

Automotive-grade N-channel 100 V, 180 A, 3.9 mΩ typ., STripFET™ F3 Power MOSFET in an H²PAK-2 package

Datasheet - production data

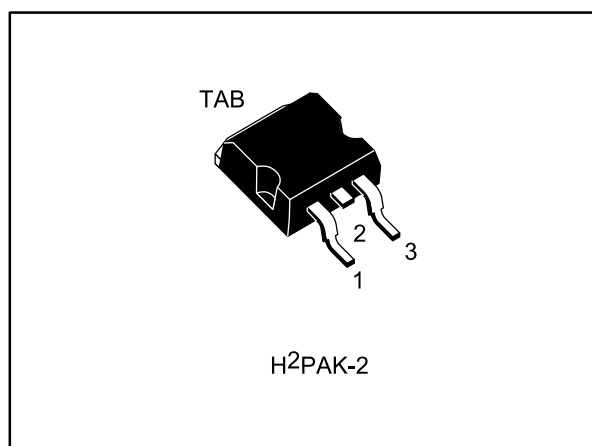
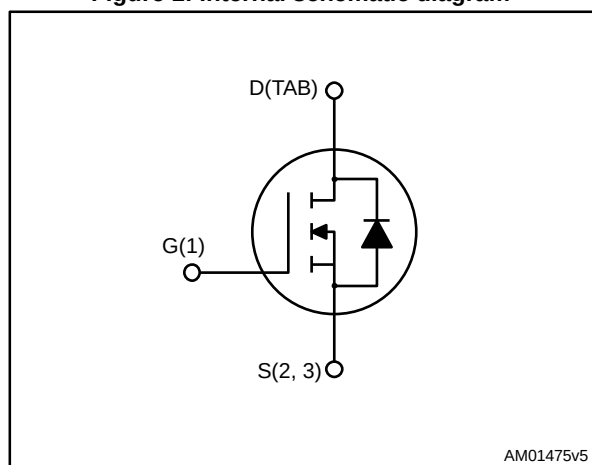


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STH185N10F3-2	100 V	4.5 mΩ	180 A

- AEC-Q101 qualified
- Ultra low on-resistance
- 100% avalanche tested



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.

Table 1: Device summary

Order code	Marking	Packages	Packing
STH185N10F3-2	185N10F3	H ² PAK-2	Tape and reel

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves).....	6
3	Test circuits	8
4	Package information	9
	4.1 H ² PAK-2 package information.....	10
	4.2 H ² PAK packing information	12
5	Revision history	14

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	100	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	180	A
$I_D^{(1)}$	Drain current (continuous) at $T_C=100^\circ\text{C}$	120	A
$I_{DM}^{(2)}$	Drain current (pulsed)	720	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	315	W
dv/dt	Peak diode recovery voltage slope	20	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	350	mJ
T_j	Operating junction temperature range	- 55 to 175	$^\circ\text{C}$
T_{stg}	Storage temperature range		

Notes:

⁽¹⁾Current limited by package.

⁽²⁾Pulse width limited by safe operating area.

⁽³⁾Starting $T_j = 25^\circ\text{C}$, $I_D = 80\text{ A}$, $V_{DD} = 50\text{ V}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.48	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	$^\circ\text{C/W}$

Notes:

⁽¹⁾When mounted on FR-4 board, on 1inch², 2oz 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	100			V
I _{DSS}	Zero gate voltage drain current	V _{GS} = 0, V _{DS} = 100 V,			10	μA
		V _{GS} = 0, V _{DS} = 100 V, ⁽¹⁾ T _C = 125°C			100	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 = 60 A		3.9	4.5	mΩ

Notes:

⁽¹⁾Defined by design, not subject to production test

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{GS} = 0, V _{DS} = 25 V, f = 1 MHz	-	6665	-	pF
C _{oss}	Output capacitance		-	786	-	pF
C _{rss}	Reverse transfer capacitance		-	49	-	pF
Q _g	Total gate charge	V _{DD} = 50 V, I _D = 120 A,	-	114.6	-	nC
Q _{gs}	Gate-source charge	V _{GS} = 10 V	-	38.8	-	nC
Q _{gd}	Gate-drain charge	(see Figure 14: "Test circuit for gate charge behavior")	-	31.9	-	nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on delay time	V _{DD} = 50 V, I _D = 60 A R _G = 4.7 Ω V _{GS} = 10 V (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform")	-	25.6	-	ns
t _r	Rise time		-	97.1	-	ns
t _{d(off)}	Turn-off delay time		-	99.9	-	ns
t _f	Fall time		-	6.9	-	ns

