



# STH210N75F6-2

N-channel 75 V, 2.7 mΩ typ., 180 A STripFET™ VI DeepGATE™ Power MOSFET in H<sup>2</sup>PAK-2 package

Datasheet — production data

## Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STH210N75F6-2	75 V	< 3.4 mΩ	180 A

- Low gate charge
- Very low on-resistance
- High avalanche ruggedness

## Applications

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using the 6<sup>th</sup> generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

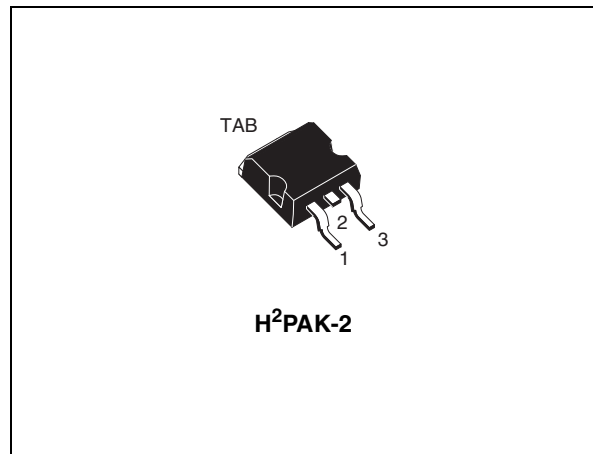


Figure 1. Internal schematic diagram

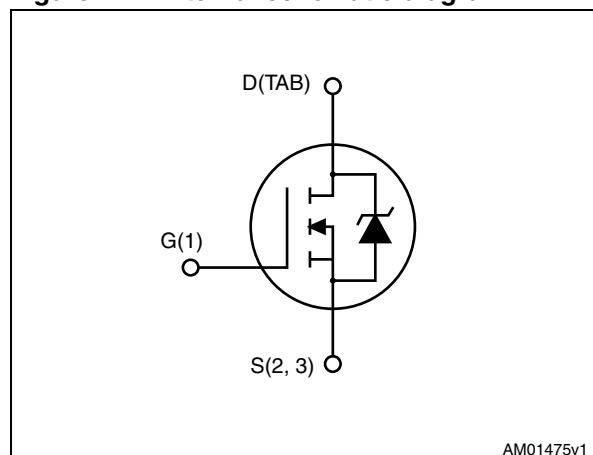


Table 1. Device summary

Order code	Marking	Package	Packaging
STH210N75F6-2	210N75F6	H <sup>2</sup> PAK-2	Tape and reel

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	75	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	180	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	150	A
$I_{DM}^{(1)}$	Drain current (pulsed)	720	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
$E_{AS}^{(2)}$	Single pulse avalanche energy	540	mJ
	Derating factor	2	W/ $^\circ\text{C}$
$T_{stg}$	Storage temperature	- 55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

1. Current limited by package.
2. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 60\text{ A}$ ,  $V_{DD} = 50\text{ V}$ .

**Table 3. Thermal data**

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

1. When mounted on FR-4 board of 1 inch<sup>2</sup>, 2 oz Cu.

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS} = 0$ )	$I_D = 250\ \mu\text{A}$	75			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 75\ \text{V}$ $V_{DS} = 75\ \text{V}, T_C = 125\text{ °C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\ \text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\ \text{V}, I_D = 90\ \text{A}$		2.7	3.4	m $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance			11800		pF
$C_{oss}$	Output capacitance	$V_{DS} = 25\ \text{V}, f = 1\ \text{MHz},$ $V_{GS} = 0$	-	1060	-	pF
$C_{rss}$	Reverse transfer capacitance			394		pF
$Q_g$	Total gate charge	$V_{DD} = 37.5\ \text{V}, I_D = 120\ \text{A},$ $V_{GS} = 10\ \text{V}$ <i>(see Figure 14)</i>		171		nC
$Q_{gs}$	Gate-source charge		-	50	-	nC
$Q_{gd}$	Gate-drain charge			36		nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 40\ \text{V}, I_D = 60\ \text{A}$ $R_G = 4.7\ \Omega, V_{GS} = 10\ \text{V}$ <i>(see Figure 13)</i>	-	34	-	ns
$t_r$	Rise time			70		
$t_{d(off)}$	Turn-off-delay time	<i>(see Figure 13)</i>	-	154	-	ns
$t_f$	Fall time			71		

