

Automotive-grade N-channel 40 V, 1.4 mΩ typ., 180 A STripFET™ F3 Power MOSFET in a H²PAK-2 package

Datasheet - production data

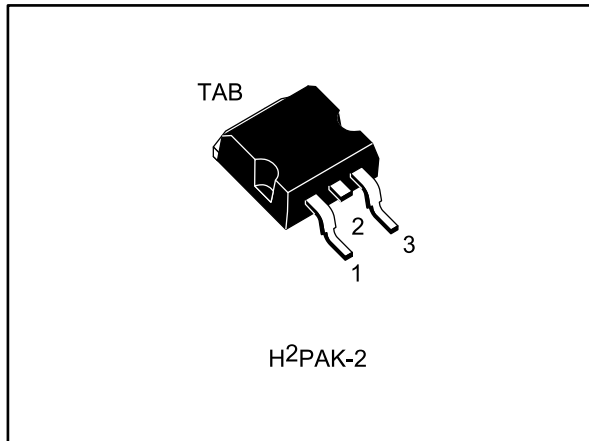


Figure 1: Internal schematic diagram

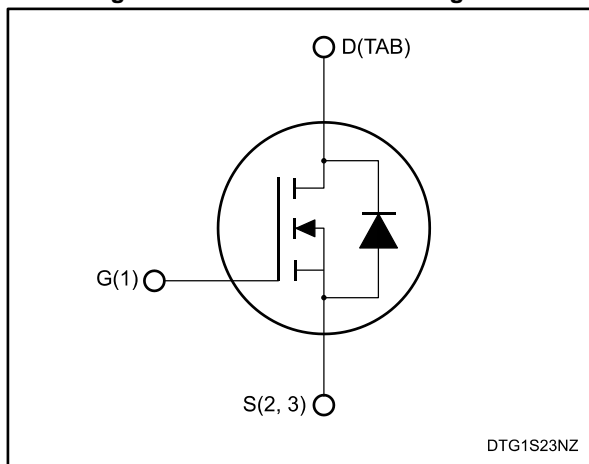


Table 1: Device summary

Order code	Marking	Package	Packing
STH270N4F3-2	270N4F3	H ² PAK-2	Tape and reel

Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STH270N4F3-2	40 V	1.7 mΩ	190 A

- Designed for automotive applications and AEC-Q101 qualified
- Conduction losses reduced
- Low profile, very low parasitic inductance, high current package

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using STripFET™ F3 technology. It is designed to minimize on-resistance and gate charge to provide superior switching performance.

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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 $T_C = 25\text{ }^\circ\text{C}$	180	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	180	A
$I_D^{(2)}$	Drain current (pulsed)	720	A
$P_{TOT}^{(3)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	1000	mJ
T_J	Operating junction temperature	-55 to 175	$^\circ\text{C}$
T_{stg}	Storage temperature		$^\circ\text{C}$

Notes:

- (1) Current limited by package
 (2) Pulse width limited by safe operating area
 (3) This value is rated according to R_{thj-c}
 (4) Starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = 80$, $V_{DD} = 32\text{ V}$

Table 3: Thermal resistance

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	$^\circ\text{C/W}$

Notes:

- (1) When mounted on FR-4 board of 1 inch², 2 oz Cu

2 Electrical characteristics

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

Table 4: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS} = 0$)	$I_D = 250\ \mu\text{A}$	40			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{GS} = 0\ \text{V}, V_{DS} = 40\ \text{V}$			10	μA
		$V_{GS} = 0\ \text{V}, V_{DS} = 40\ \text{V};$ $T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\ \text{V}$			± 200	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	$V_{GS} = 10\ \text{V}, I_D = 80\ \text{A}$		1.4	1.7	m Ω