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	$V_{GS} = 0$, $I_{SD} = 120$ A	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 120$ A, $di/dt = 100$ A/ μ s, $V_{DD} = 80$ V, $T_j = 150^\circ\text{C}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	83.4		ns
Q_{rr}	Reverse recovery charge		-	295.7		nC
I_{RRM}	Reverse recovery current		-	7.1		A

Notes:

(1) Pulse width limited by safe operating area.

(2) Pulsed: pulse duration = 300 μ s, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

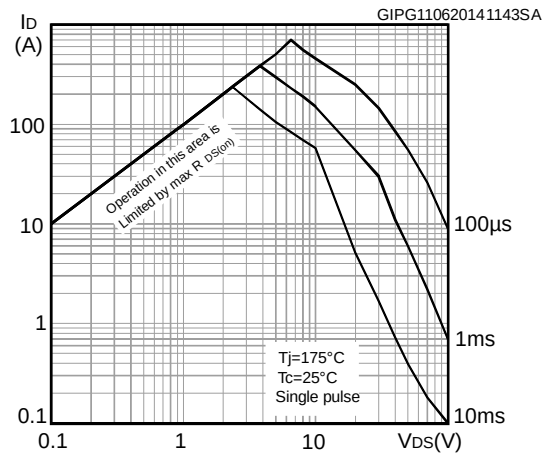


Figure 3: Thermal impedance

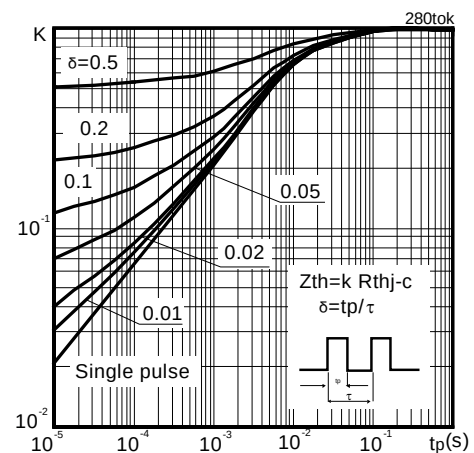


Figure 4: Output characteristics

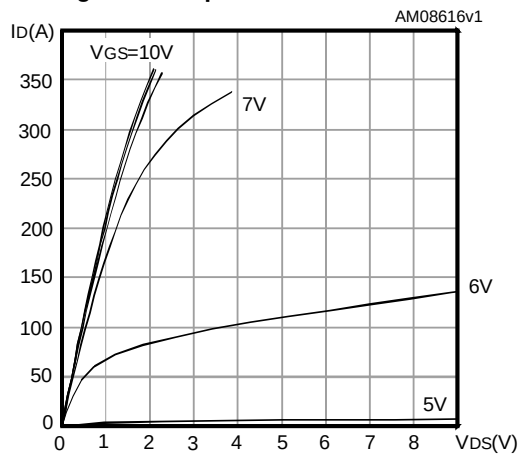


Figure 5: Transfer characteristics

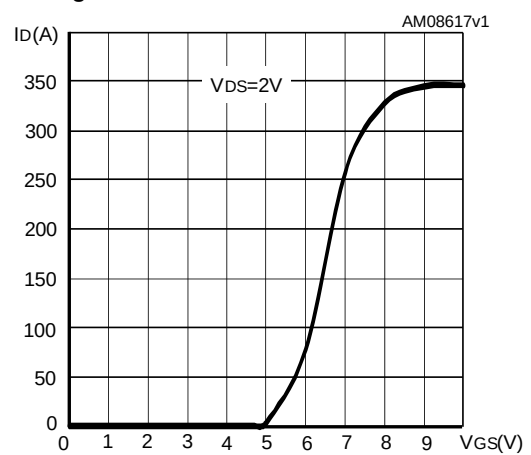
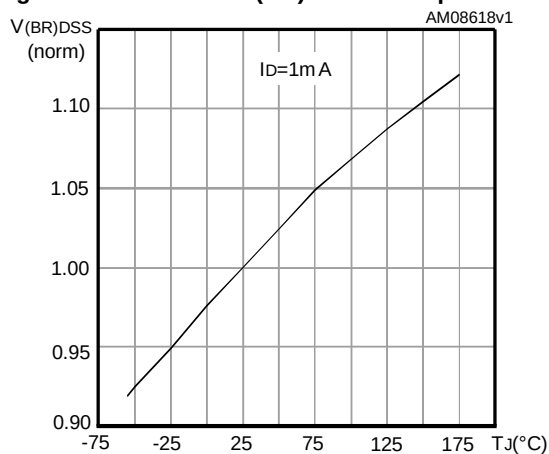
Figure 6: Normalized $V(BR)_{DSS}$ vs temperature

