STH145N8F7-2AG

Automotive-grade N-channel 80 V, 3.3 mΩ typ., 90 A STripFET™ F7 Power MOSFET in a H²PAK-2 package

Datasheet - production data

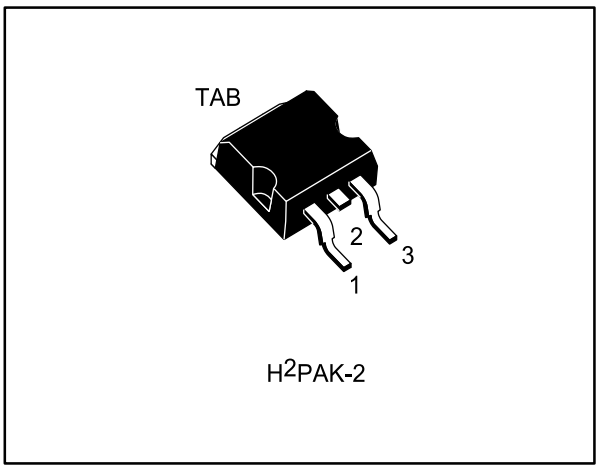
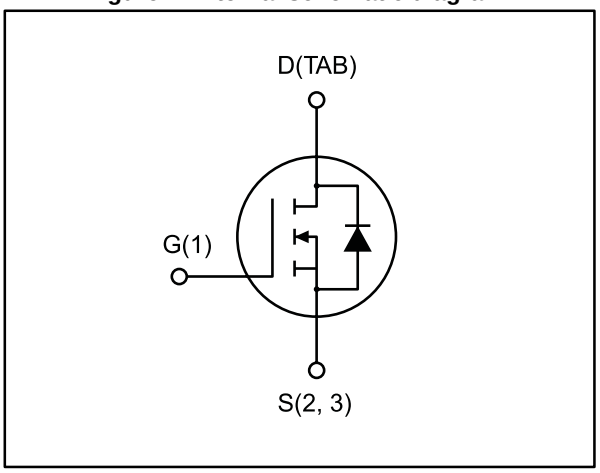


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STH145N8F7-2AG	80 V	4 mΩ	90 A	200 W

- Designed for automotive applications and AEC-Q101 qualified
- Among the lowest $R_{DS(on)}$ on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1: Device summary

Order code	Marking	Package	Packaging
STH145N8F7-2AG	145N8F7	H²PAK-2	Tape and reel

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	80	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at T_C = 25 ° C	90 (1)	A
I_D	Drain current (continuous) at T_C = 100 ° C	90	A
I_{DM}(2)	Drain current (pulsed)	360	A
P_{TOT}	Total dissipation at T_C = 25 ° C	200	W
E_{AS}(3)	Single pulse avalanche energy	515	mJ
T_j	Operating junction temperature	- 55 to 175	° C
T_{stg}	Storage temperature		

Notes:

(1)Limited by package

(2)Pulse width is limited by safe operating area

(3)Starting Tj =25 ° C, Id = 18.5 A, Vdd = 50 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	35	° C/W
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.75	° C/W

Notes:

(1)When mounted on FR-4 board of 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	80			V
I_{DSS}	Zero gate voltage Drain current	V_{GS} = 0, V_{DS} = 80 V			1	µA
		V_{GS} = 0, V_{DS} = 80 V, T_J=125 ° C			10	µA
I_{GSS}	Gate-source 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	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS}=10 V, I_D = 45 A		3.3	4	mΩ

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{GS} = 0, V_{DS} = 40 V, f = 1 MHz	-	6340	-	pF
C_{oss}	Output capacitance		-	1195	-	pF
C_{rss}	Reverse transfer capacitance		-	105	-	pF
Q_g	Total gate charge	V_{DD} = 40 V, I_D = 64 A, V_{GS} = 10 V	-	96	-	nC
Q_{gs}	Gate-source charge		-	30	-	nC
Q_{gd}	Gate-drain charge		-	26	-	nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 40 V, I_D = 45 A R_G=4.7 Ω, V_{GS} = 10 V	-	26	-	ns
t_r	Rise time		-	51	-	ns
$t_{d(off)}$	Turn-off-delay time		-	82	-	ns
t_f	Fall time		-	44	-	ns

