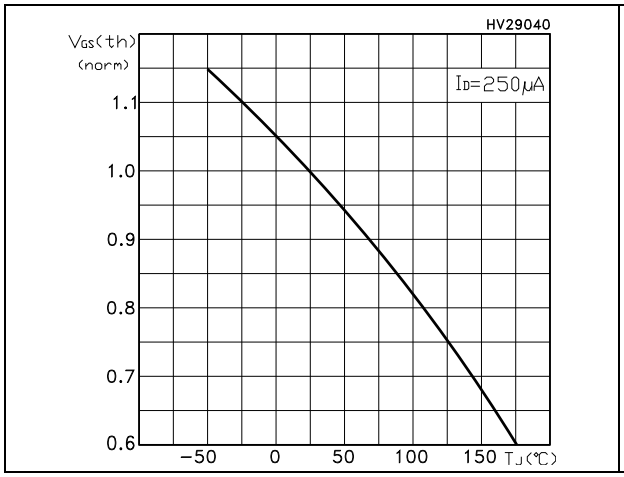


Figure 11. Normalized on resistance vs temperature

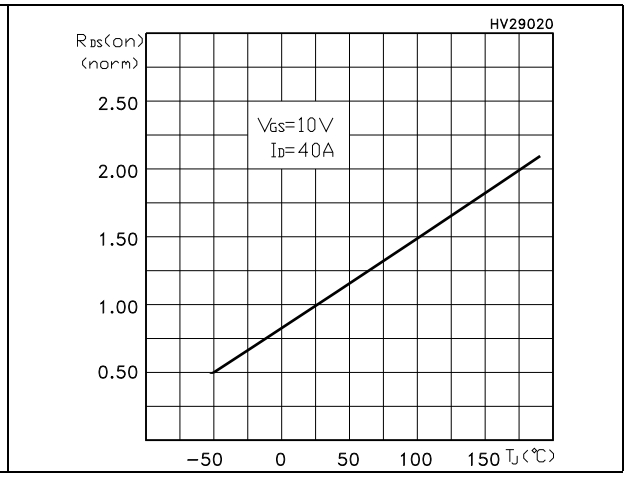
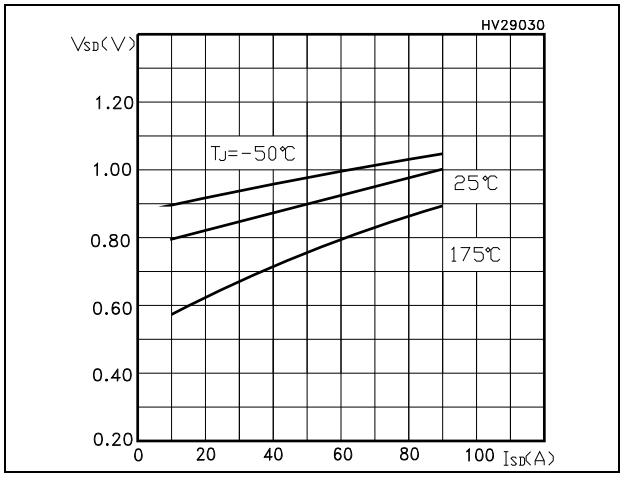


