



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

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.

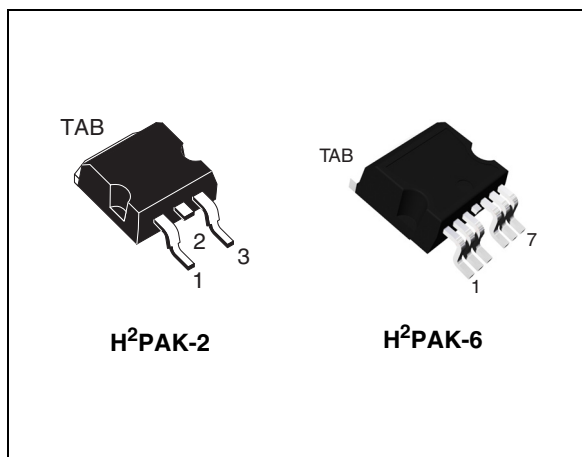


Figure 1. Internal schematic diagram

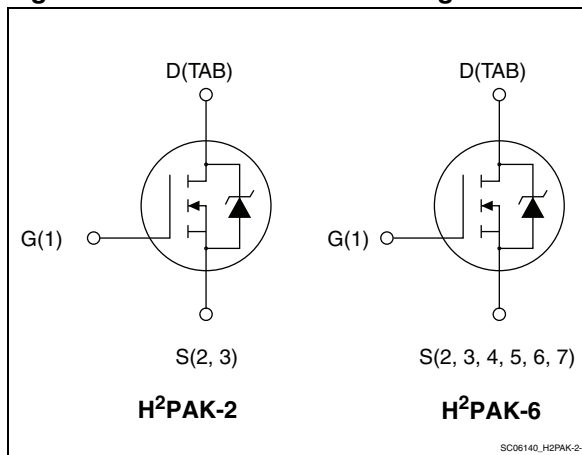


Table 1. Device summary

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

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

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

Table 3. Thermal data

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

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

2 Electrical characteristics

(T_{case} = 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}	Source-drain current		-		200	A
$I_{SD}^{(1)}$	Source-drain current (pulsed)				800	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 80 \text{ A}, V_{GS} = 0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 160 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$		58.7		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 32 \text{ V}, T_j = 25 \text{ }^\circ\text{C}$	-	99.2		nC
I_{RRM}	Reverse recovery current	(see Figure 15)		3.38		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