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		180	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		720	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 180 \text{ A}, V_{GS} = 0$	-		1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 120 \text{ A}, V_{DD} = 60 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$ , $T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 15)</i>	-	60 144 4.8		ns nC A

1. Current limited by package.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

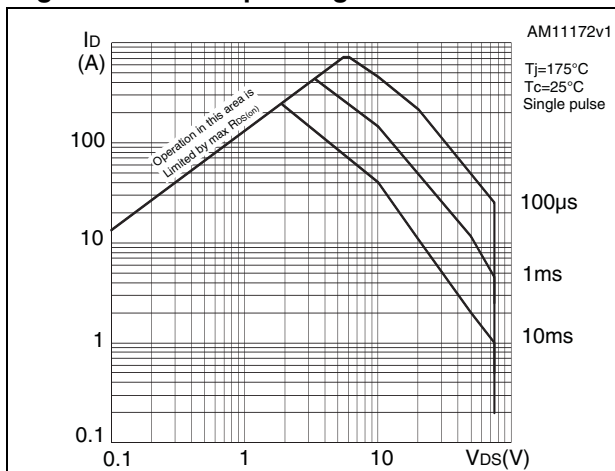


Figure 3. Thermal impedance

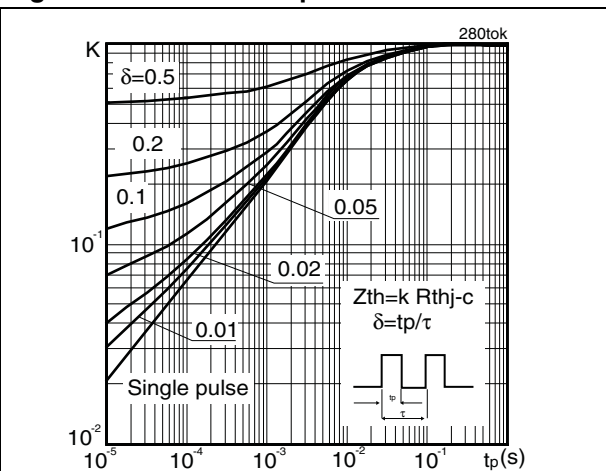


Figure 4. Output characteristics

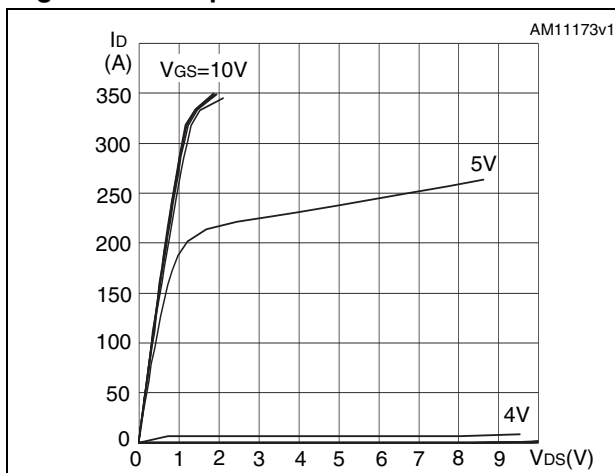


Figure 5. Transfer characteristics

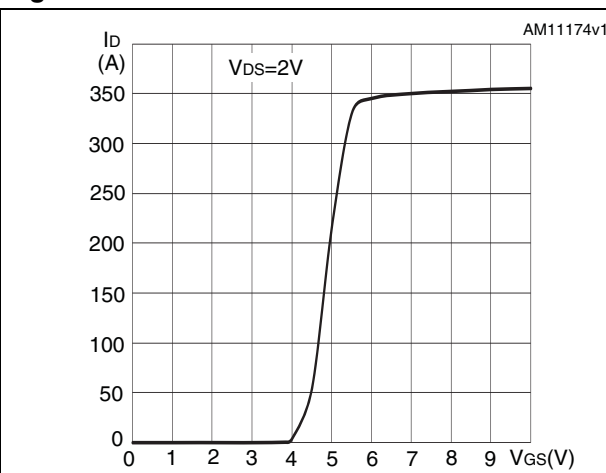


Figure 6. Normalized  $V_{DS}$  vs temperature

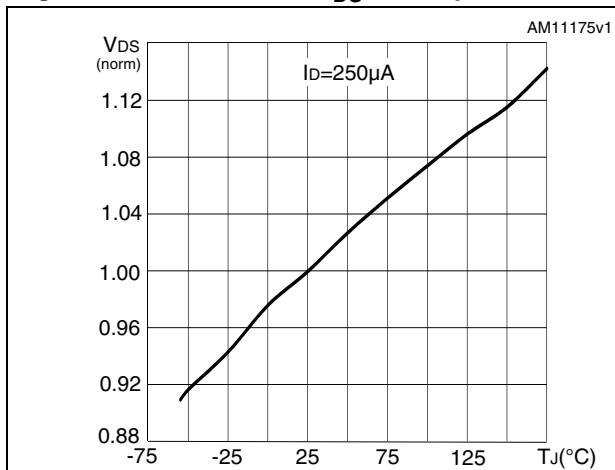


Figure 7. Static drain-source on-resistance

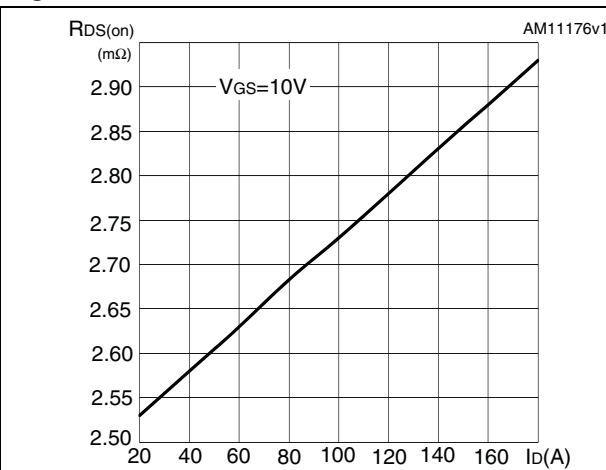


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

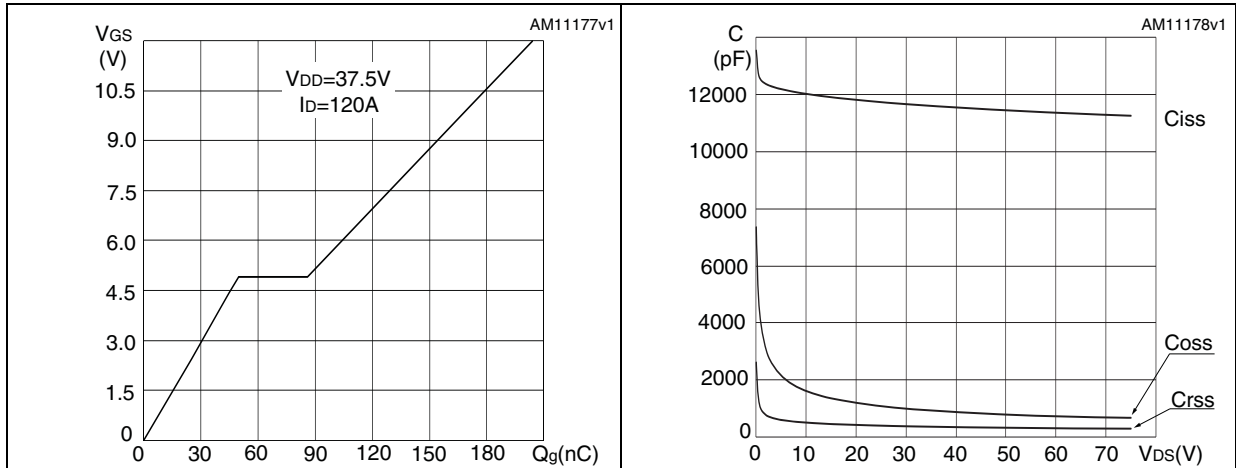


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on-resistance vs temperature