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

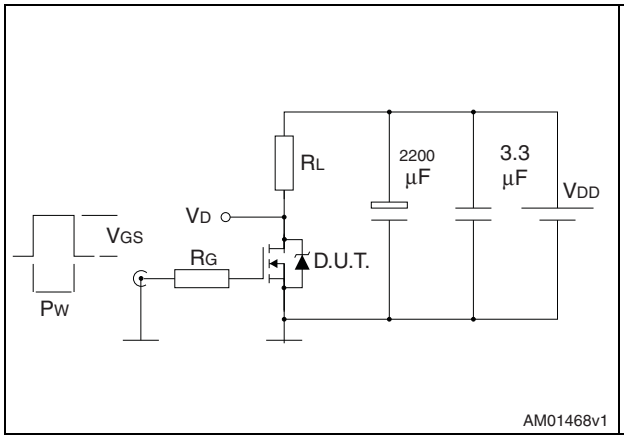


Figure 14. Gate charge test circuit

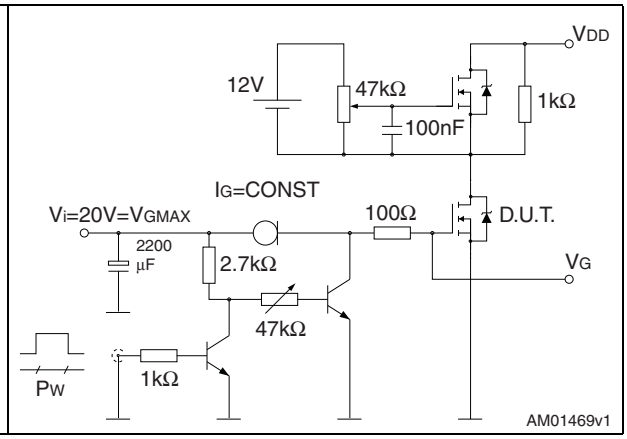


Figure 15. Test circuit for inductive load switching and diode recovery times

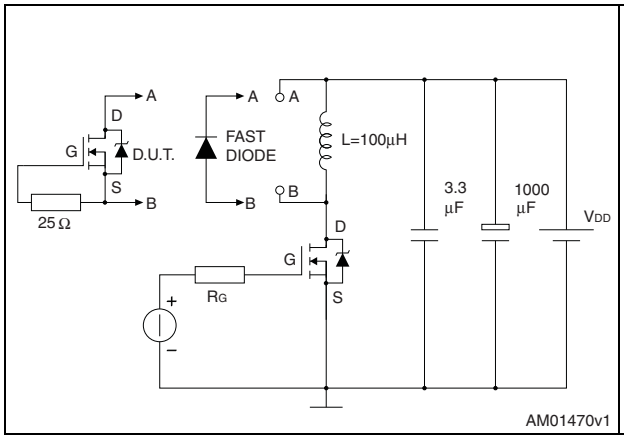


Figure 16. Unclamped inductive load test circuit

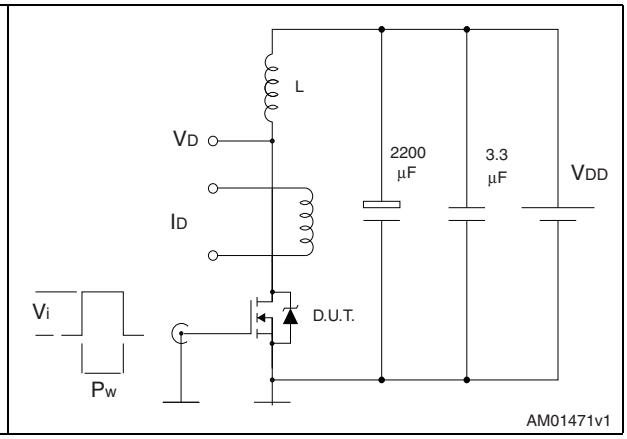


Figure 17. Unclamped inductive waveform

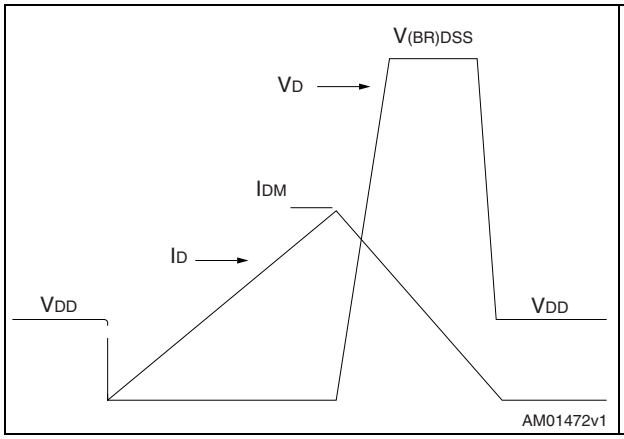
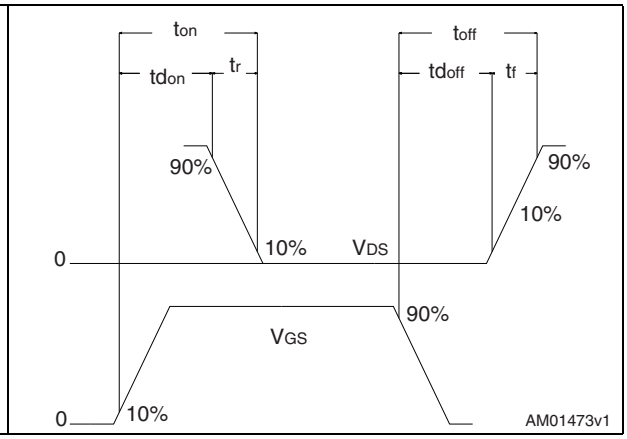