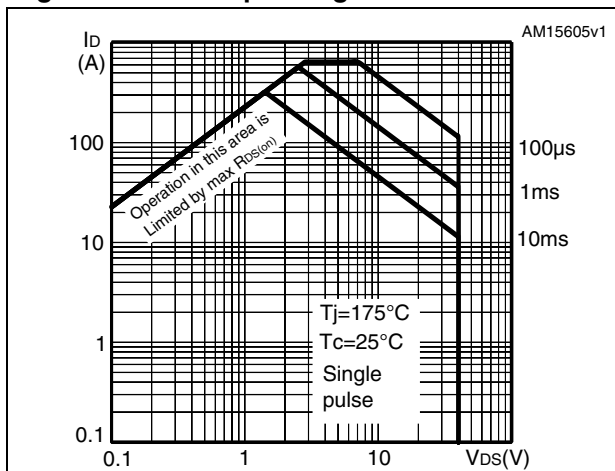


Figure 3. Thermal impedance

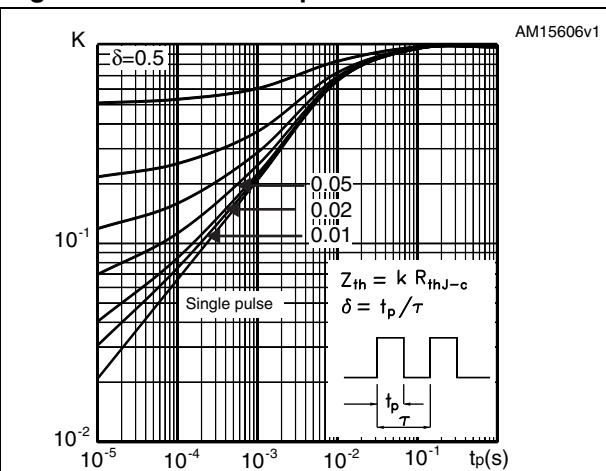


Figure 4. Output characteristics

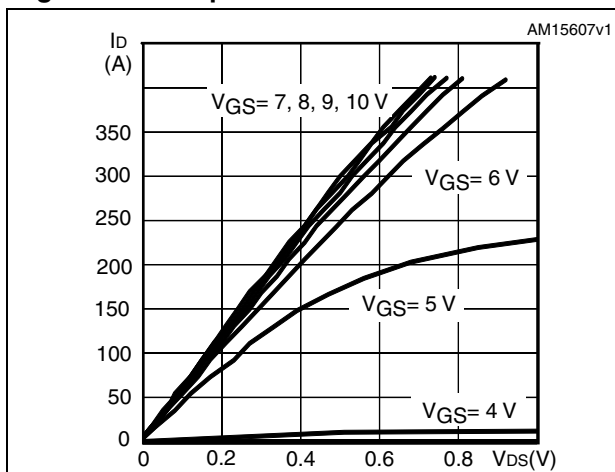


Figure 5. Transfer characteristics

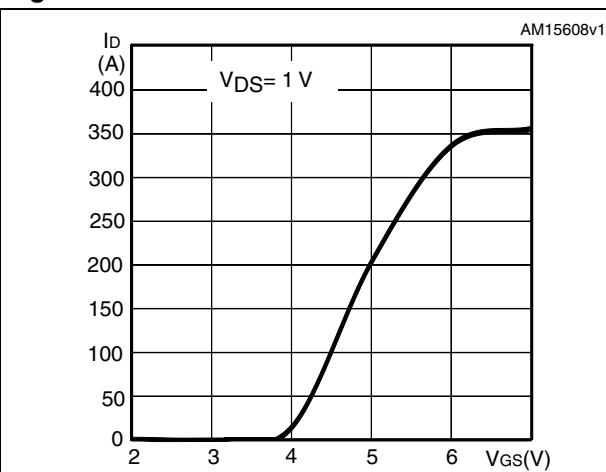


Figure 6. Gate charge vs gate-source voltage

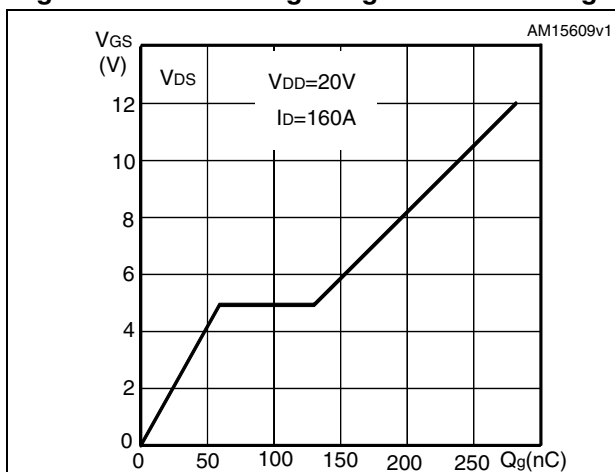


Figure 7. Static drain-source on-resistance

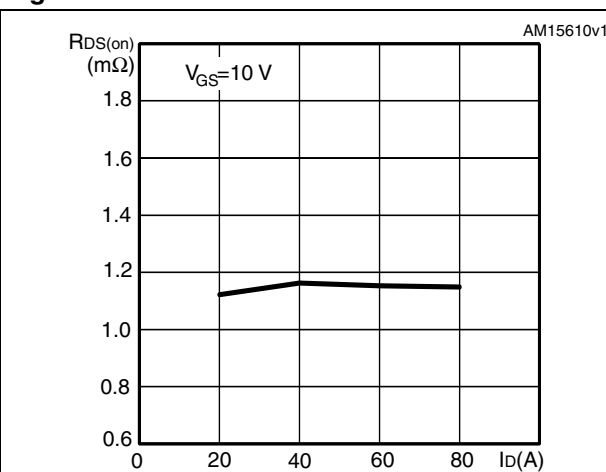