Table 7: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		90	A
I_{SDM}(1)	Source-drain current (pulsed)		-		360	A
V_{SD} (2)	Forward on voltage	V_{GS} = 0, I_{SD} = 90 A	-		1.2	V
t_{rr}	Reverse recovery time	I_{SD} = 64 A, di/dt = 100 A/µ s, V_{DD} = 60 V T_j = 150 ° C	-	58		ns
Q_{rr}	Reverse recovery charge		-	92		nC
I_{RRM}	Reverse recovery current		-	3.2		A

Notes:

(1)Pulse width is limited by safe operating area

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

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

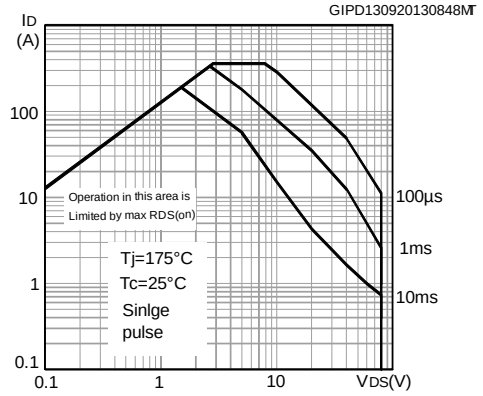


Figure 3: Thermal impedance

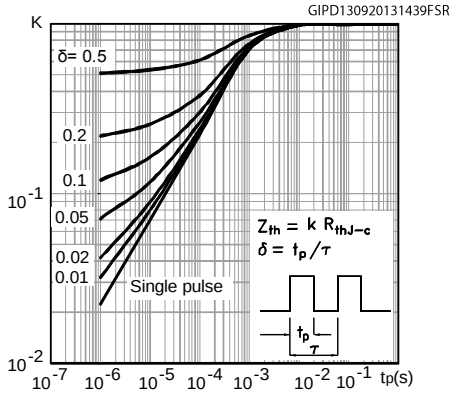


Figure 4: Output characteristics

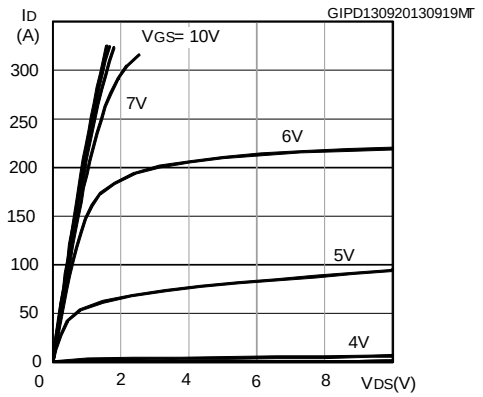


Figure 5: Transfer characteristics