Figure 18. Switching time waveform



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.

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°

Figure 19. D²PAK (TO-263) drawing

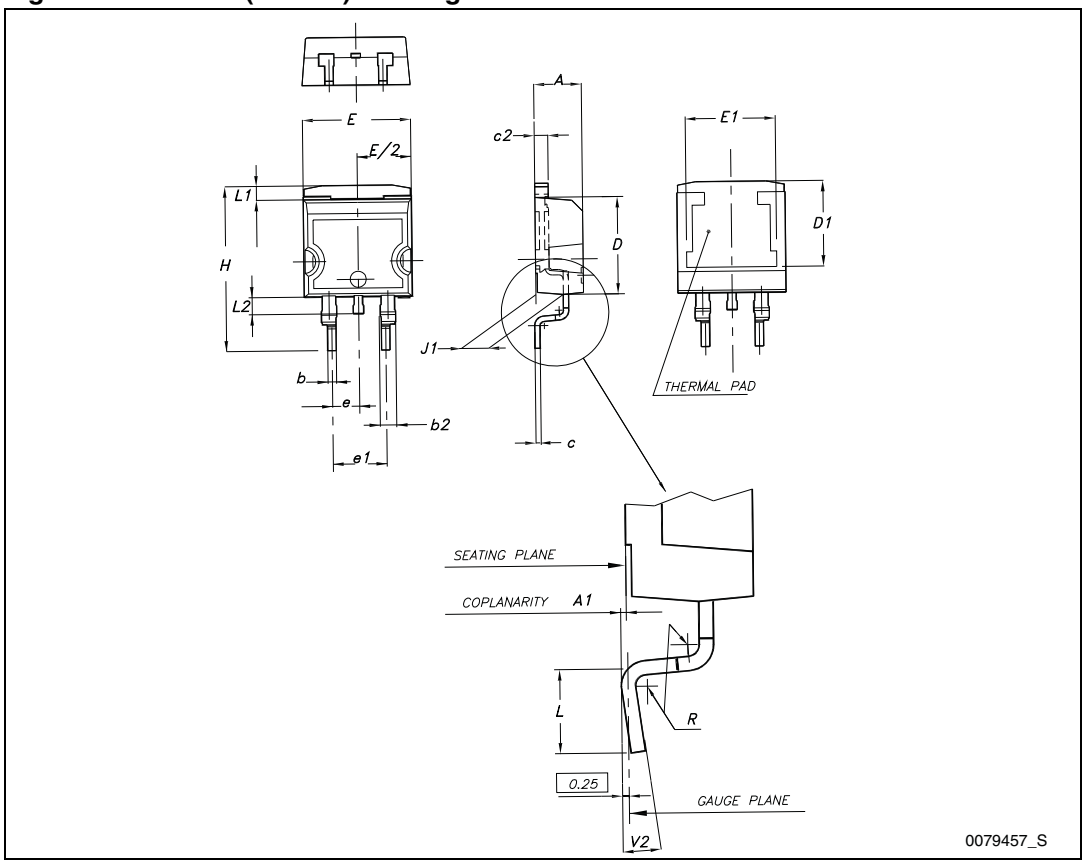
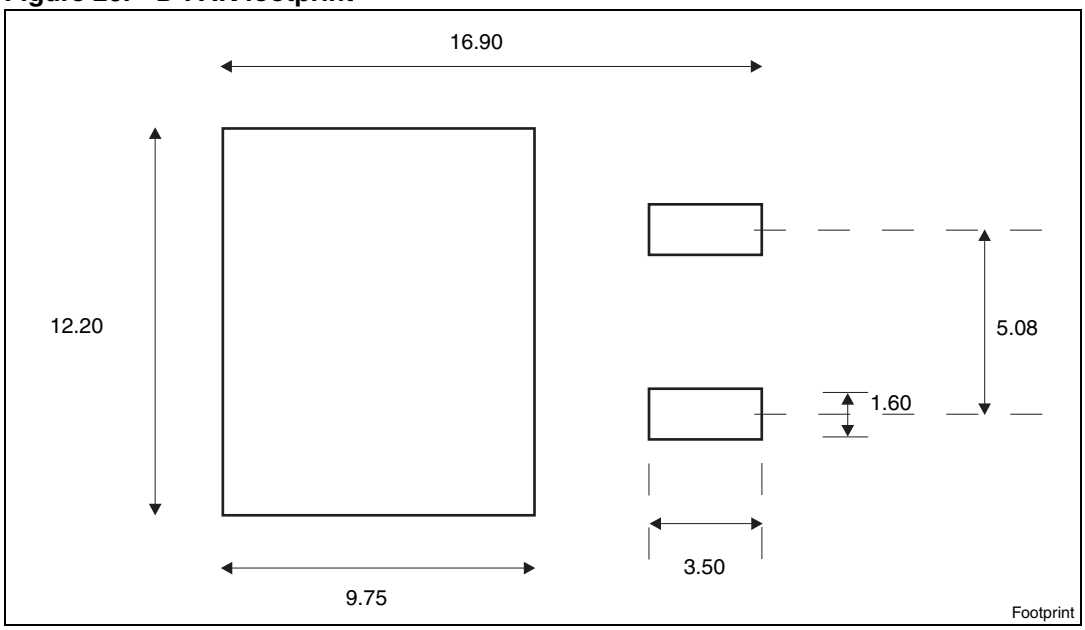