Figure 8. Capacitance variations

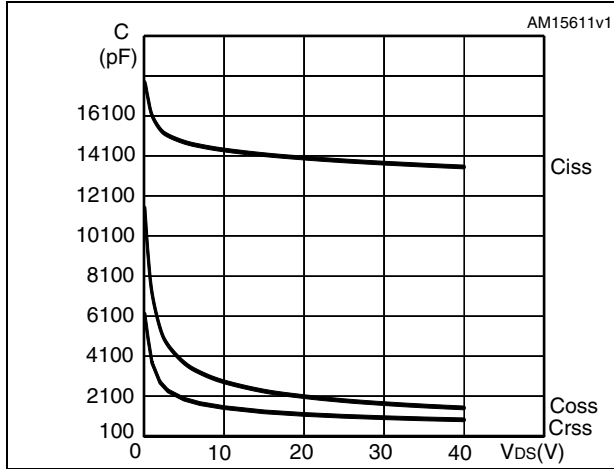


Figure 9. Drain-source diode forward characteristics

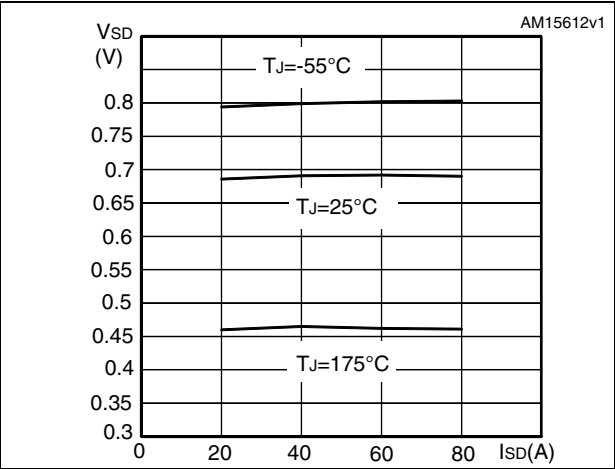


Figure 10. Normalized gate threshold voltage vs temperature

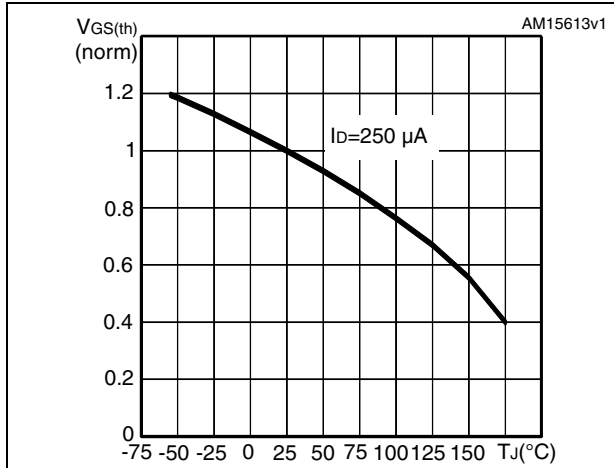


Figure 11. Normalized on-resistance vs temperature

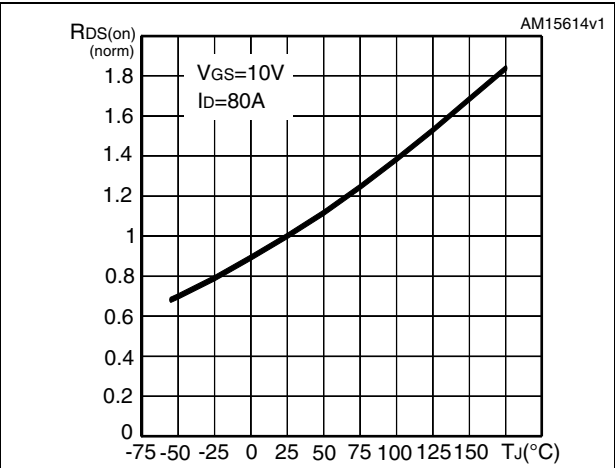
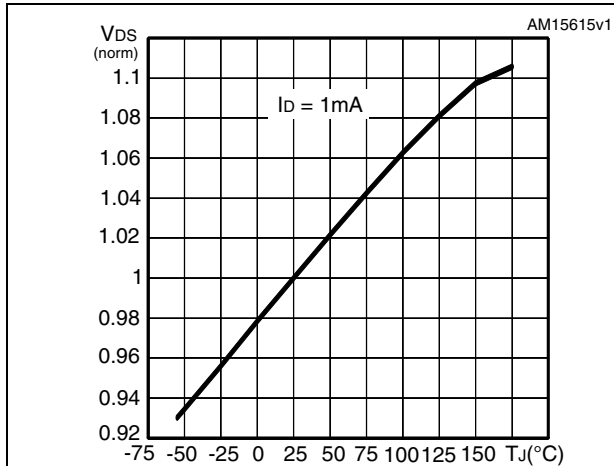
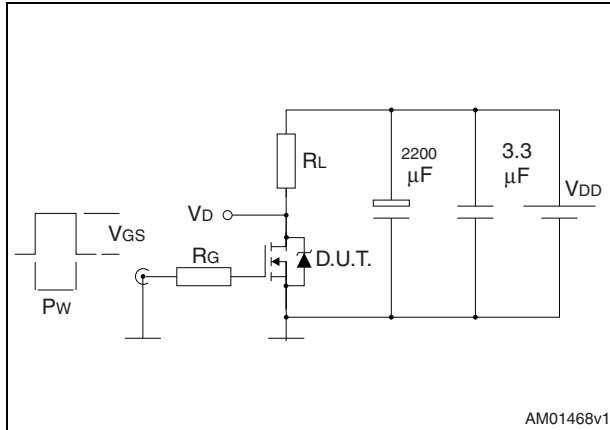


