STH320N4F6-2, STH320N4F6-6

N-channel 40 V, 1.1 mΩ typ., 200 A, H²PAK-2, H²PAK-6 STripFET™ VI DeepGATE™ Power MOSFET

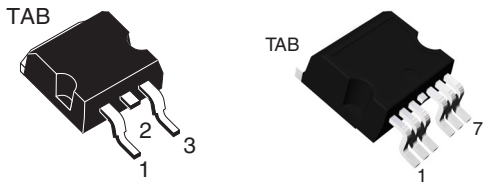
Datasheet — production data

Features

Order codes	V_{DS}	$R_{DS(on)}$ max	I_D(1)
STH320N4F6-2	40 V	1.3 mΩ	200 A
STH320N4F6-6			

1. Current limited by package.

- Standard threshold drive
- 100% avalanche tested



H²PAK-2 H²PAK-6

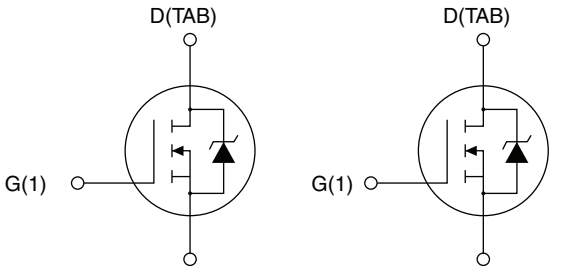
Applications

- Automotive switching applications

Description

These devices are N-channel Power MOSFETs developed using the 6th generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFETs exhibits the lowest $R_{DS(on)}$ in all packages.

Figure 1. Internal schematic diagram



H²PAK-2 H²PAK-6

Table 1. Device summary

Order codes	Marking	Package	Packaging
STH320N4F6-2	320N4F6	H²PAK-2	Tape and reel
STH320N4F6-6		H²PAK-6	

Contents

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	200	A
I_D (1)	Drain current (continuous) at T_C = 100 °C	200	A
I_{DM} (2)	Drain current (pulsed)	800	A
P_{TOT}	Total dissipation at T_C = 25 °C,	300	W
	Derating factor	2	W/°C
I_{AV}	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{j\ max}$)	160	A
E_{AS}	Single pulse avalanche energy (starting T_J=25 °C, I_D=I_{AV}, V_{DD}=35 V)	1100	mJ
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Operating junction temperature		

1. The value is rated according $R_{thj\text{-}c}$, current limited by package.
2. Pulse is rated according SOA.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.5	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb max	35	°C/W

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

2 Electrical characteristics

(Tcase = 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 = 250 µA	40			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 40 V, V_{DS} = 40 V, T_C=125 °C			1 100	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	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10 V, I_D= 80 A		1.1	1.3	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} = 15 V, f = 1 MHz, V_{GS} =0	-	13800 1870 1095	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}= 20 V, I_D= 160 A, V_{GS}= 10 V *(see Figure 14)*	-	240 59 75.2	-	nC nC nC

Table 6. Switching times

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 = 80 A R_G= 4.7 Ω V_{GS}= 10 V, *(see Figure 13)*	-	28 98	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time		-	190 95	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SD} (1)	Source-drain current Source-drain current (pulsed)		-		200 800	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 80 A, V_{GS} = 0	-		1.1	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 160 A,di/dt = 100 A/µs V_{DD} = 32 V, T_j = 25 °C *(see Figure 15)*	-	58.7 99.2 3.38		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