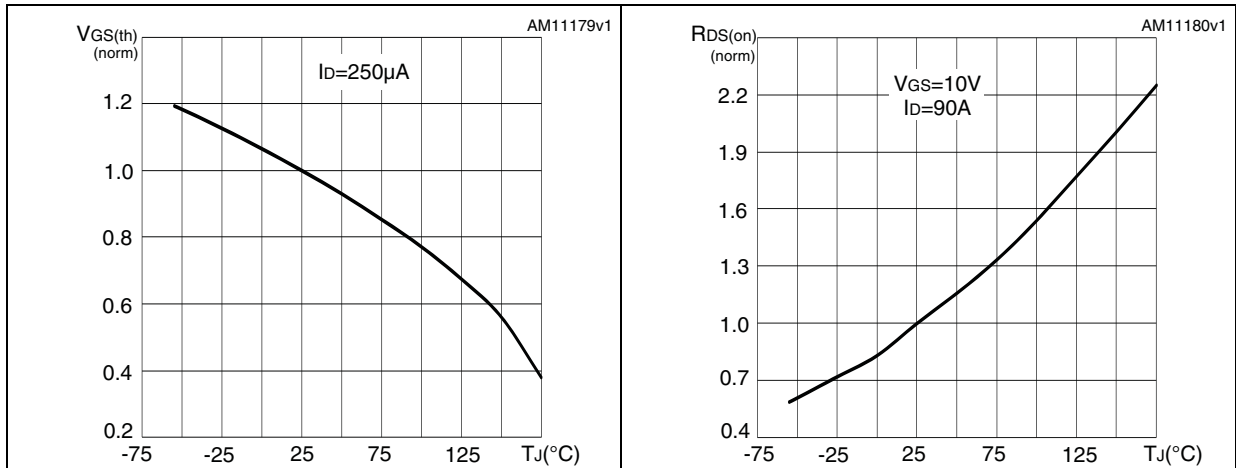
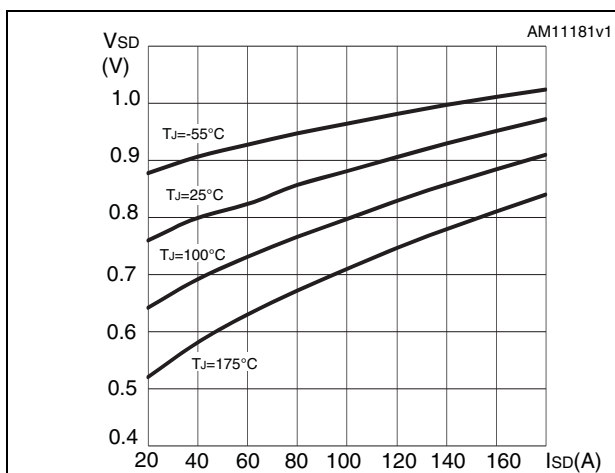


Figure 12. Source-drain diode forward characteristics

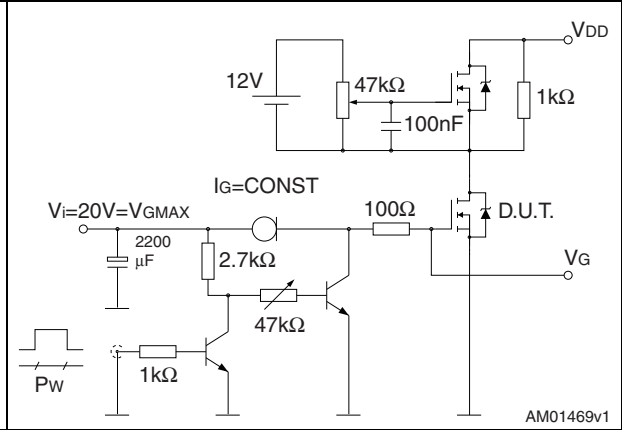


### 3 Test circuits

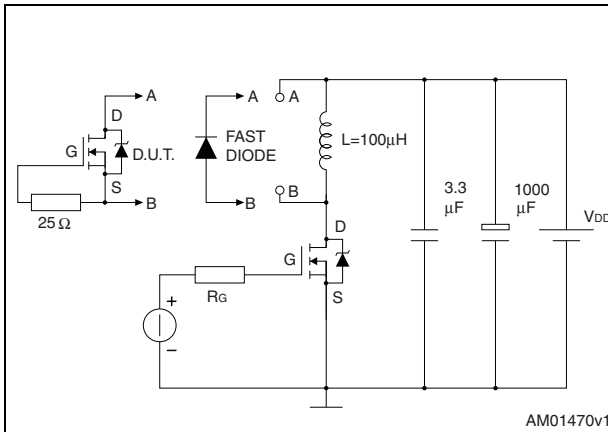
**Figure 13. Switching times test circuit for resistive load**