Figure 12. Normalized BV_{DSS} vs temperature



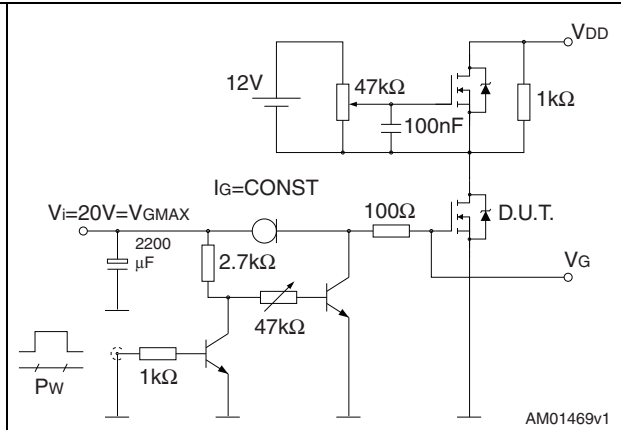
3 Test circuits

Figure 13. Switching times test circuit for resistive load



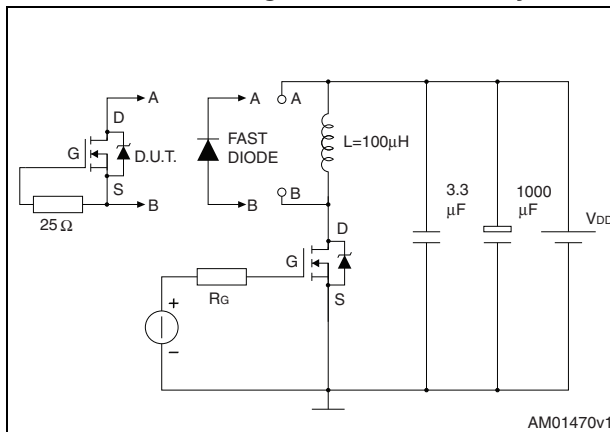
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Figure 14. Gate charge test circuit



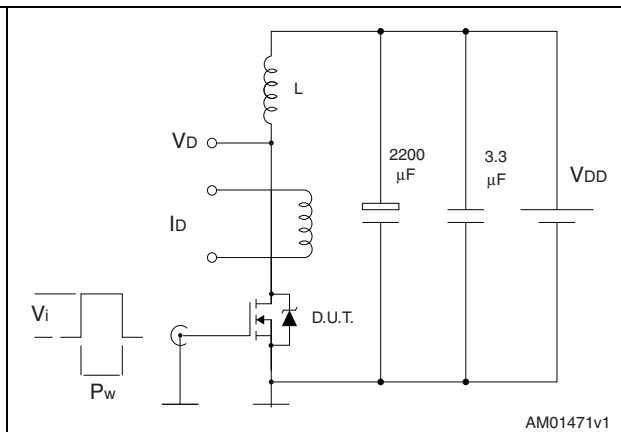
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Figure 15. Test circuit for inductive load switching and diode recovery times



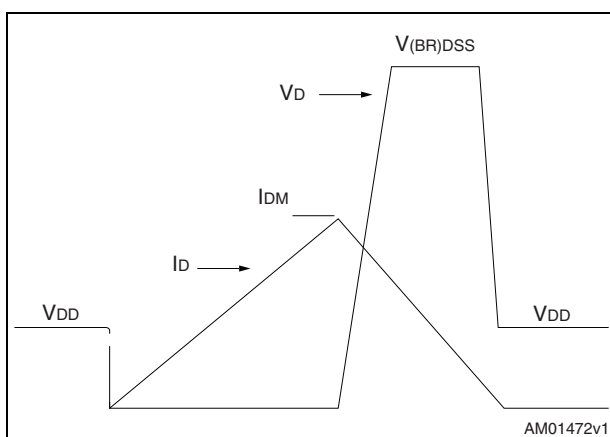
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Figure 16. Unclamped inductive load test circuit



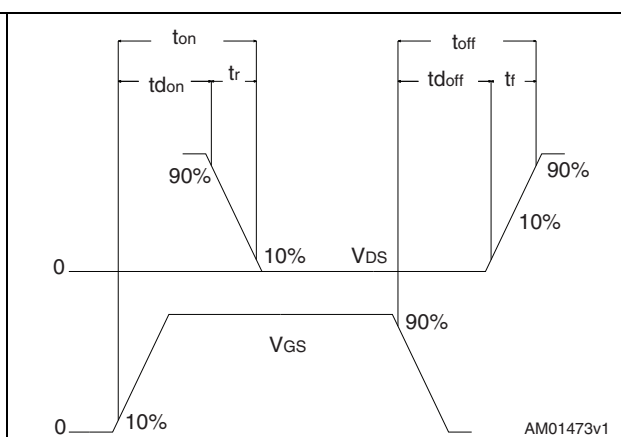
AM01471v1

Figure 17. Unclamped inductive waveform



AM01472v1

Figure 18. 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 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