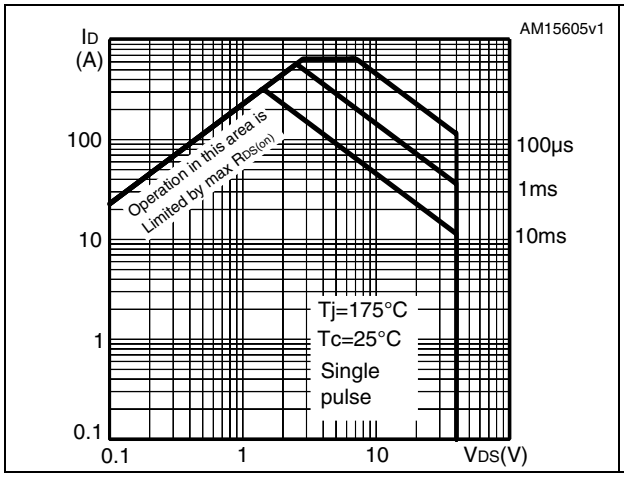


Figure 3. Thermal impedance

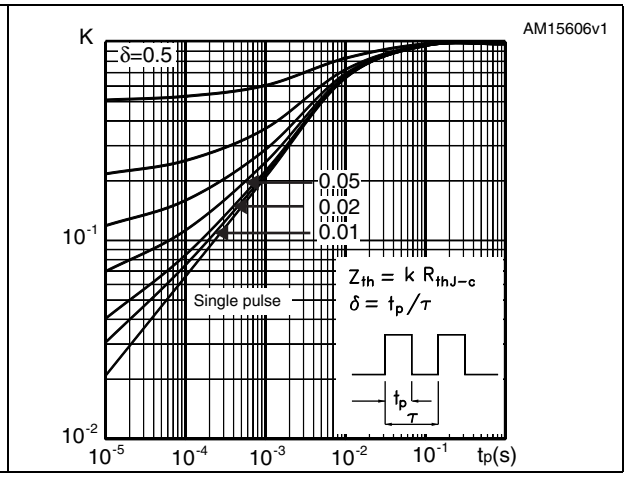


Figure 4. Output characteristics

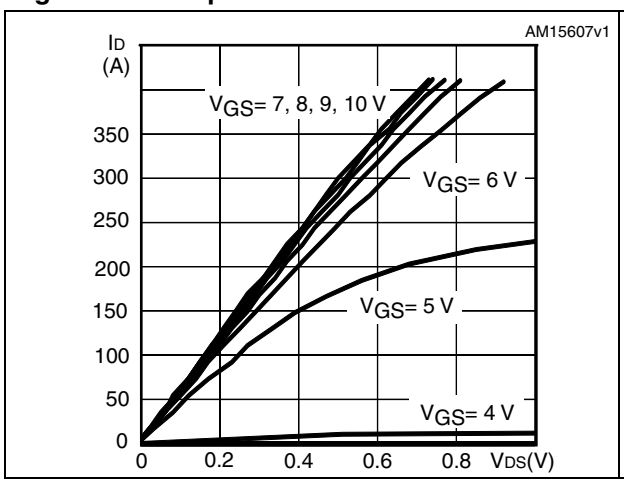


Figure 5. Transfer characteristics

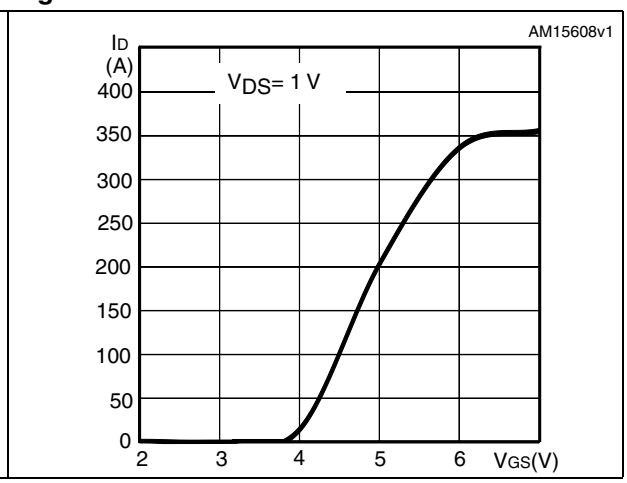


Figure 6. Gate charge vs gate-source voltage

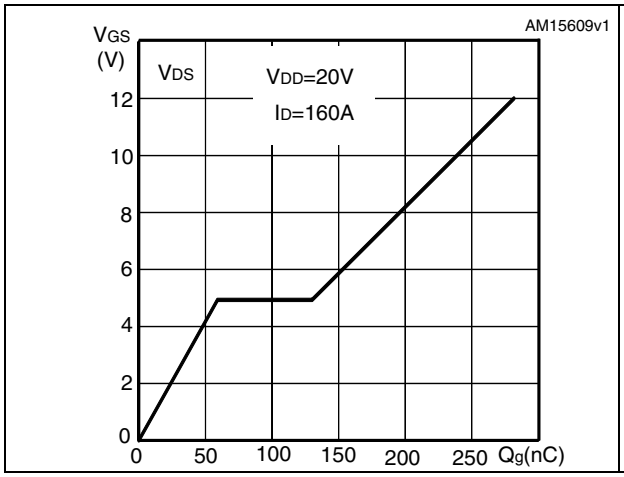


Figure 7. Static drain-source on-resistance

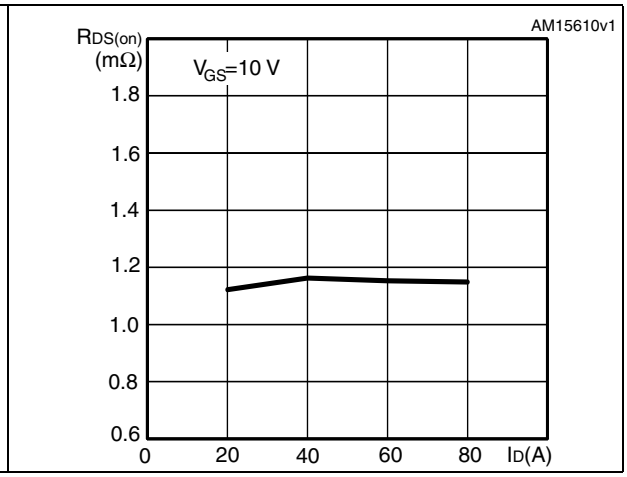


Figure 8. Capacitance variations