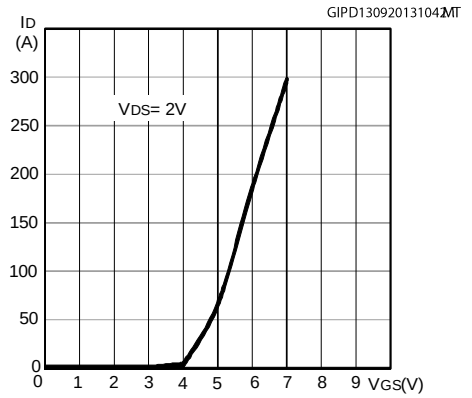


Figure 6: Normalized V(BR)DSS vs. temperature

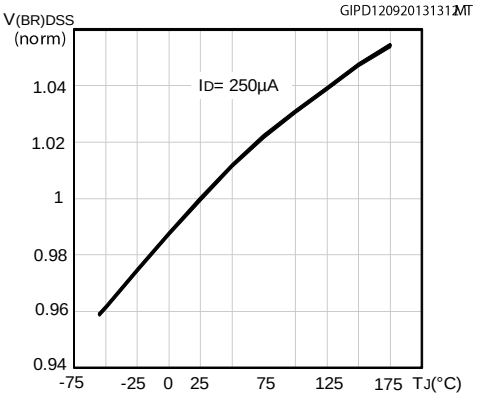


Figure 7: Static drain-source on resistance

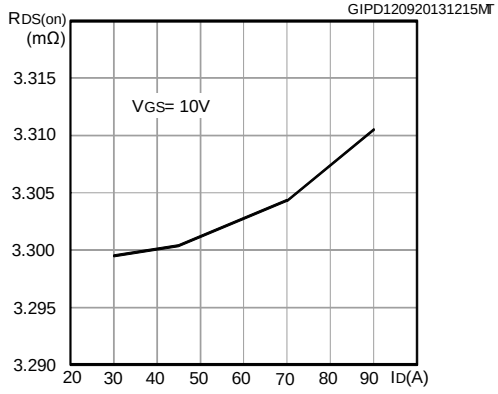


Figure 8: Gate charge vs. gate-source voltage

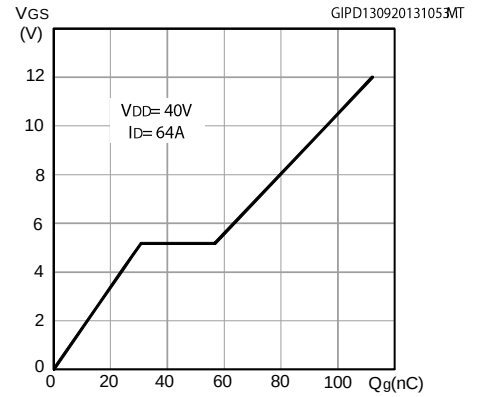


Figure 9: Capacitance variations

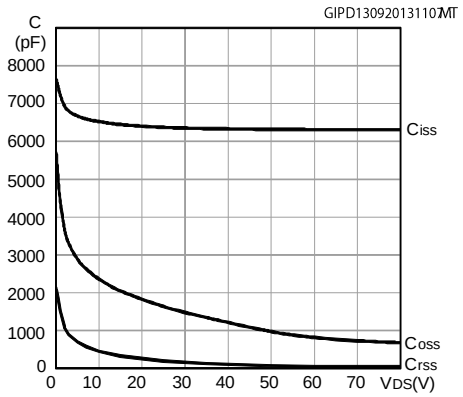


Figure 10: Normalized gate threshold voltage vs. temperature

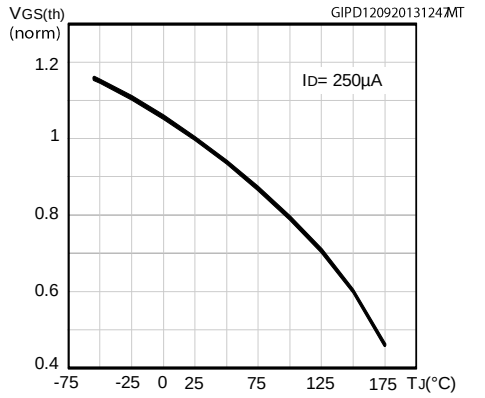


Figure 11: Normalized on resistance vs. temperature

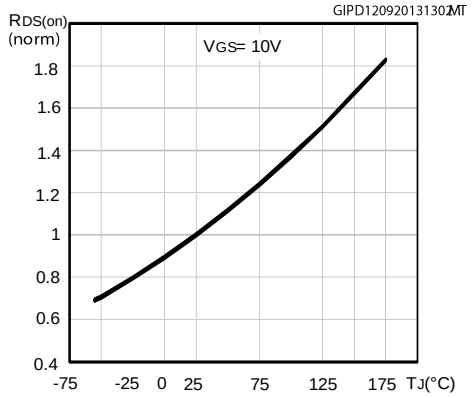
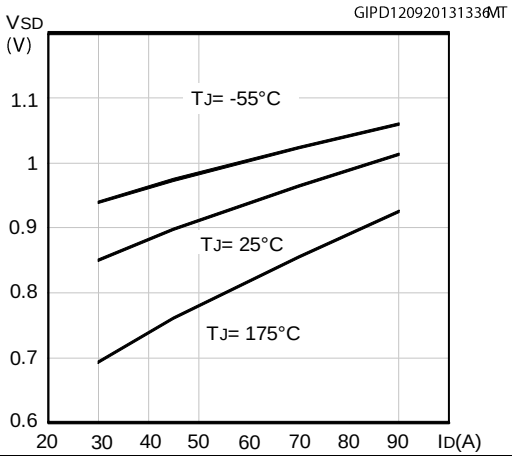


Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Switching times test circuit for resistive load