Figure 20. D²PAK footprint[a]



a. All dimension are in millimeters

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 21. DPAK (TO-252) drawing

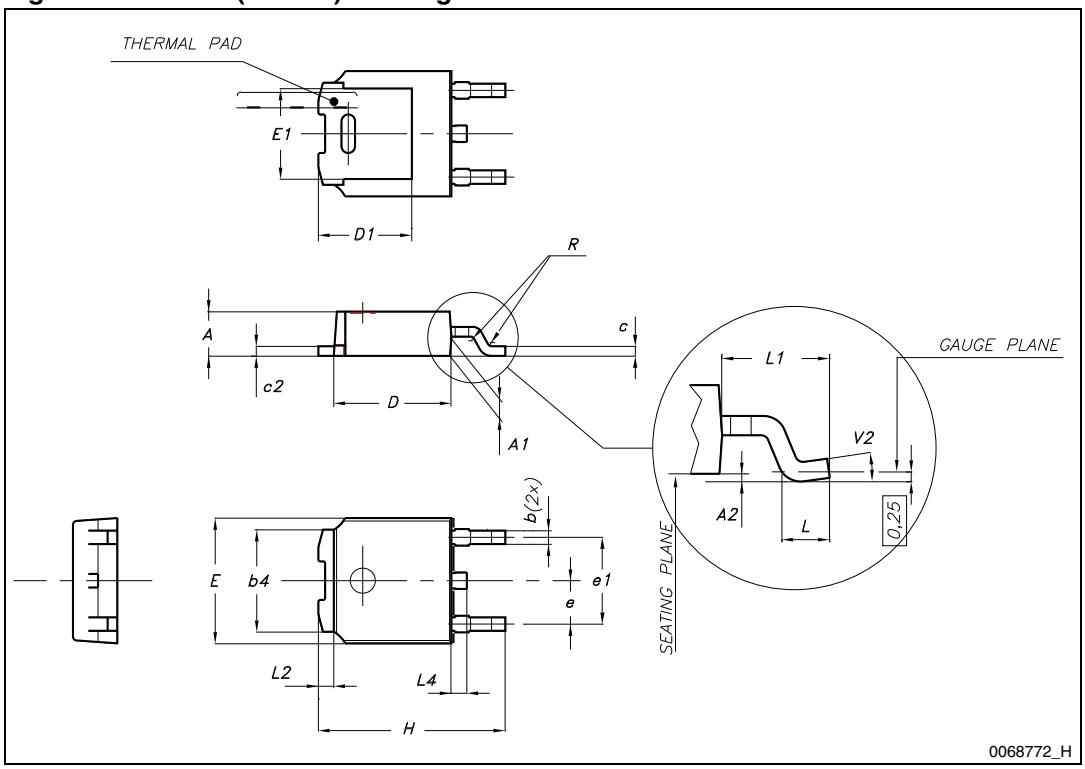
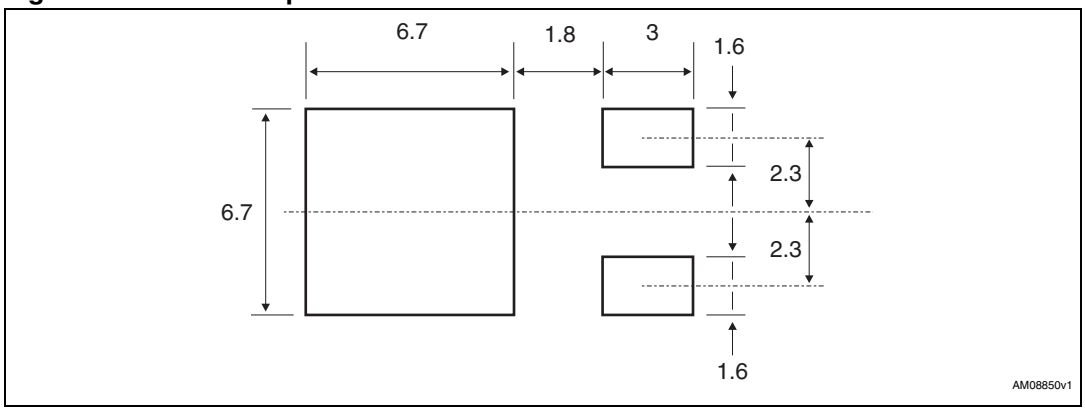


Figure 22. DPAK footprint[(b)]