Figure 7: Static drain-source on-resistance

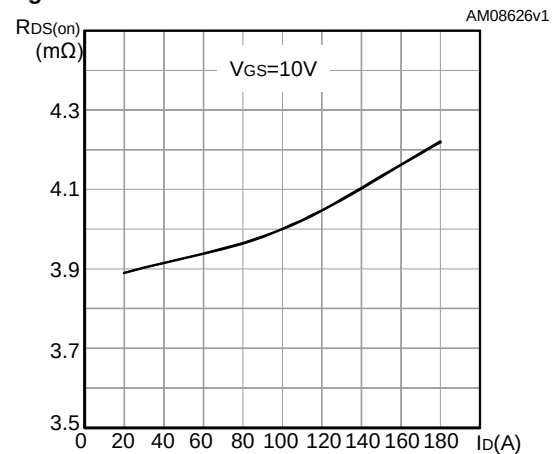


Figure 8: Gate charge vs gate-source voltage

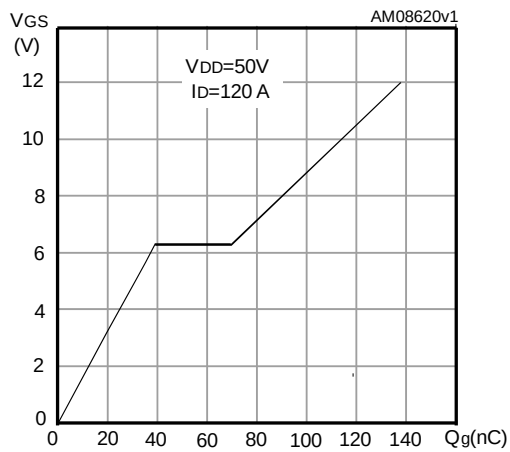


Figure 9: Capacitance variations

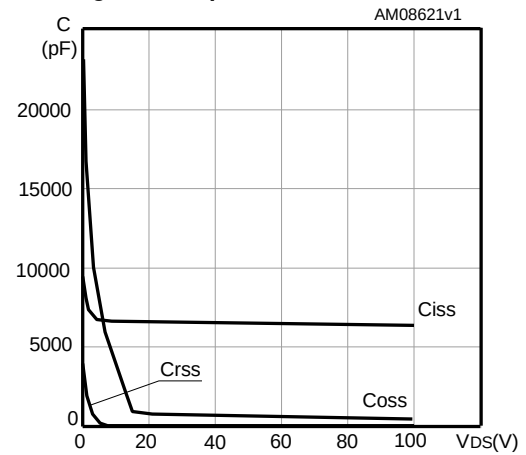


Figure 10: Normalized gate threshold voltage vs temperature

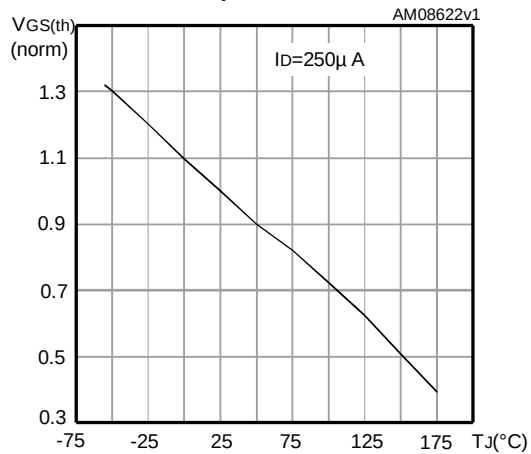


Figure 11: Normalized on-resistance vs temperature

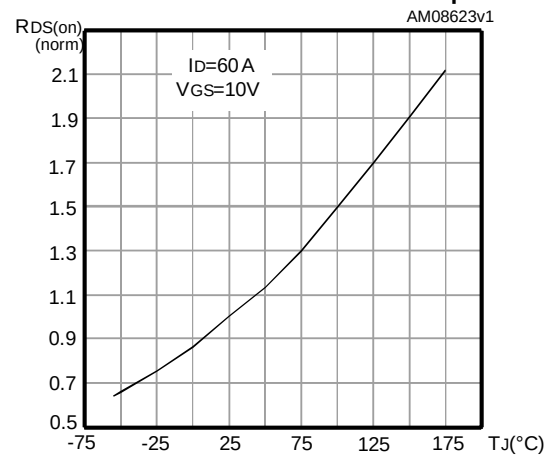
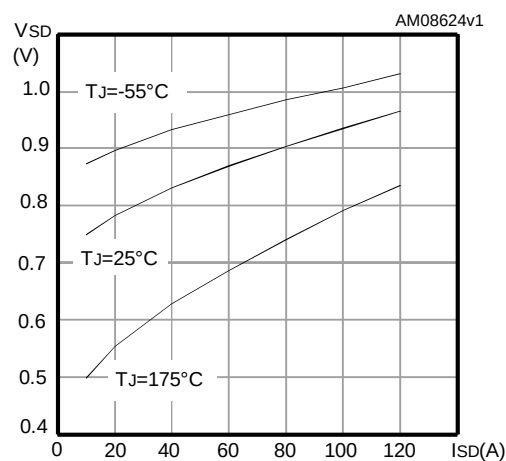
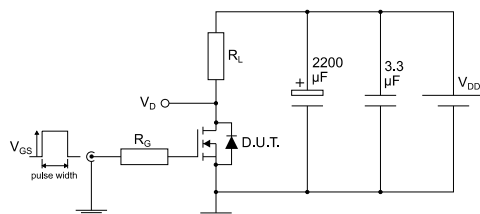


Figure 12: Source-drain diode forward characteristics