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\ \text{V}, f = 1\ \text{MHz},$ $V_{GS} = 0$	-	7400	-	pF
C_{oss}	Output capacitance			1800		pF
C_{rss}	Reverse transfer capacitance			50		pF
Q_g	Total gate charge	$V_{DD} = 20\ \text{V}, I_D = 160\ \text{A}$ $V_{GS} = 10\ \text{V}$ See Figure 14: "Test circuit for gate charge behavior"	-	110	-	nC
Q_{gs}	Gate-source charge			30		nC
Q_{gd}	Gate-drain charge			25		nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\ \text{V}, I_D = 80\ \text{A},$ $R_G = 4.7\ \Omega, V_{GS} = 10\ \text{V}$ See Figure 2: "Safe operating area"	-	25	-	ns
t_r	Rise time			180		ns
$t_{d(off)}$	Turn-off delay time			110		ns
t_f	Fall time			45		ns

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current				180	A
$I_{SDM}^{(2)}$	Source-drain current (pulsed)				720	A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD} = 180 \text{ A}, V_{GS} = 0$			1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 160 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 32 \text{ V}, T_j = 150$ $^{\circ}\text{C}$ <i>Figure 15: "Test circuit for inductive load switching and diode recovery times"</i>		70		ns
Q_{rr}	Reverse recovery charge			225		nC
I_{RRM}	Reverse recovery current				3.2	

Notes:

- ⁽¹⁾Current limited by package
- ⁽²⁾Pulse width limited by safe operating area
- ⁽³⁾Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.2 Electrical characteristics (curves)

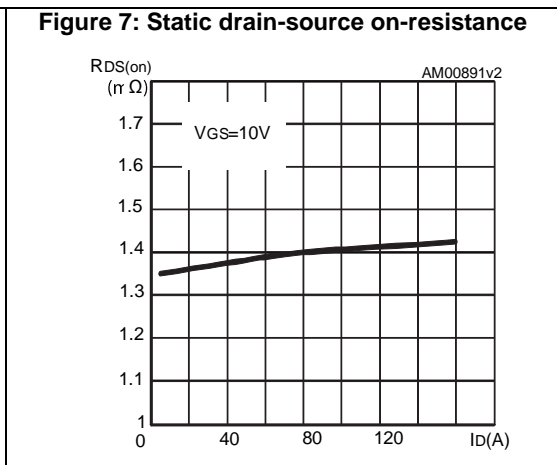
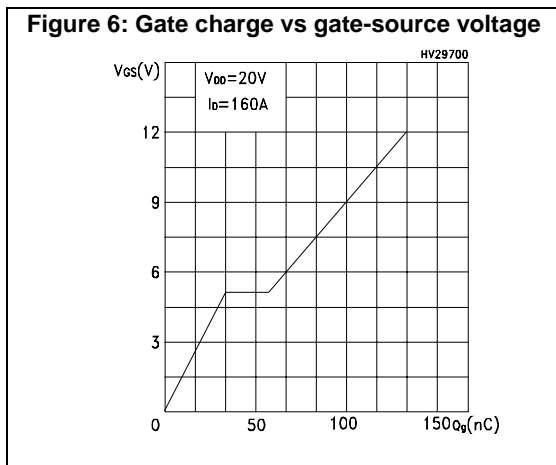
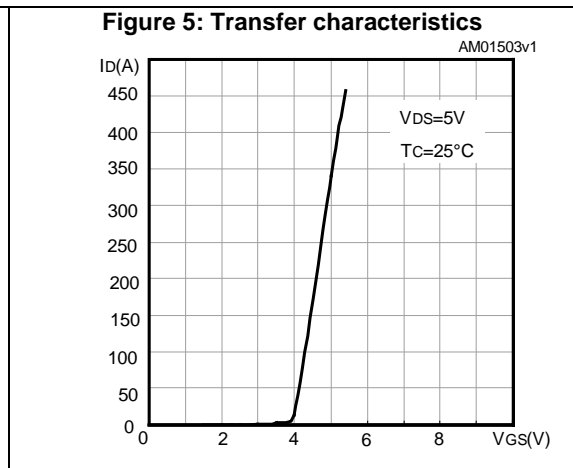
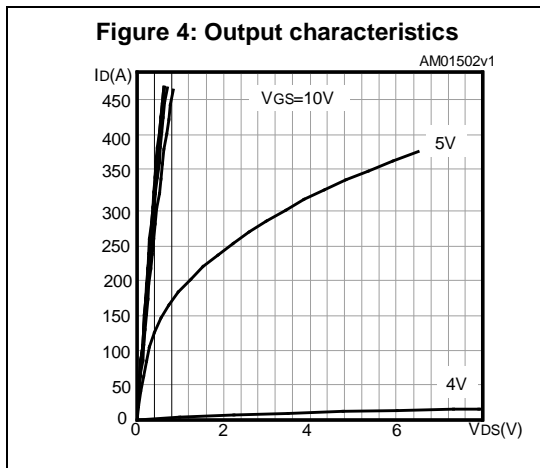
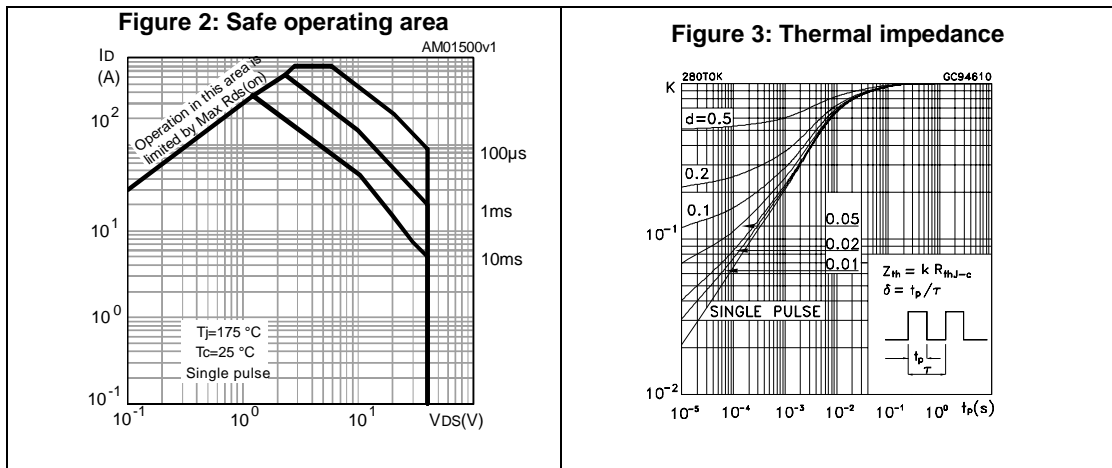