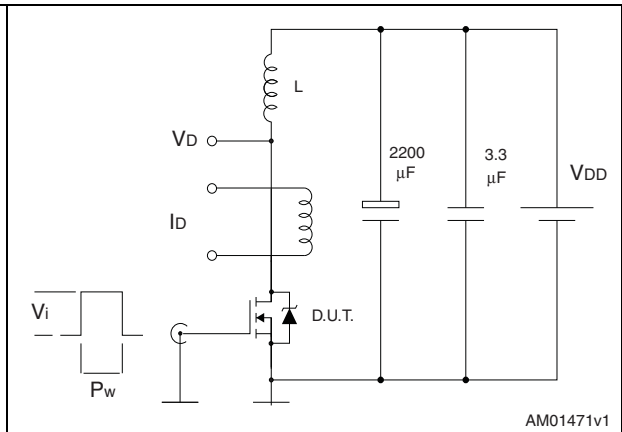
**Figure 14. Gate charge test circuit**



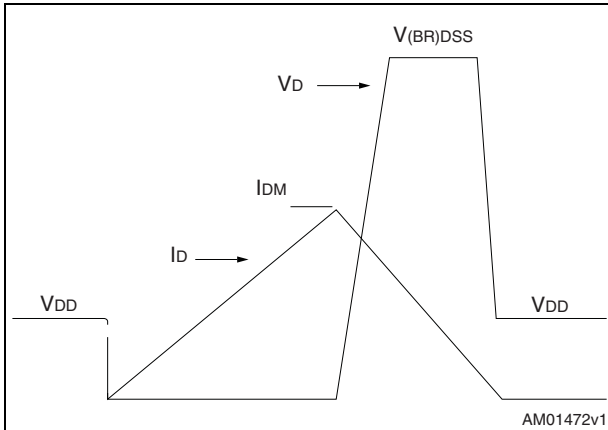
**Figure 15. Test circuit for inductive load switching and diode recovery times**



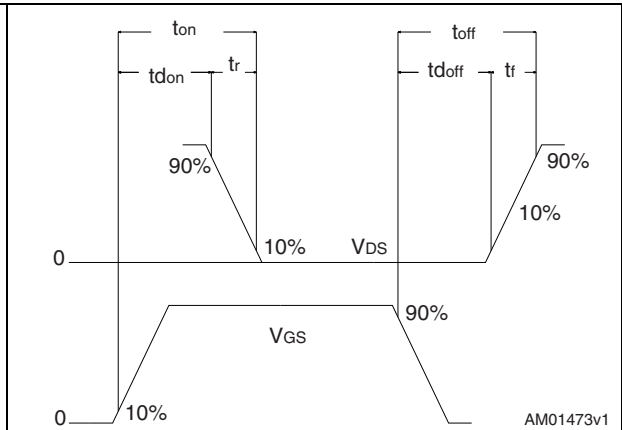
**Figure 16. Unclamped inductive load test circuit**



**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<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 8. H<sup>2</sup>PAK-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. H<sup>2</sup>PAK-2 drawing