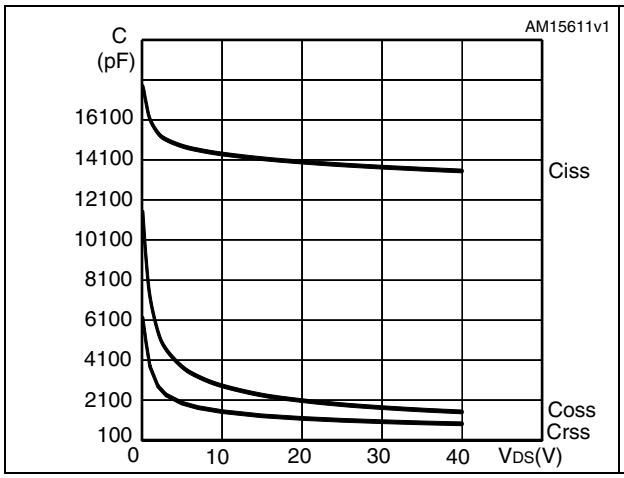


Figure 9. Drain-source diode forward characteristics

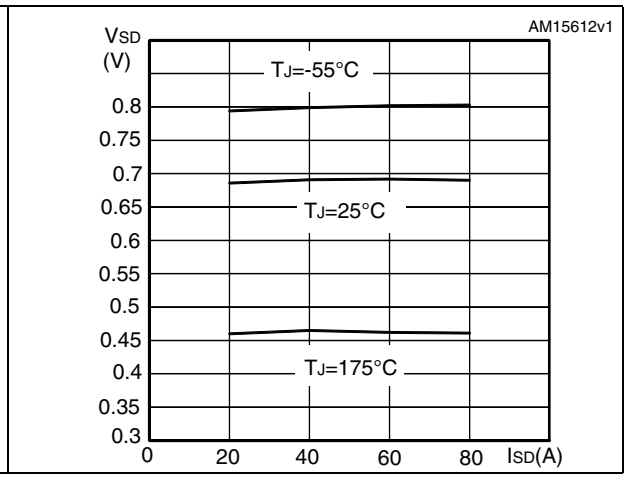


Figure 10. Normalized gate threshold voltage vs temperature

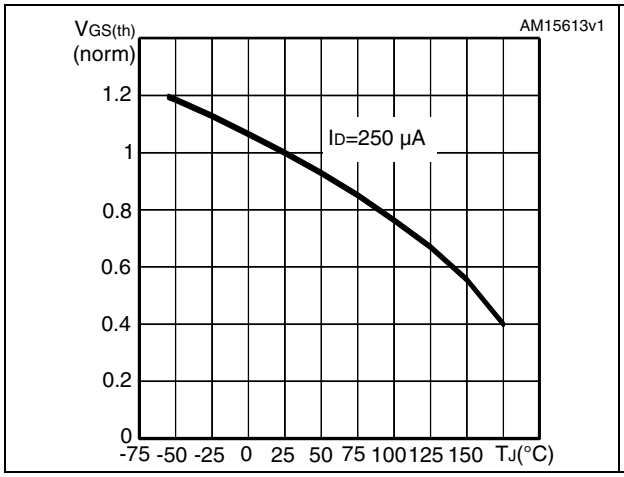


Figure 11. Normalized on-resistance vs temperature

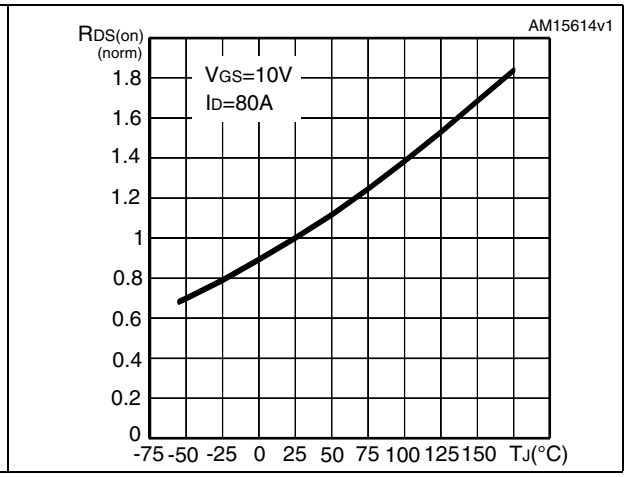
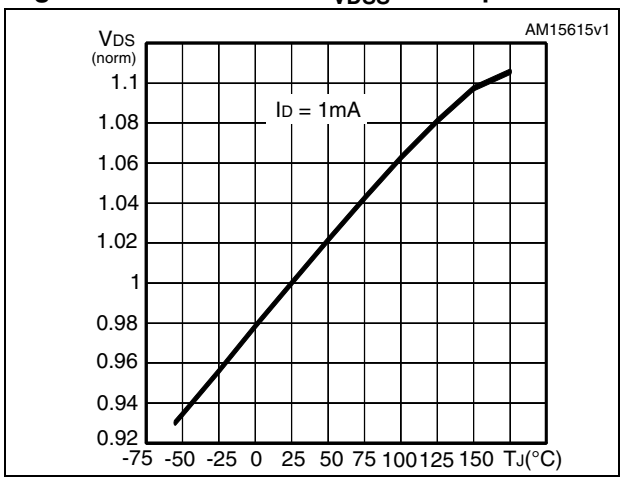


Figure 12. Normalized B_{VDSS} vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