Figure 8: Capacitance variations

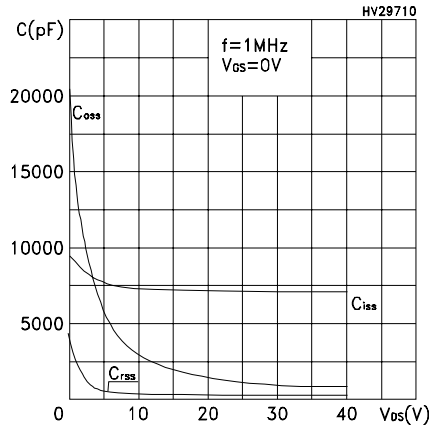


Figure 9: Normalized gate threshold voltage vs temperature

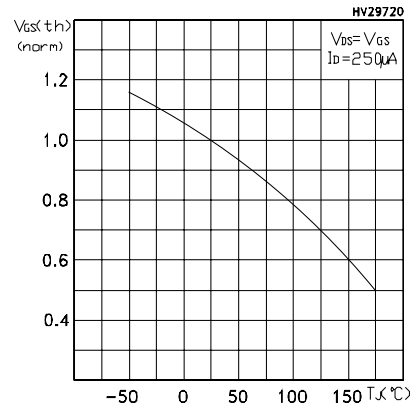


Figure 10: Normalized on-resistance vs temperature

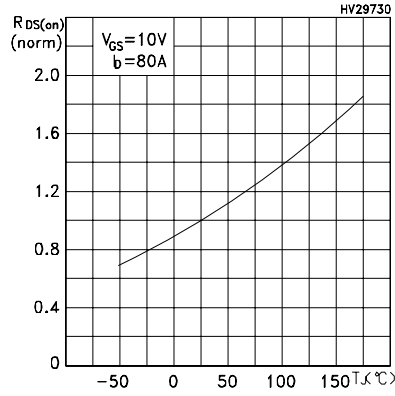


Figure 11: Normalized V(BR)DSS vs temperature

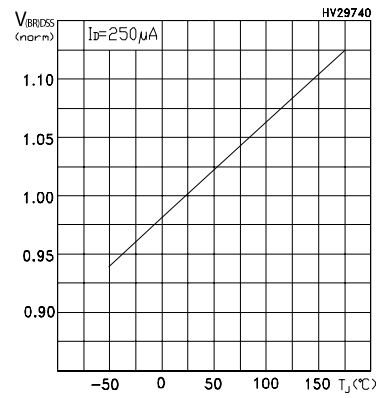
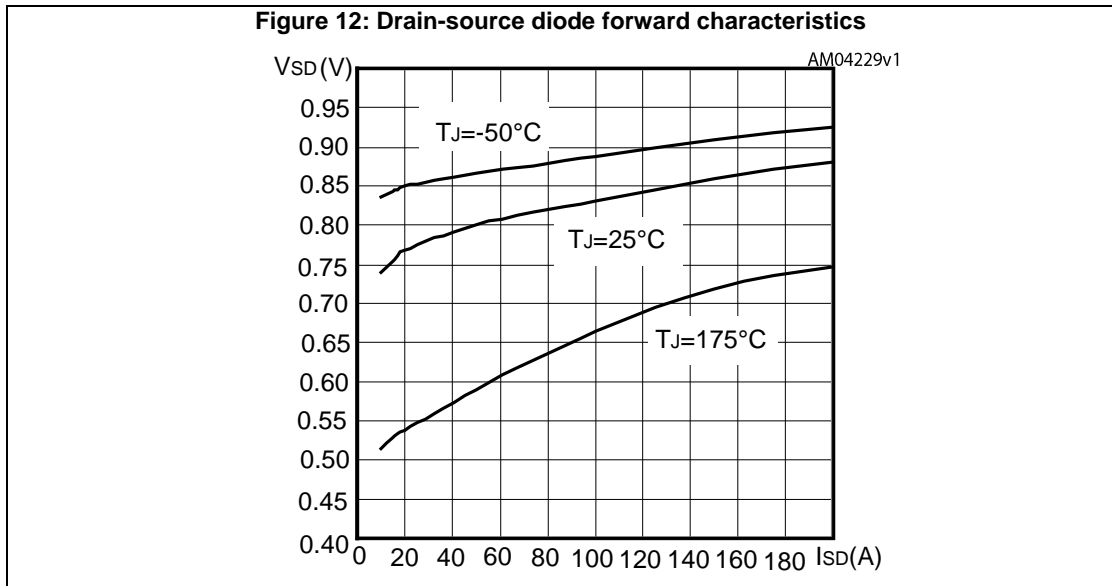
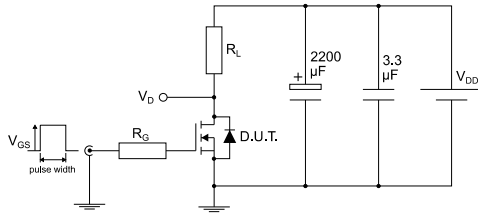


Figure 12: Drain-source diode forward characteristics



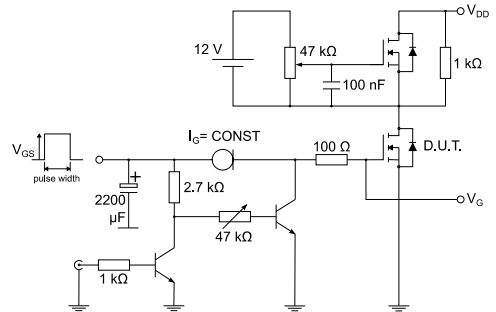
3 Test circuits

Figure 13: Test circuit for resistive load switching times



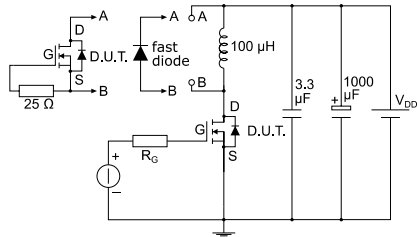
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Figure 14: Test circuit for gate charge behavior