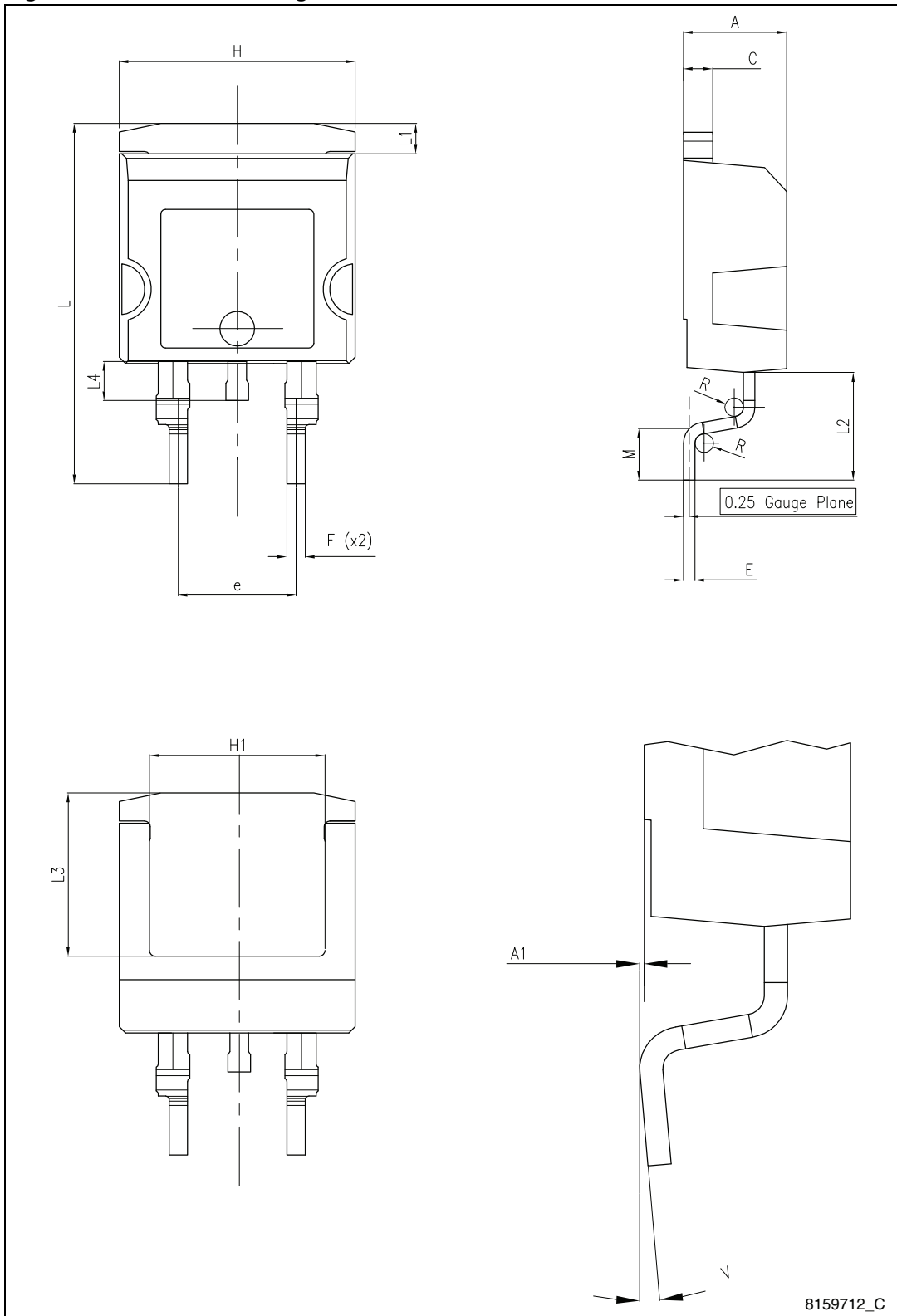
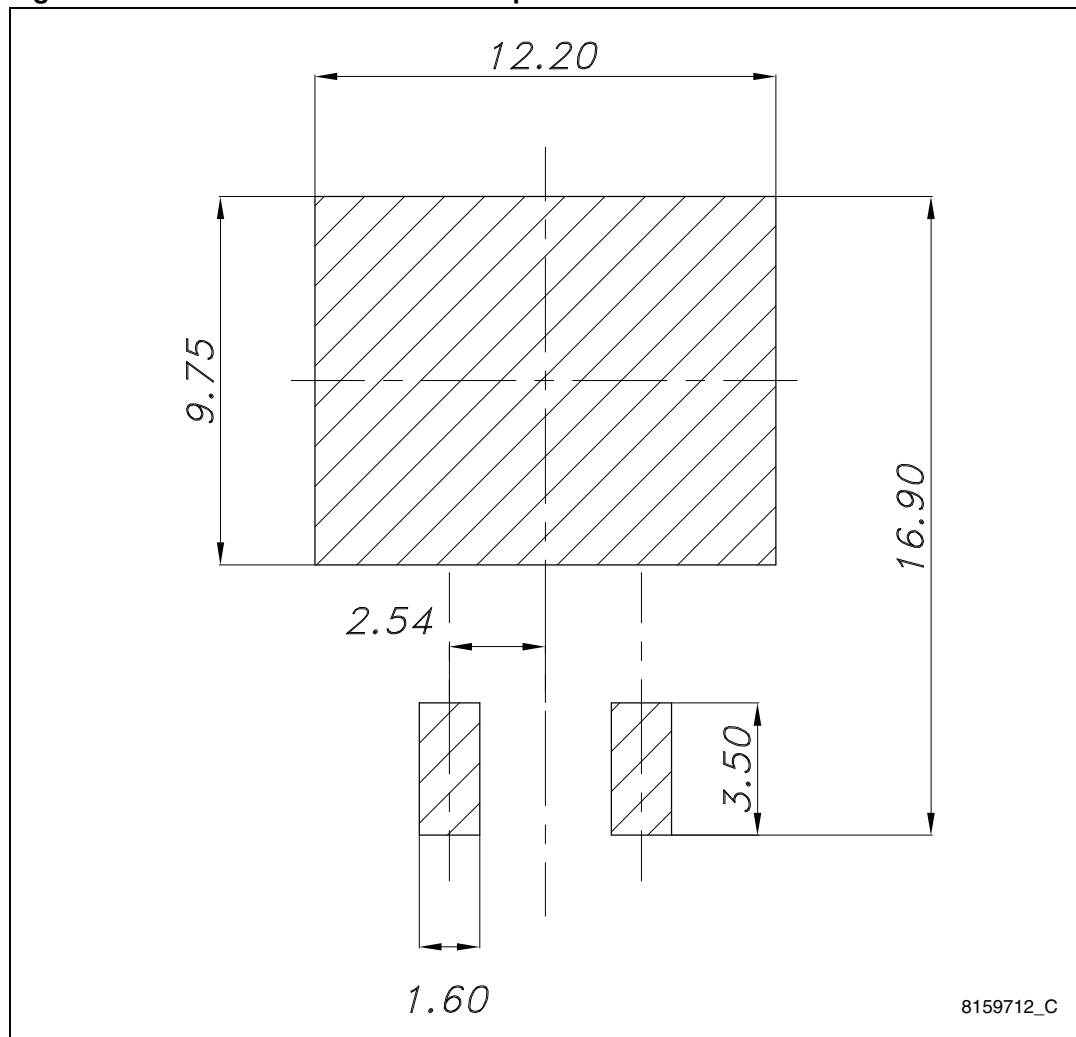