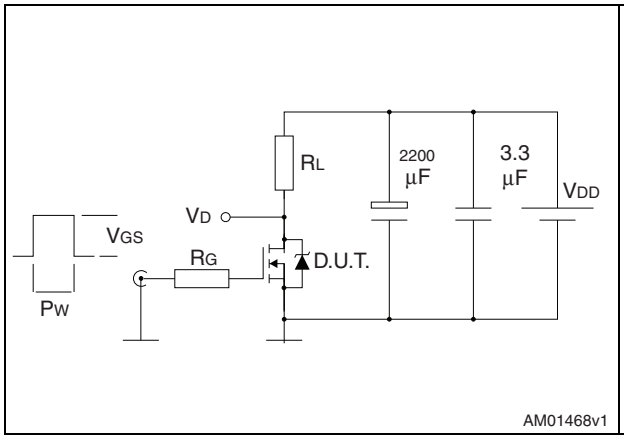


Figure 14. Gate charge test circuit

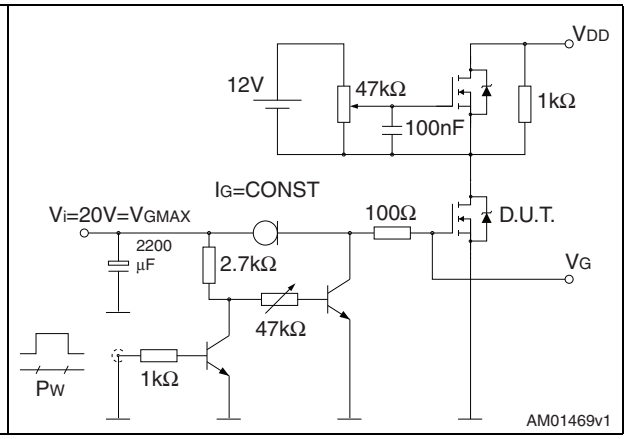


Figure 15. Test circuit for inductive load switching and diode recovery times

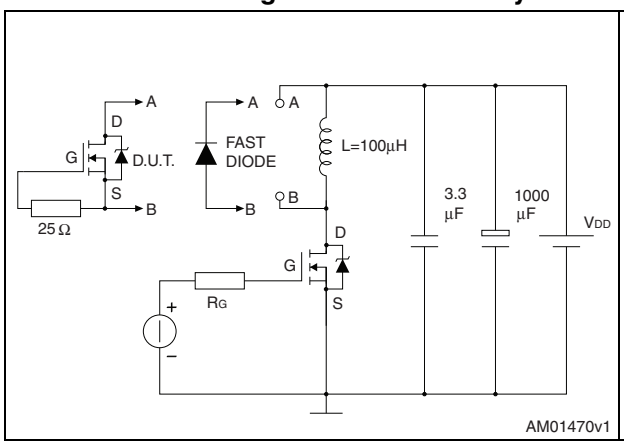


Figure 16. Unclamped inductive load test circuit

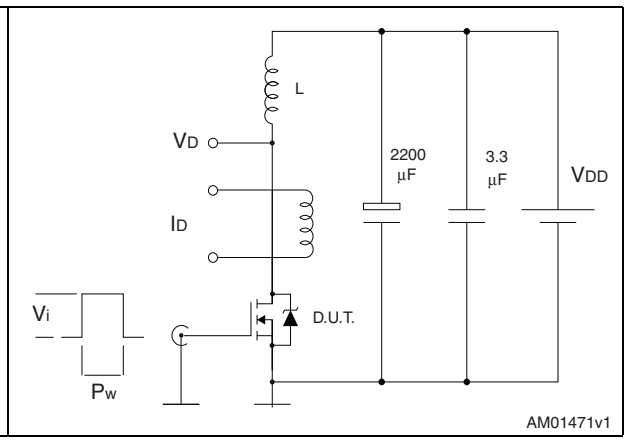


Figure 17. Unclamped inductive waveform

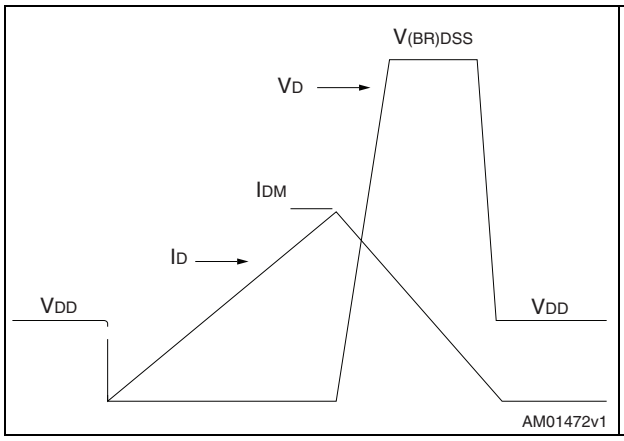
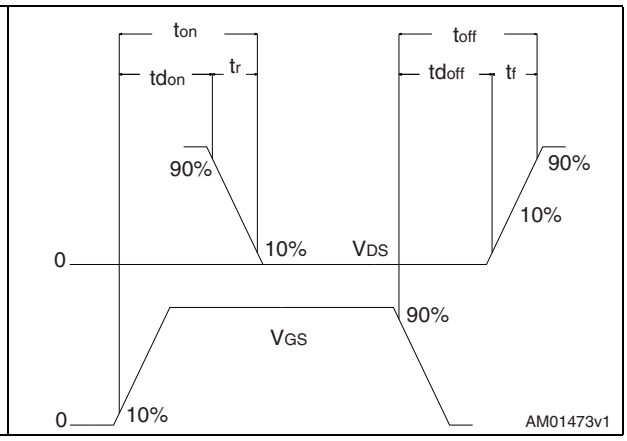