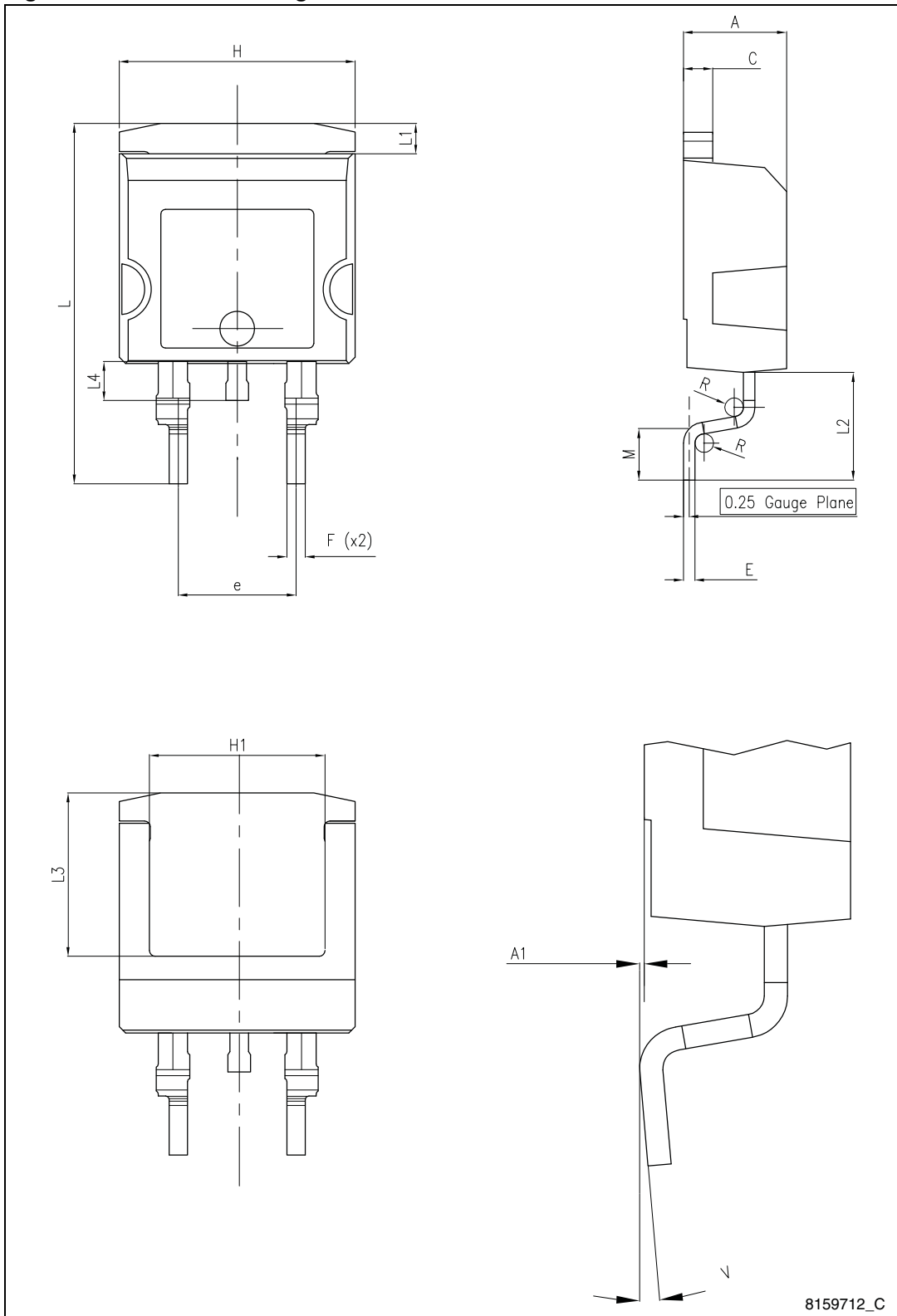