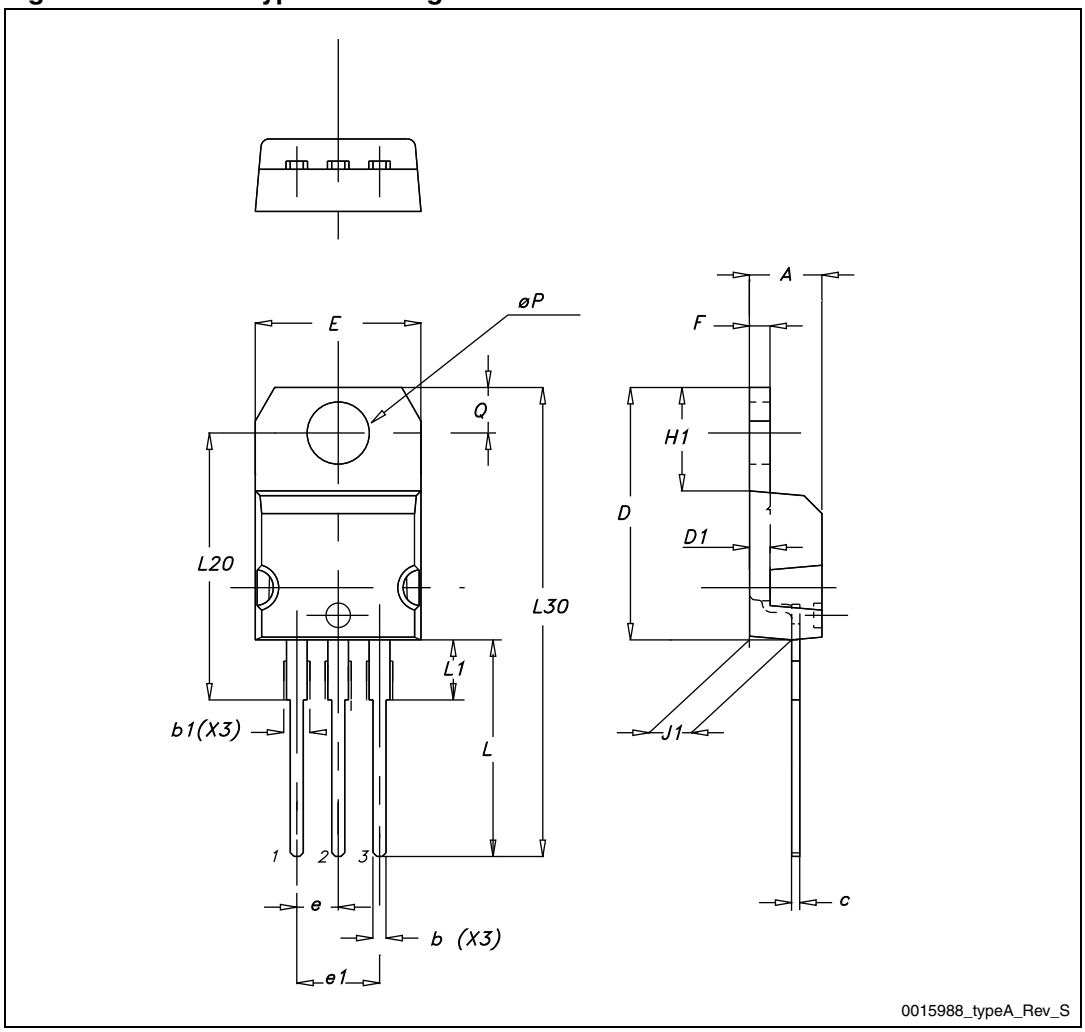


b. All dimension are in millimeters

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	
∅P	3.75		3.85
Q	2.65		2.95