Figure 18. Switching time waveform



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. H²PAK-2 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30	-	4.80
A1	0.03		0.20
C	1.17		1.37
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
H	10.00		10.40
H1	7.40		7.80
L	15.30		15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.5		1.7
M	2.6		2.9
R	0.20		0.60
V	0°		8°

Figure 19. H²PAK-2 drawing

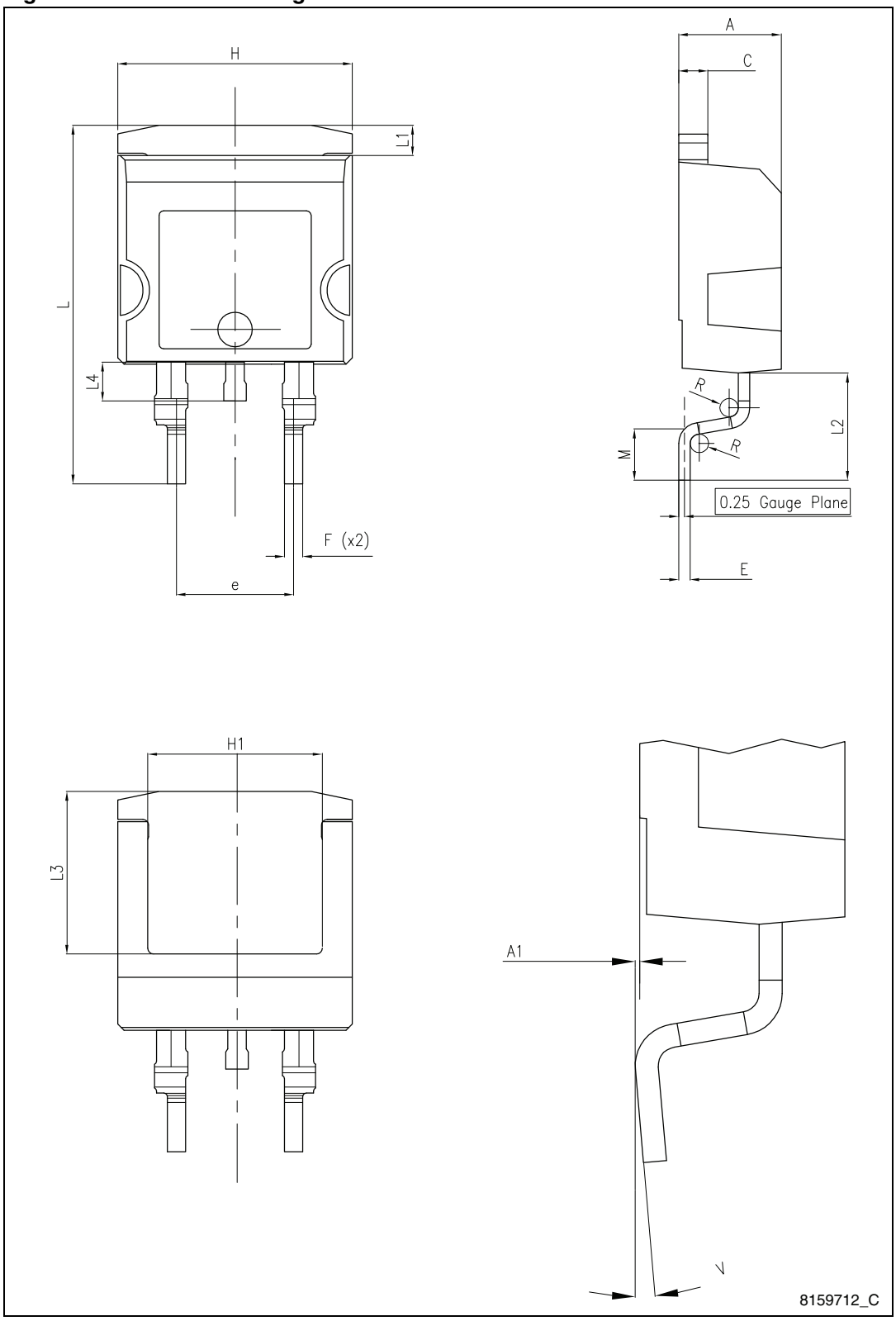