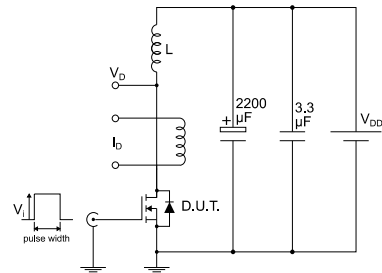
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Figure 15: Test circuit for inductive load switching and diode recovery times



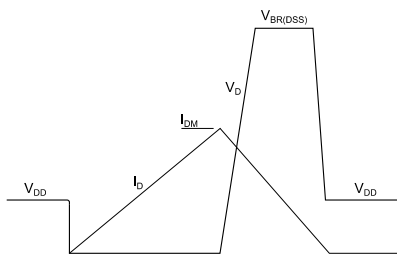
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Figure 16: Unclamped inductive load test circuit



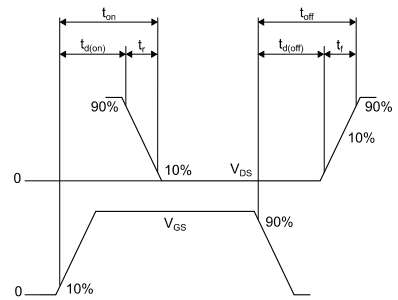
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Figure 17: Unclamped inductive waveform



AM01472v1

Figure 18: Switching time waveform



AM01473v1

4 Package information

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.