Figure 20. H²PAK-2 recommended footprint

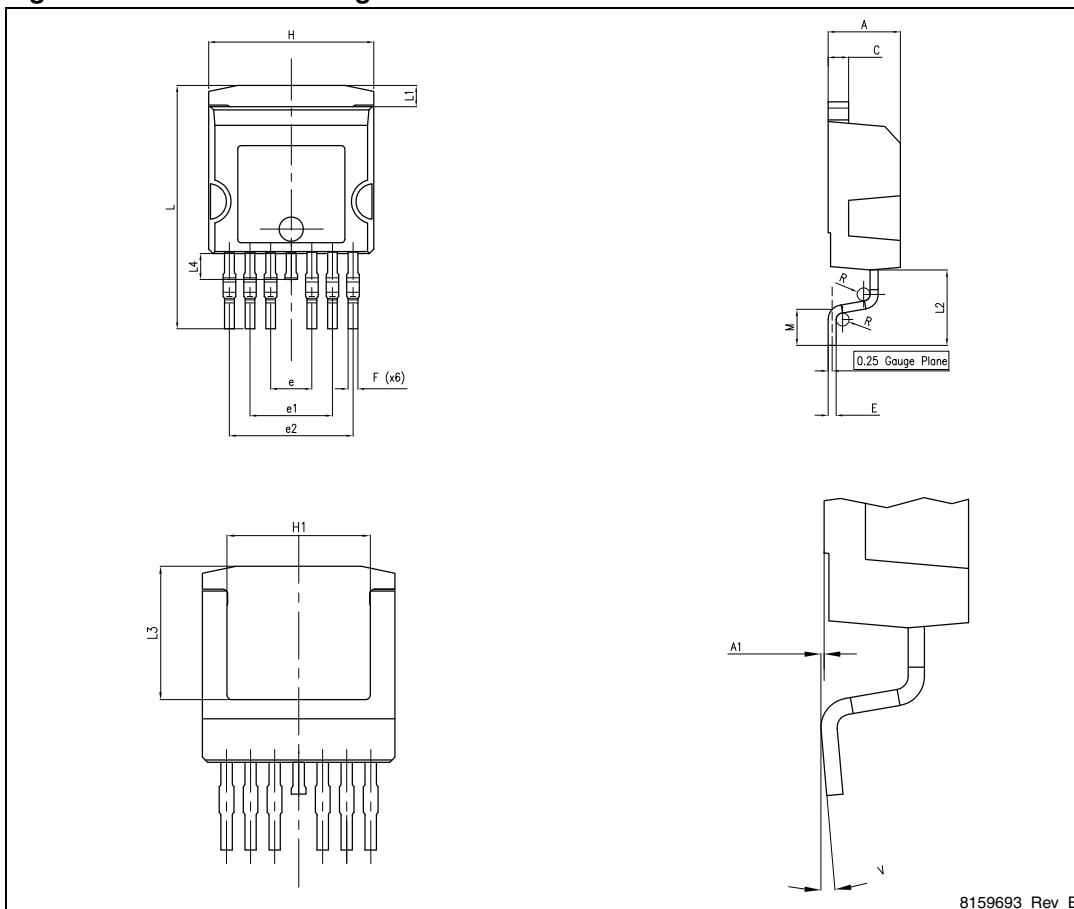


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Table 9. H²PAK-6 mechanical data