Figure 20. H²PAK-2 recommended footprint

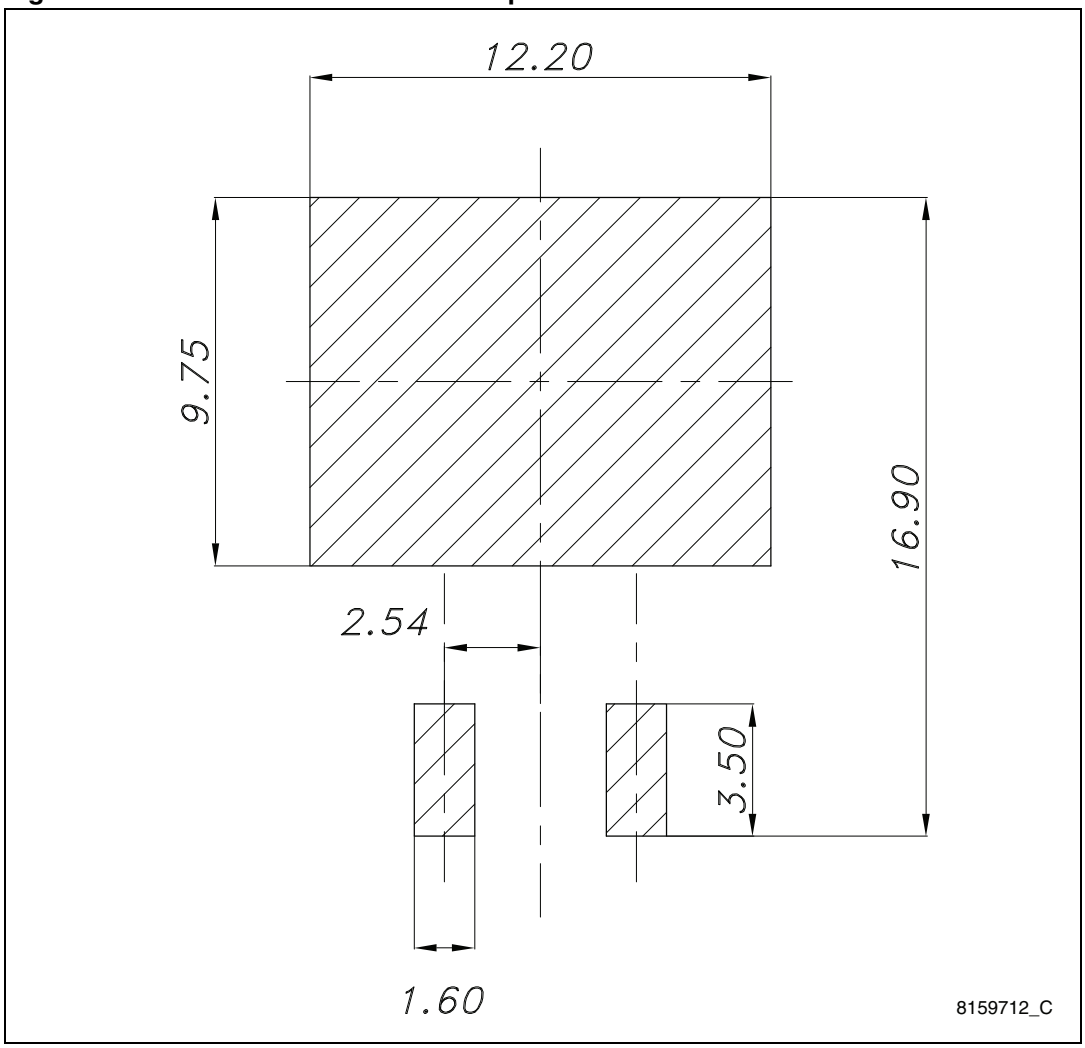


Table 9. H²PAK-6 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.80
A1	0.03		0.20
C	1.17		1.37
e	2.34		2.74
e1	4.88		5.28
e2	7.42		7.82
E	0.45		0.60
F	0.50		0.70
H	10.00	-	10.40
H1	7.40		7.80
L	14.75		15.25
L1	1.27		1.40
L2	4.35		4.95
L3	6.85		7.25
L4	1.5		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 21. H²PAK-6 drawing