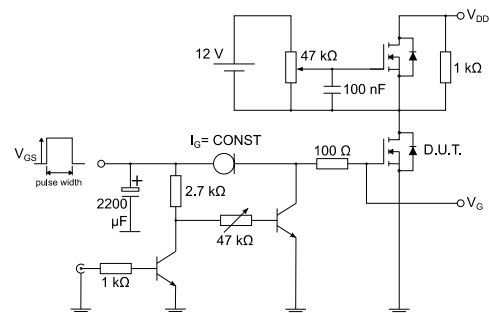
3 Test circuits

Figure 13: Test circuit for resistive load switching times



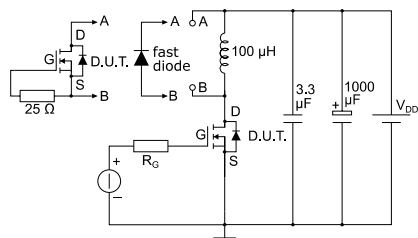
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Figure 14: Test circuit for gate charge behavior



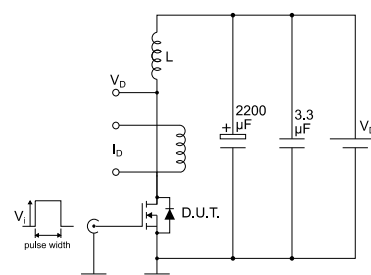
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Figure 15: Test circuit for inductive load switching and diode recovery times



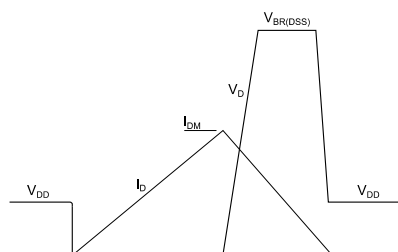
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Figure 16: Unclamped inductive load test circuit