Figure 23. TO-220 type A drawing



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			

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			

Figure 24. Tape

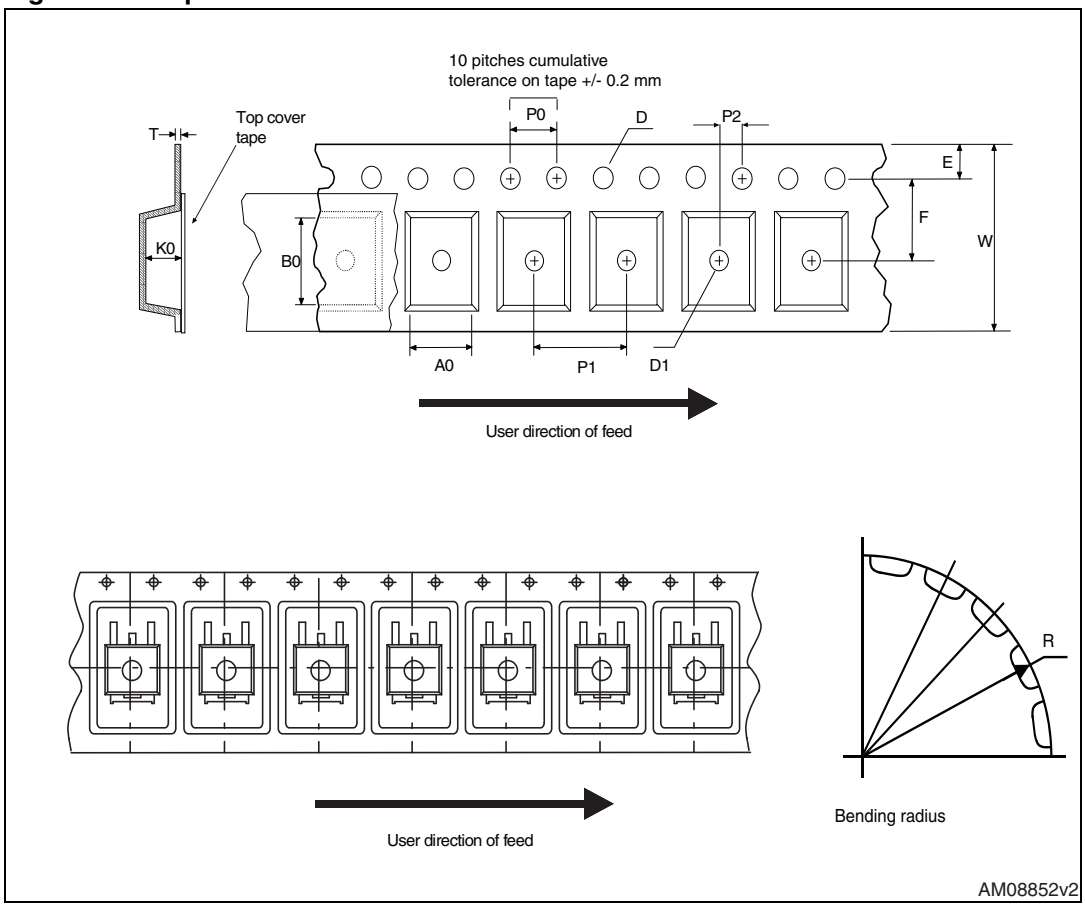