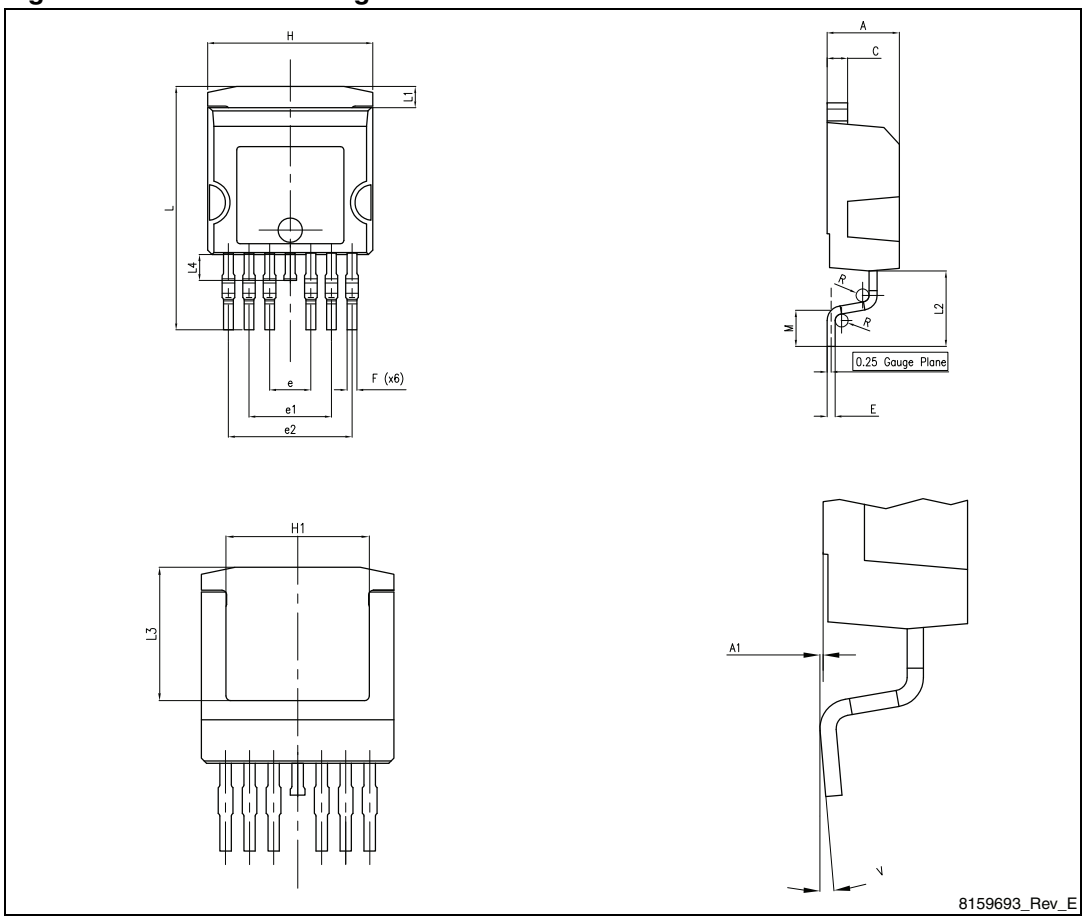
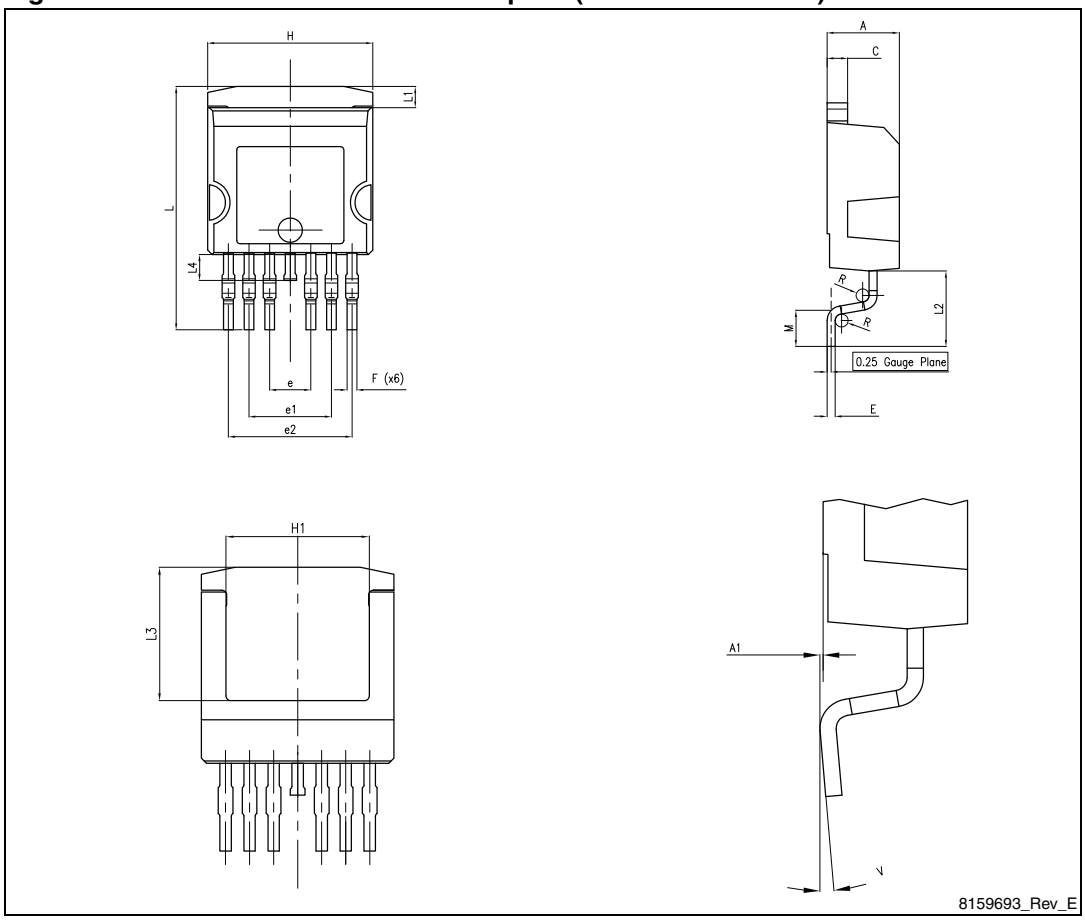


Figure 22. H²PAK-6 recommended footprint (dimensions in mm)