4.1 H²PAK-2 package information

Figure 19: H²PAK-2 package outline

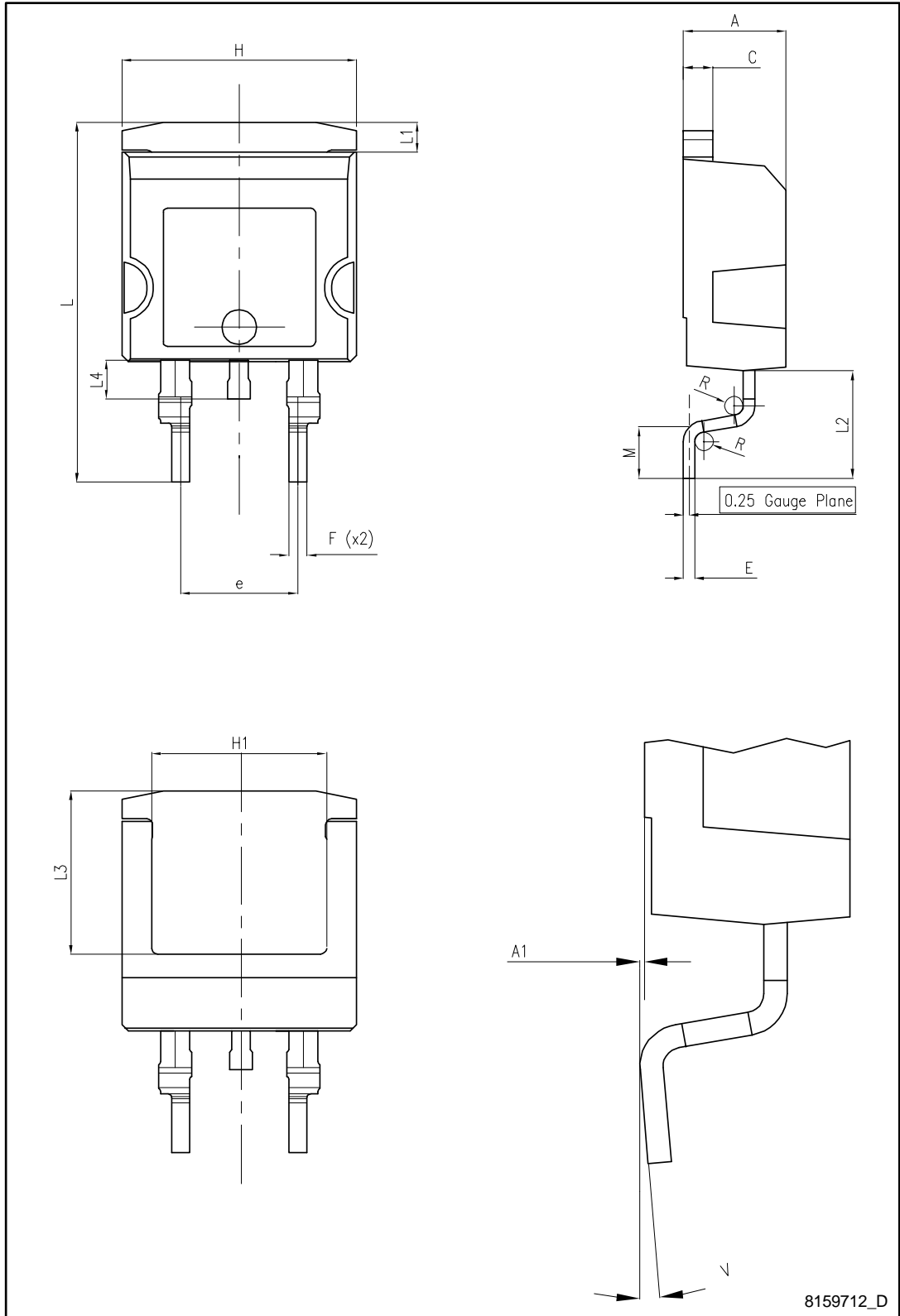
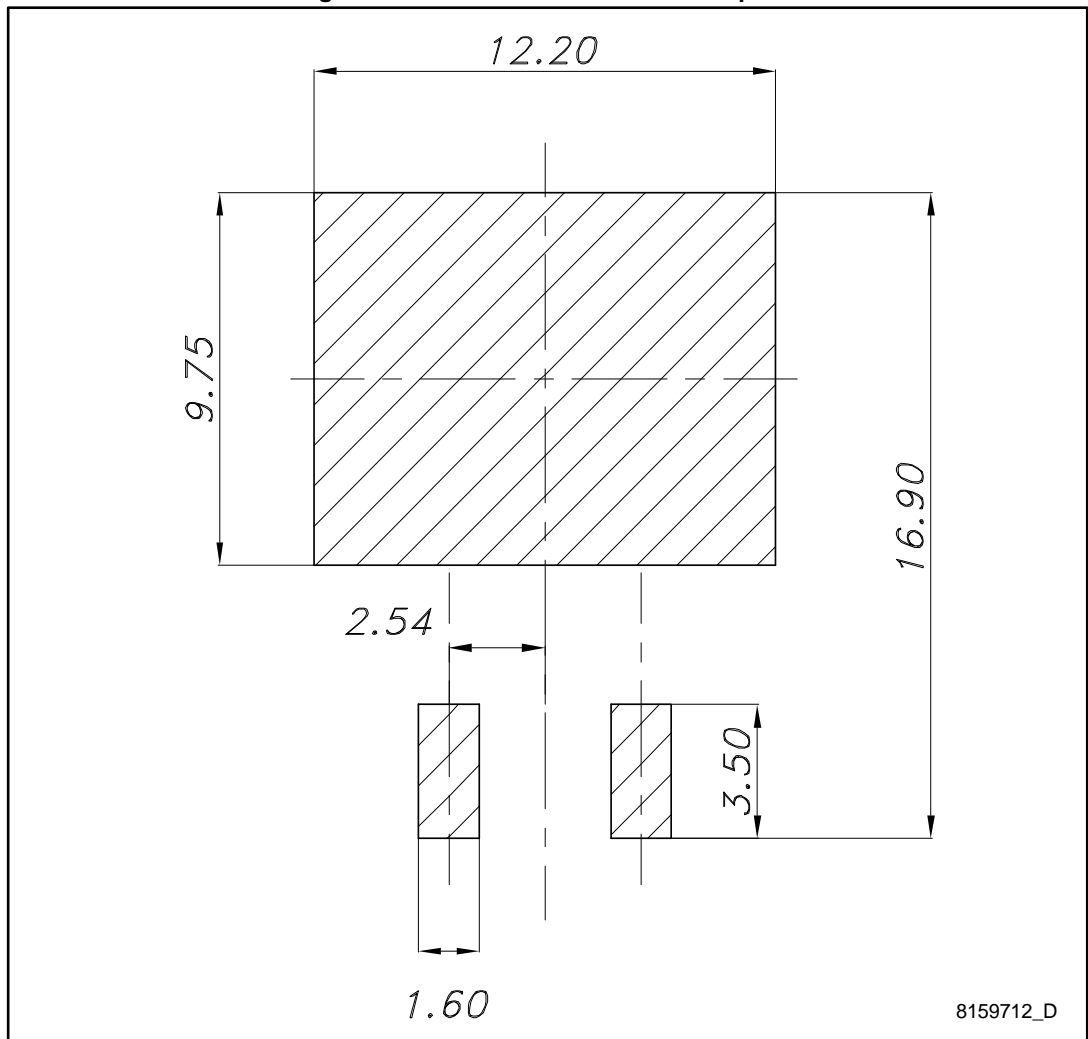