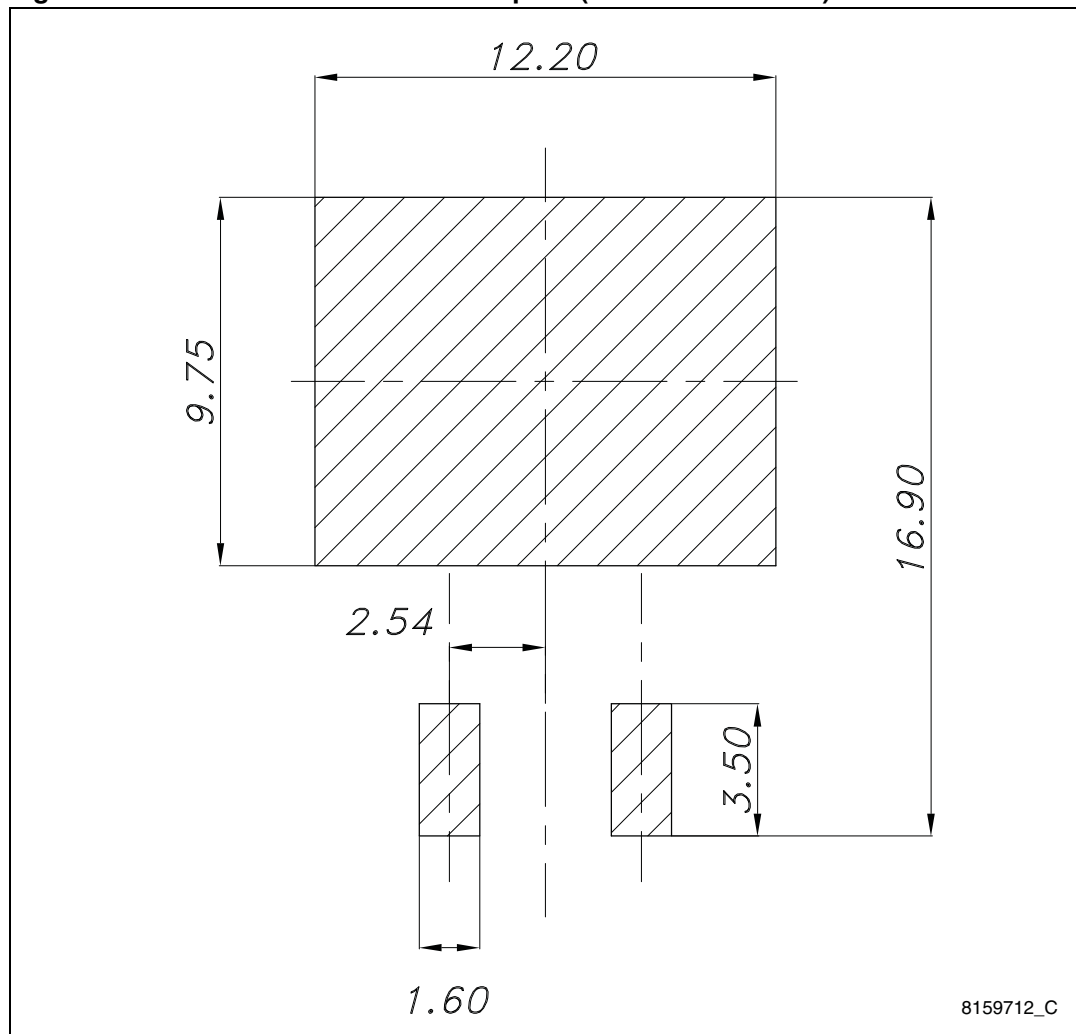