5 Packaging mechanical data

Table 10. 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			

Figure 23. Tape

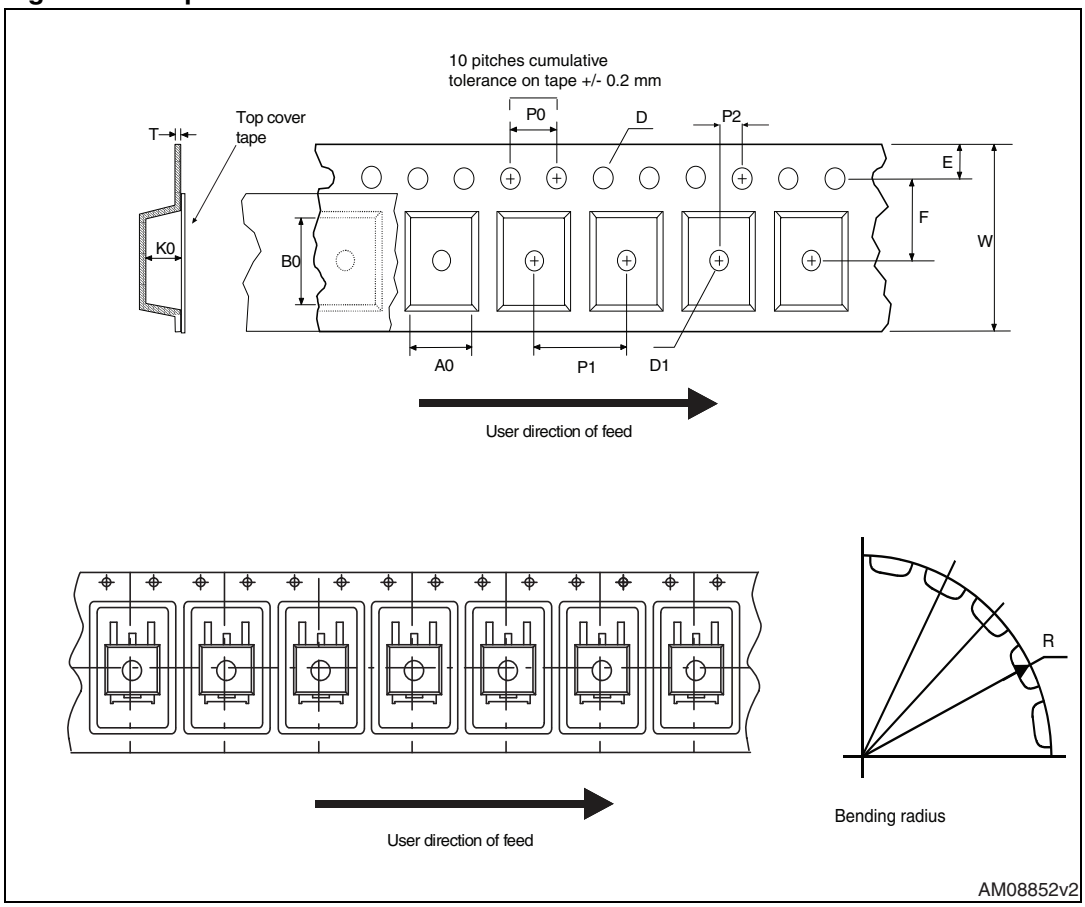
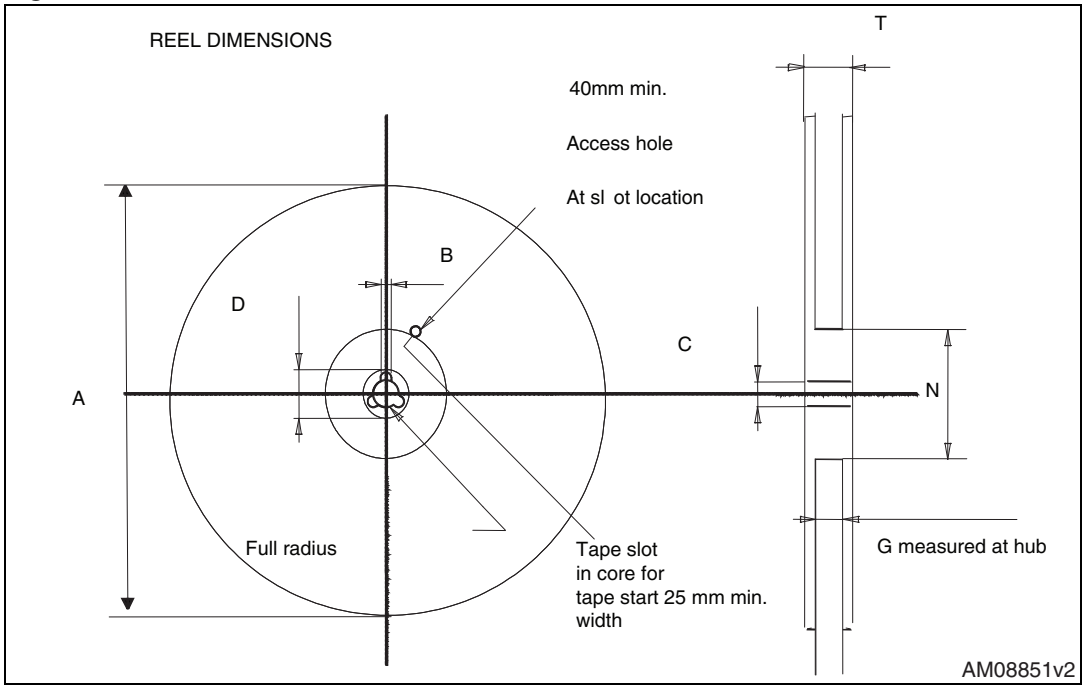


Figure 24. Reel



6 Revision history

Table 11. Document revision history

Date	Revision	Changes
01-Feb-2013	1	First release.

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