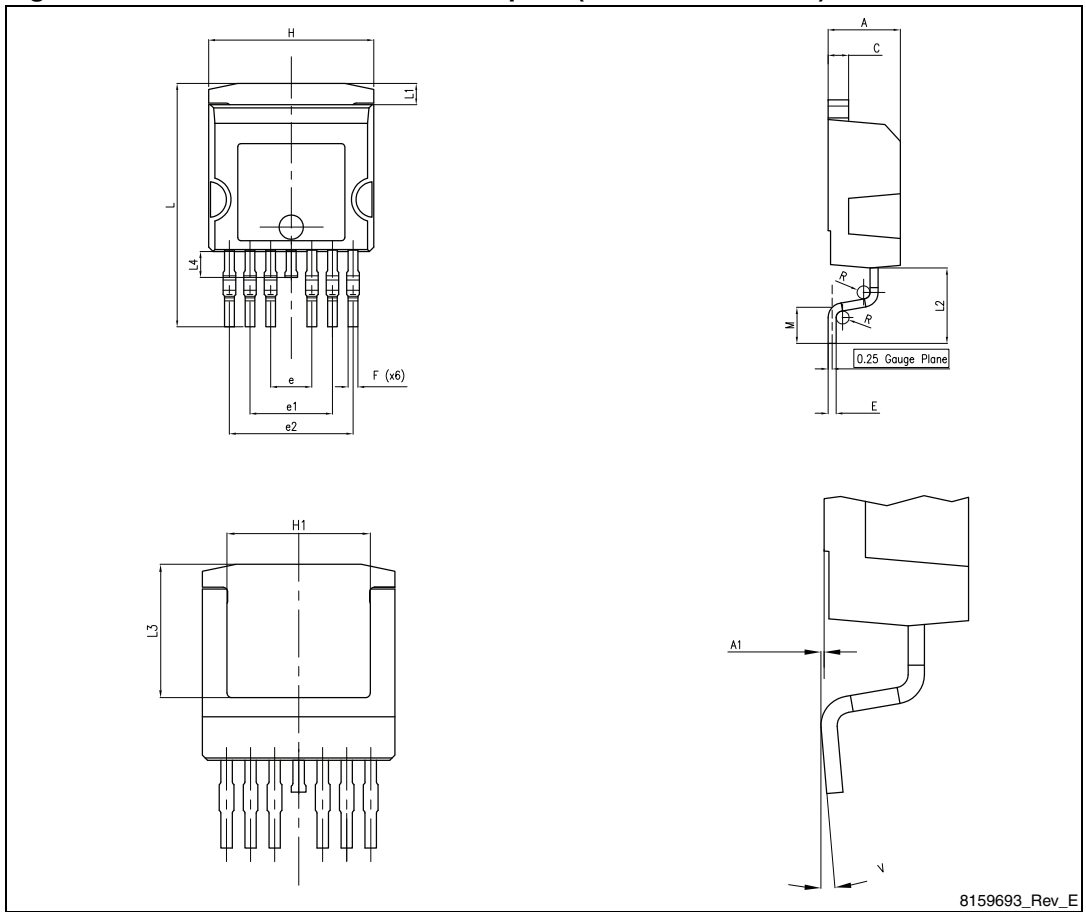
Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.80
A1	0.03		0.20
C	1.17		1.37
e	2.34		2.74
e1	4.88		5.28
e2	7.42		7.82
E	0.45		0.60
F	0.50		0.70
H	10.00		10.40
H1	7.40		7.80
L	14.75		15.25
L1	1.27		1.40
L2	4.35		4.95
L3	6.85		7.25
L4	1.5		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 21. H²PAK-6 drawing