Figure 20. H<sup>2</sup>PAK-2 recommended footprint (dimensions in mm)



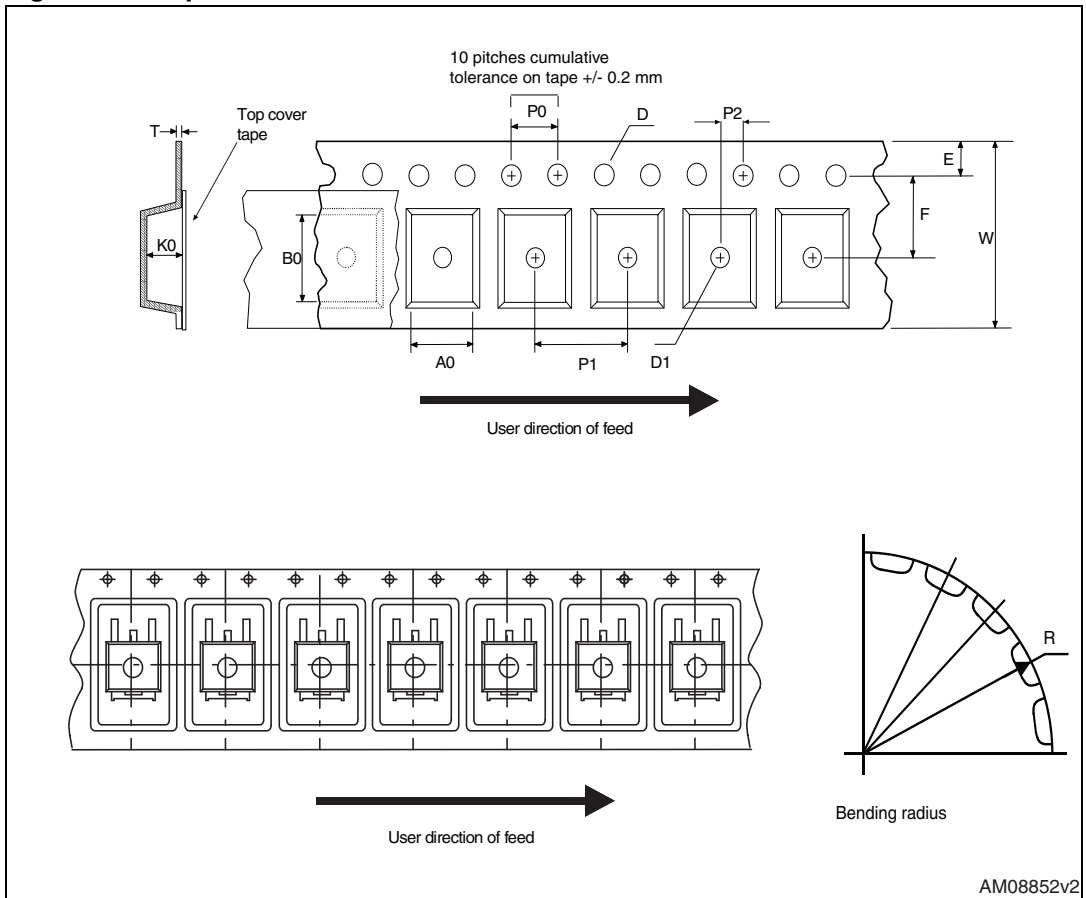
8159712\_C

## 5 Packaging mechanical data

Table 9. H<sup>2</sup>PAK-2 tape and reel mechanical data

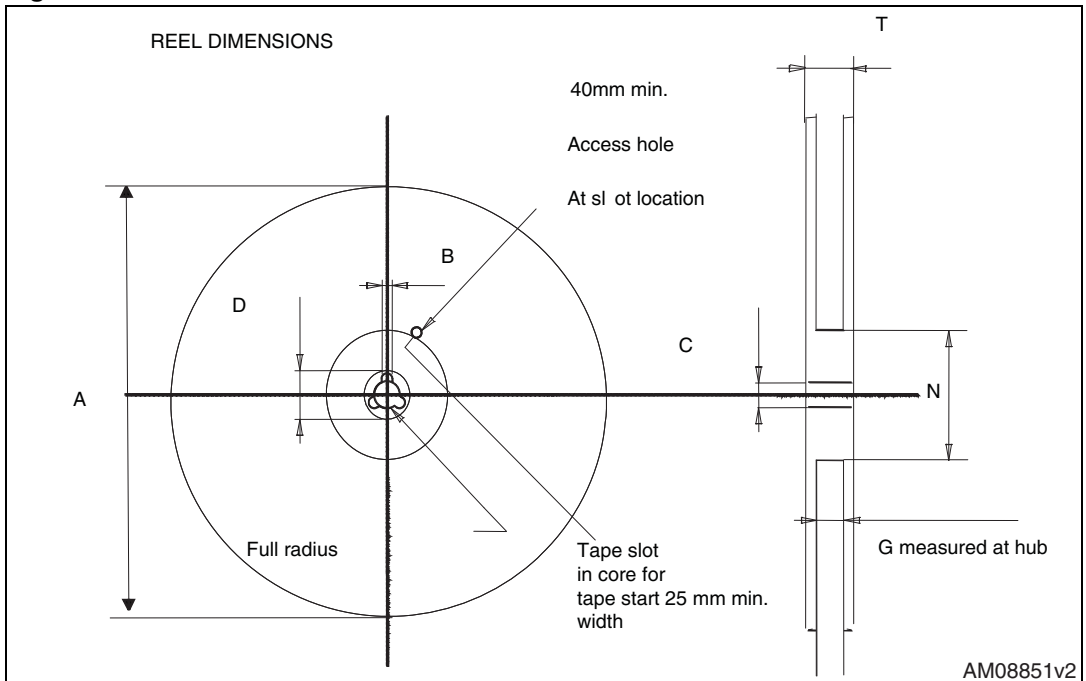
Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 21. Tape



AM08852v2

Figure 22. Reel



AM08851v2

## 6 Revision history

Table 10. Document revision history

Date	Revision	Changes
23-May-2011	1	First release.
20-Jul-2012	2	Document status promoted from preliminary data to datasheet. Updated mechanical data. Inserted <a href="#">Section 2.1: Electrical characteristics (curves)</a> . Inserted <a href="#">Section 5: Packaging mechanical data</a> .

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