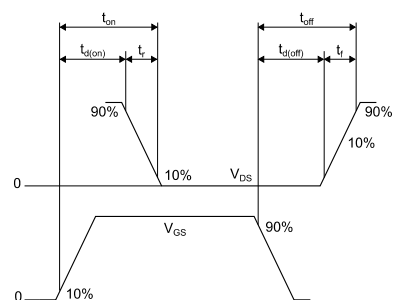
AM01471v1

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

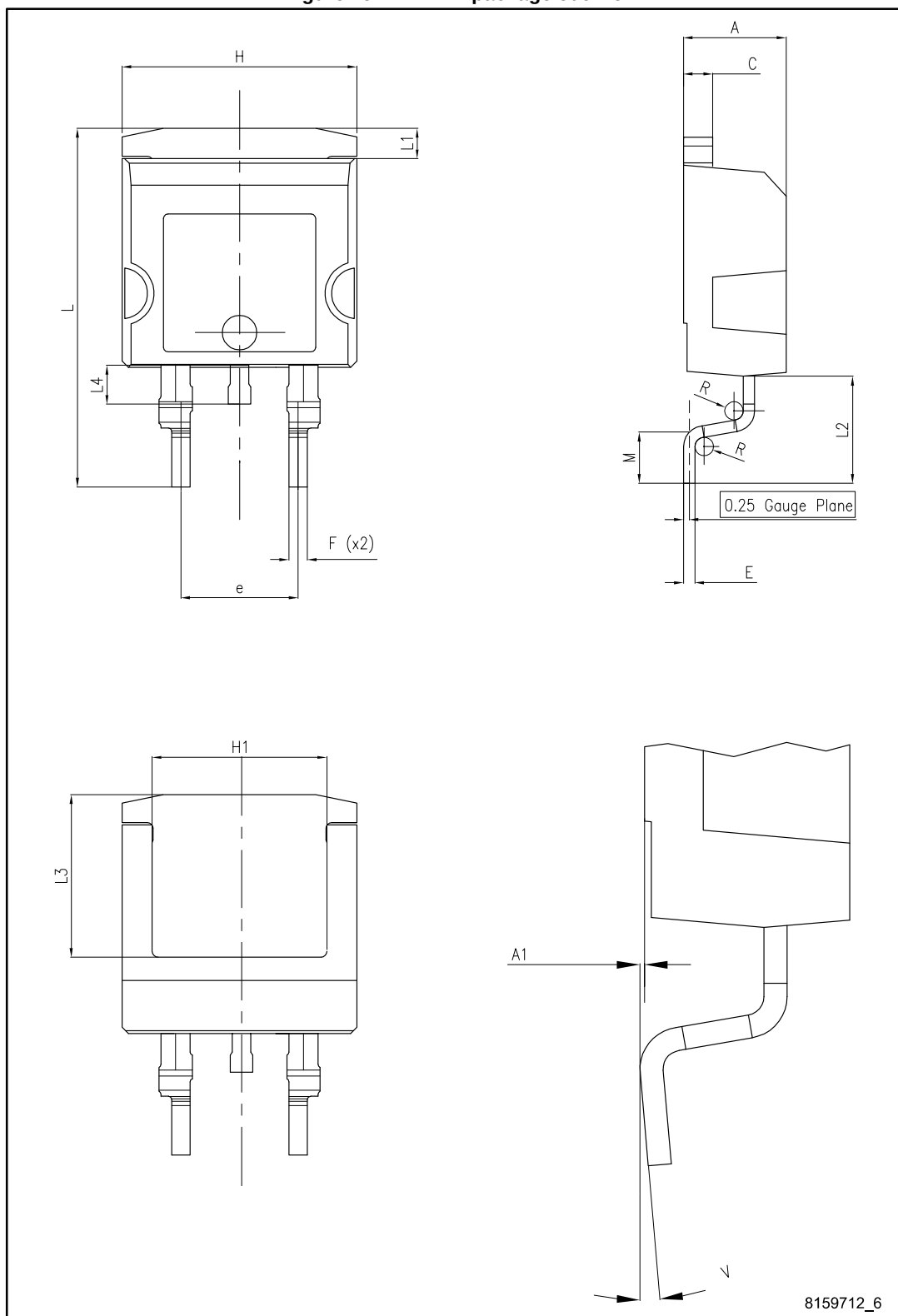
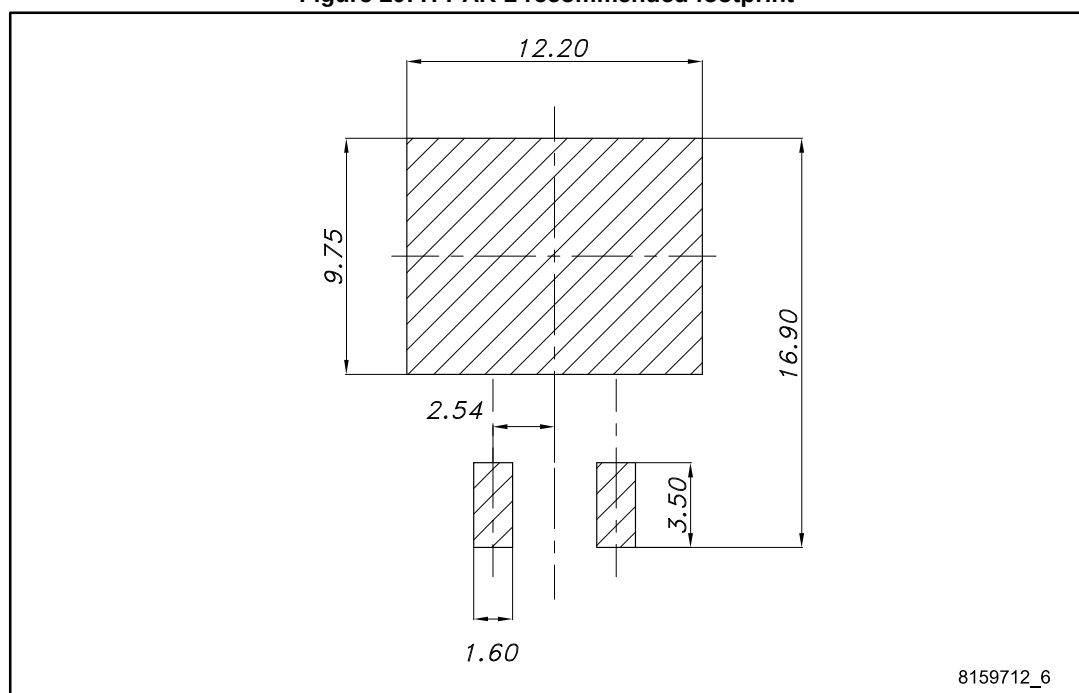
Figure 19: H²PAK-2 package outline