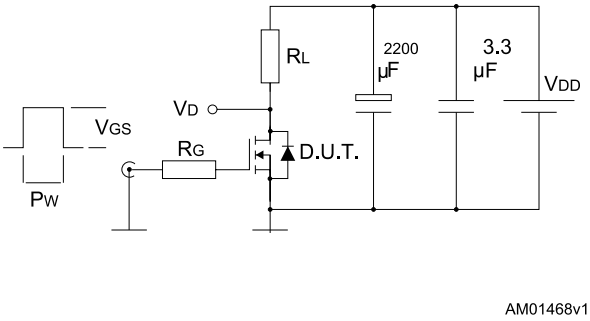


Figure 14: Gate charge test circuit

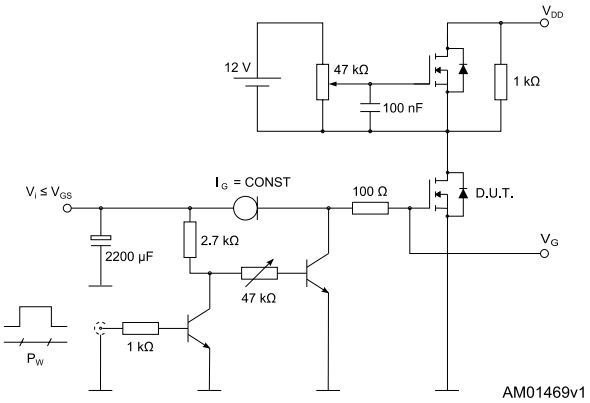


Figure 15: Test circuit for inductive load switching and diode recovery times

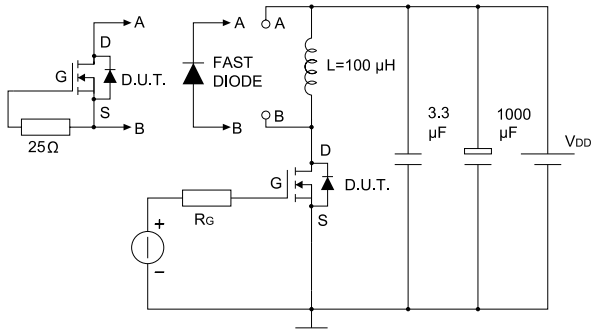


Figure 16: Unclamped inductive load test circuit

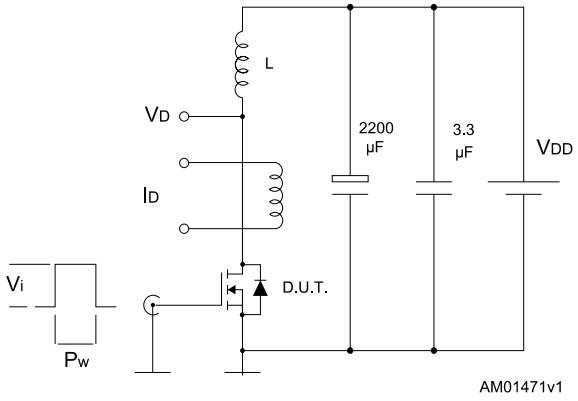


Figure 17: Unclamped inductive waveform

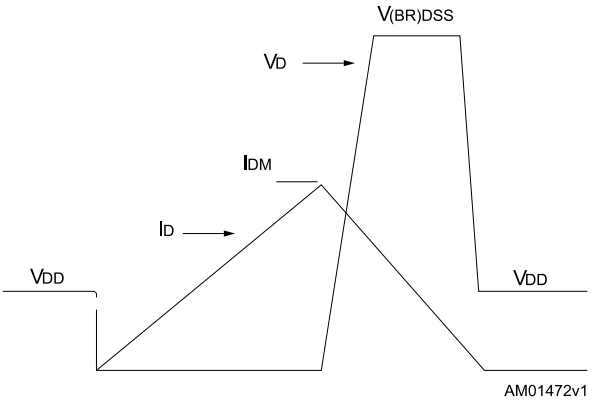
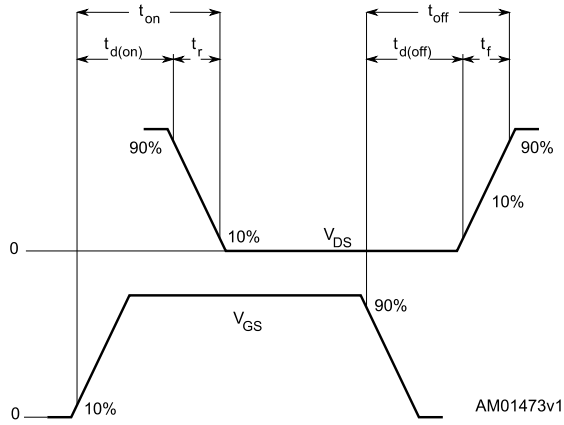