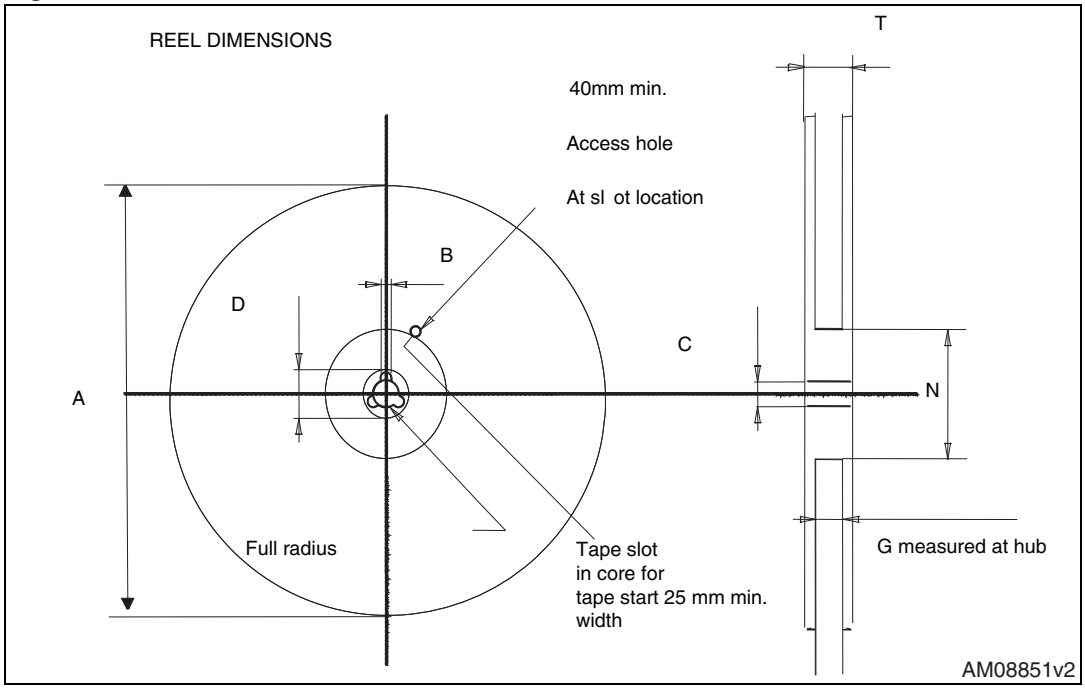


Figure 25. Reel



6 Revision history

Table 13. Dcument 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.

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