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



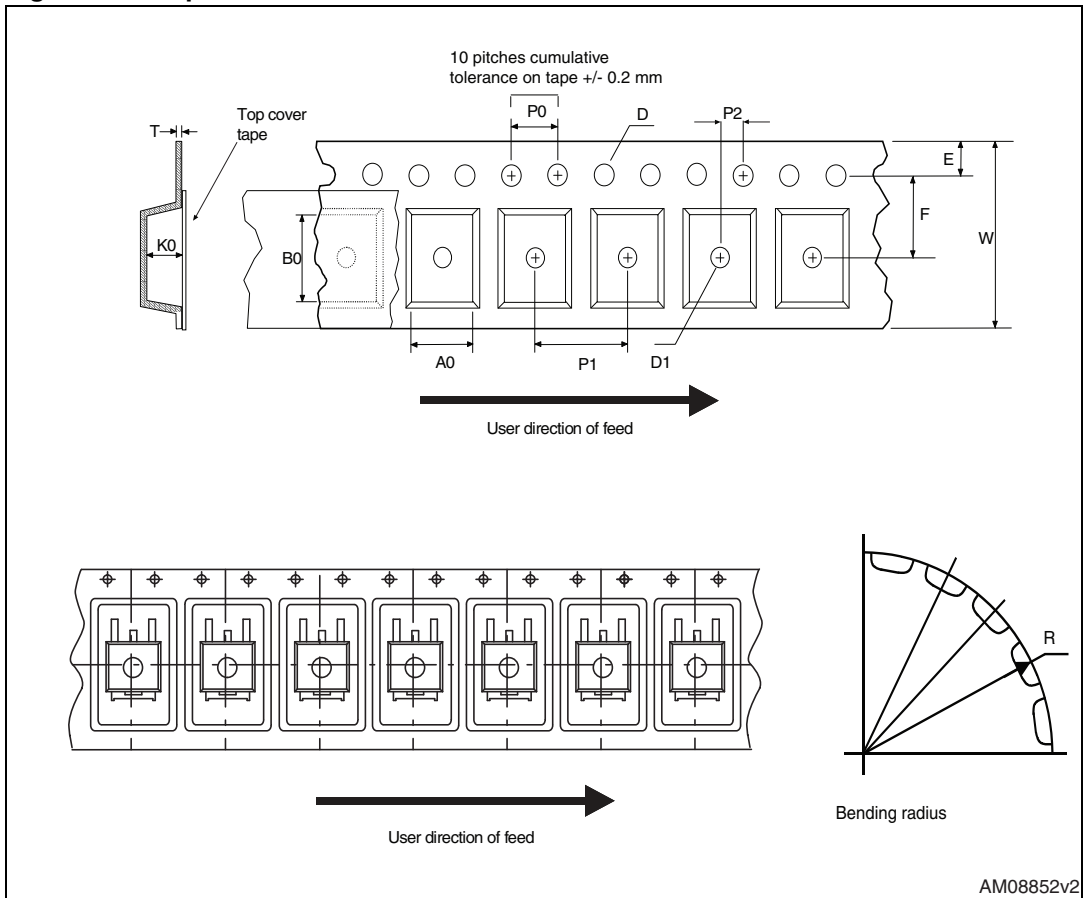
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5 Packaging mechanical data

Table 10. Tape and reel mechanical data

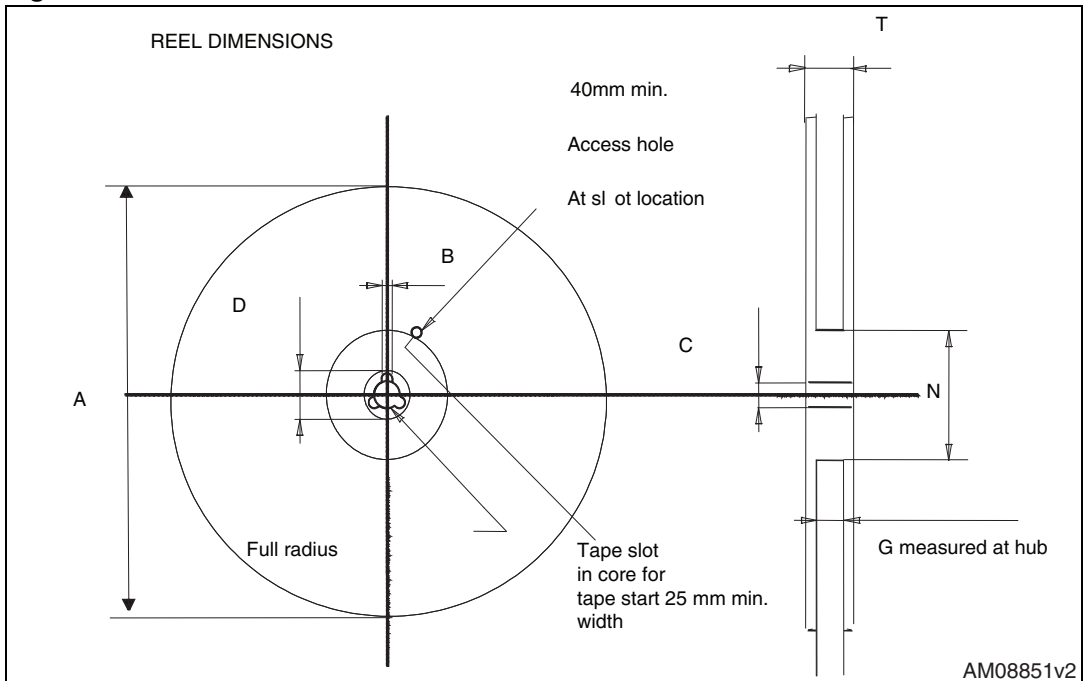
Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1		Base qty	1000
P2	1.9	2.1		Bulk qty	1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 23. Tape



AM08852v2

Figure 24. Reel



AM08851v2

6 Revision history

Table 11. Document revision history

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

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