Figure 18: Switching time waveform



4 Package 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

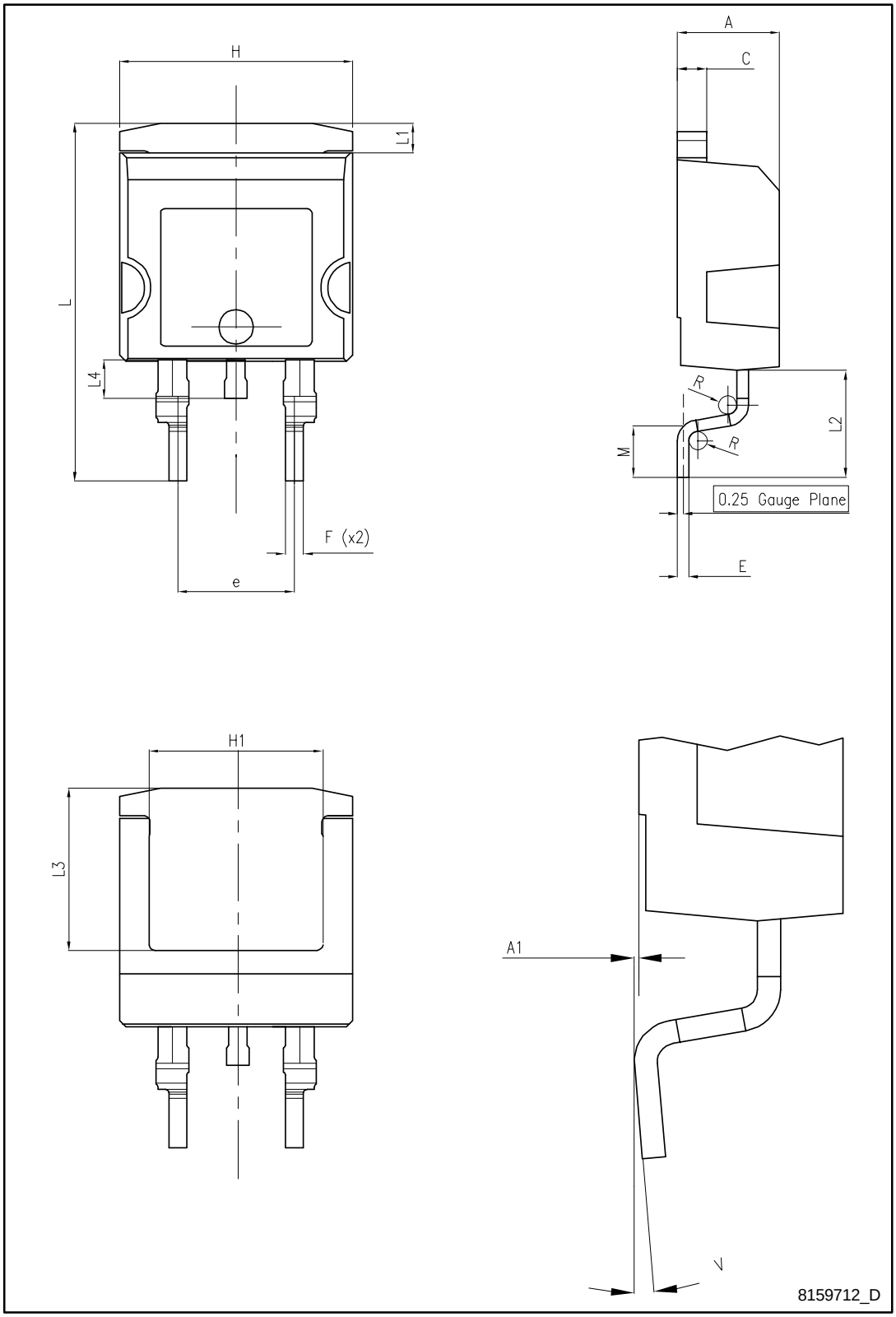
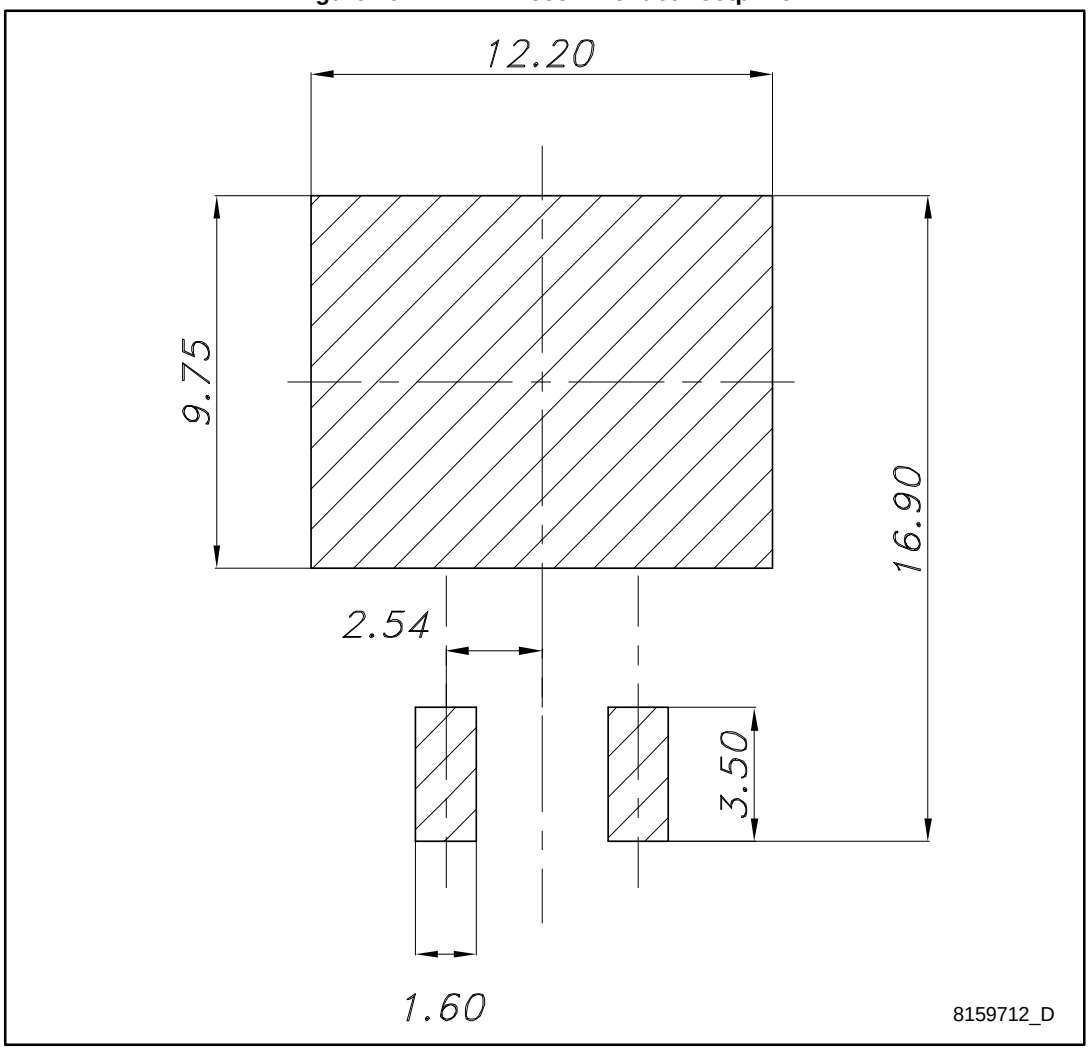