Table 8: H²PAK-2 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30	-	4.70
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



4.2 H²PAK packing information

Figure 21: Tape outline

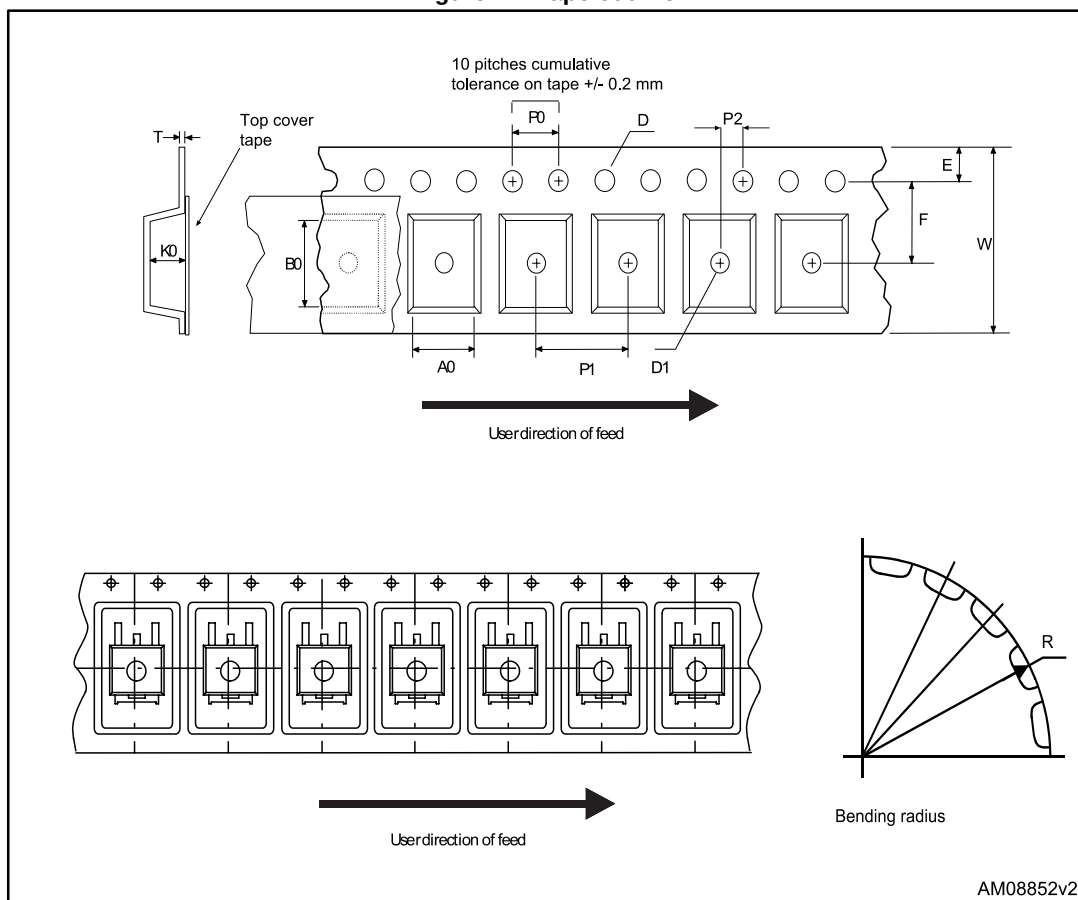


Figure 22: Reel outline

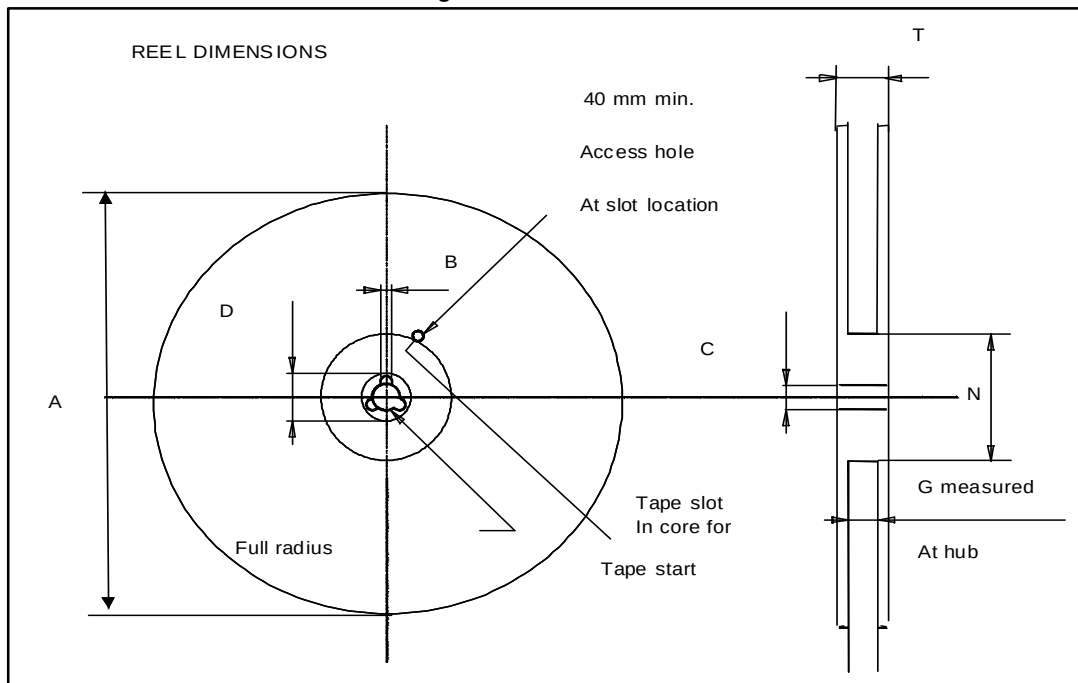


Table 9: Tape and reel mechanical data

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			

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
23-Sep-2014	1	First version.
02-Sep-2016	2	Updated Safe operating area. Updated H ² PAK package information Minor text changes.
06-Oct-2016	3	Updated Features. Updated Section 9.1: "H²PAK-2 package information" . Minor text changes.

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