Table 8: H²PAK-2 package mechanical data

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 20: H²PAK-2 recommended footprint



8159712_D

5 Packaging information

Figure 21: Tape outline

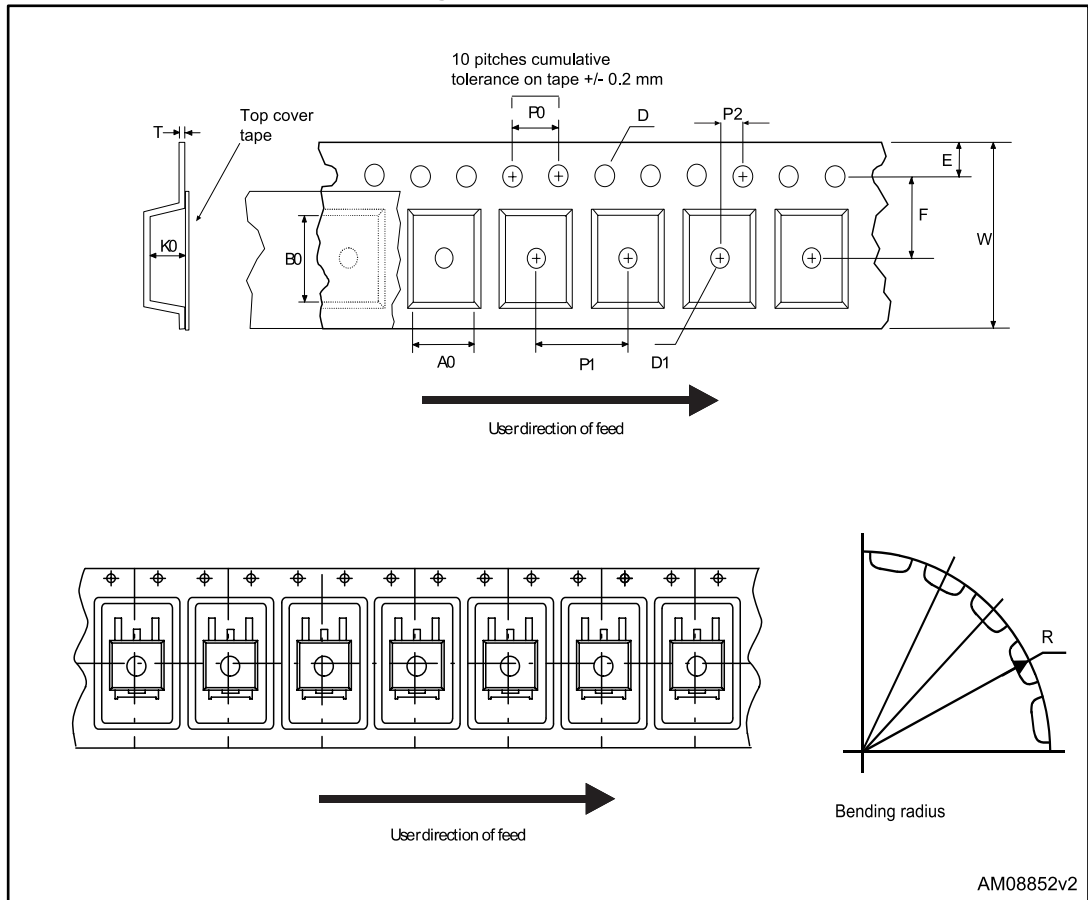


Figure 22: Reel outline

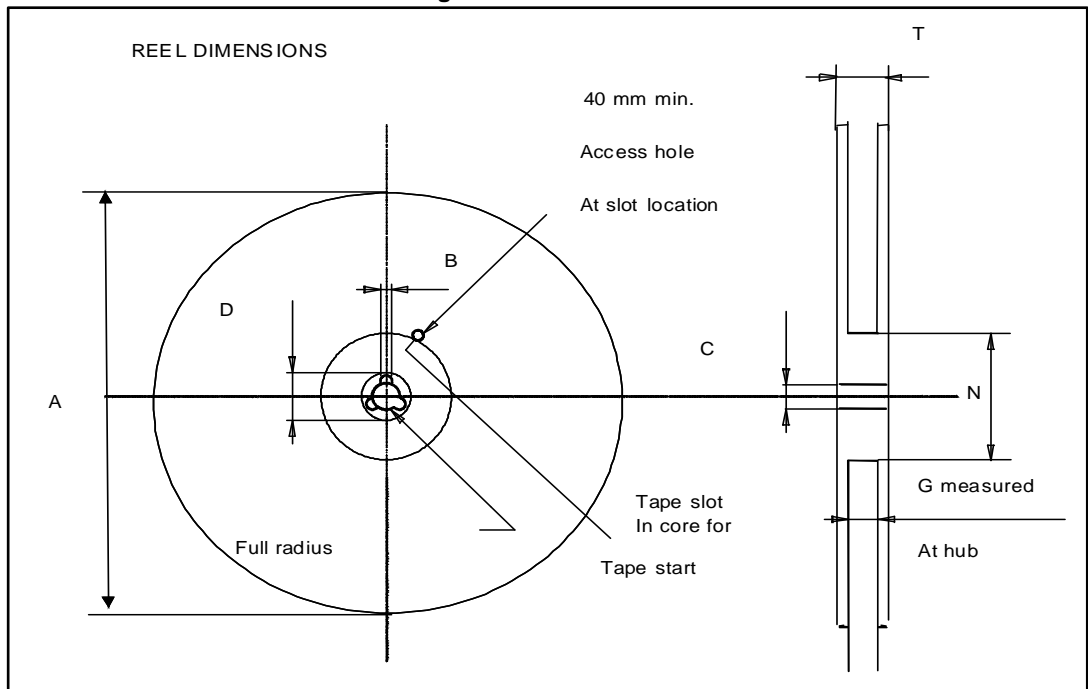


Table 9: Tape and reel mechanical data

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 quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

6 Revision history

Table 10: Document revision history

Date	Revision	Changes
10-Jan-2010	1	Initial release.
14-Mar-2013	2	<ul style="list-style-type: none">• Added H²PAK-2 package.• Updated: package and packing information.• Minor text changes
02-Dec-2014	3	<ul style="list-style-type: none">• Updated: H²PAK-6 package information.• Updated the title, features and description.• Minor text changes.
22-Oct-2015	4	<ul style="list-style-type: none">• Updated the title and features.• Minor text changes.

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