Table 8: H²PAK-2 mechanical data

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



5 Packing information

Figure 21: Tape outline

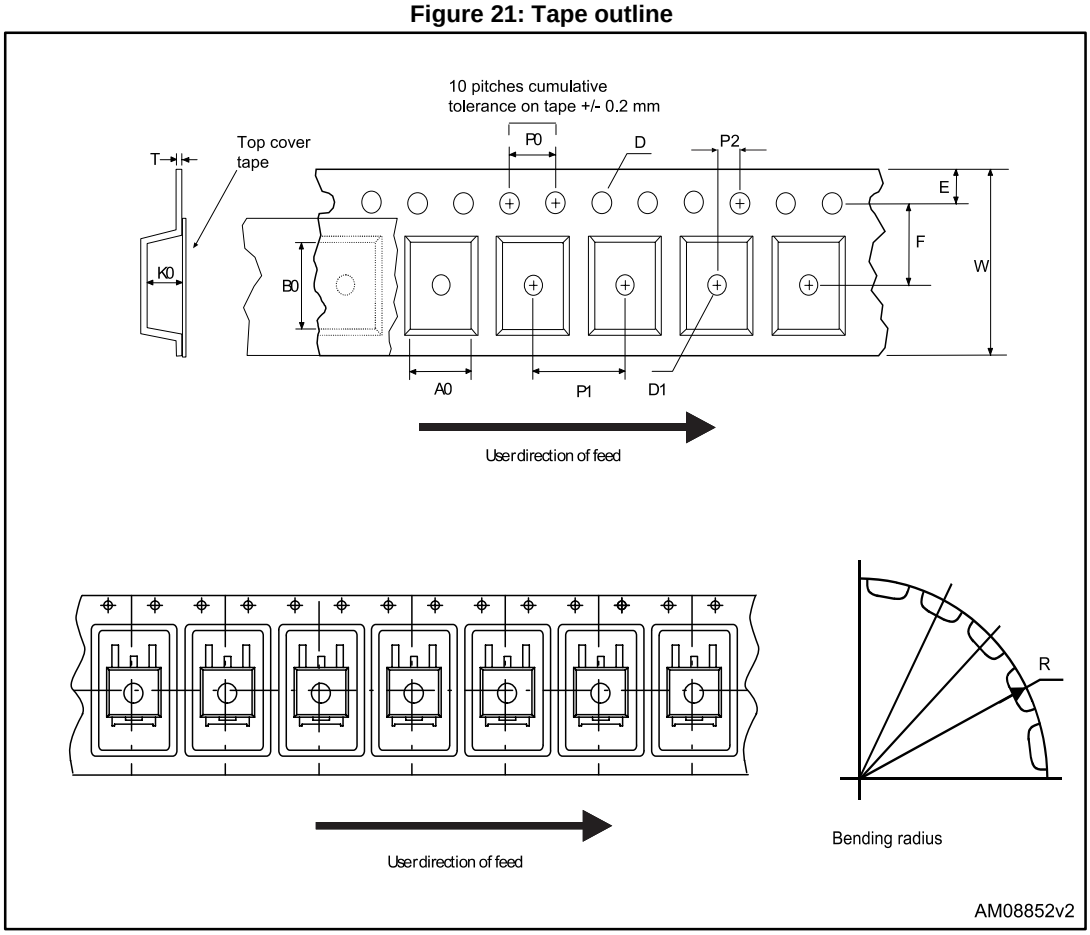


Figure 22: Reel outline

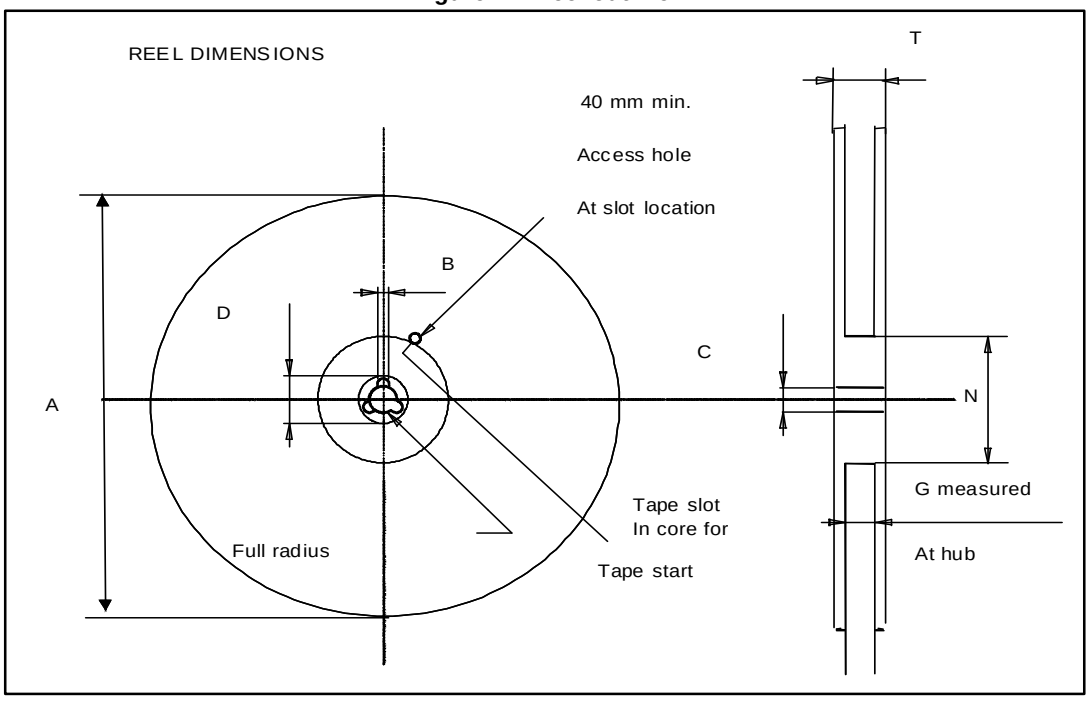


Table 9: Tape and reel mechanical data

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			

6 Revision history

Table 10: Document revision history

Date	Revision	Changes
05-Jun-2015	1	First release.

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