

N-channel 80 V, 0.0028 Ω typ., 120 A, STripFET™ F7 Power MOSFET in a H²PAK-2 package

Datasheet — production data

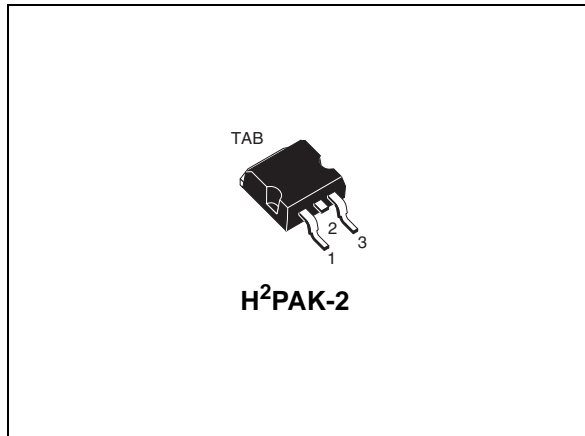
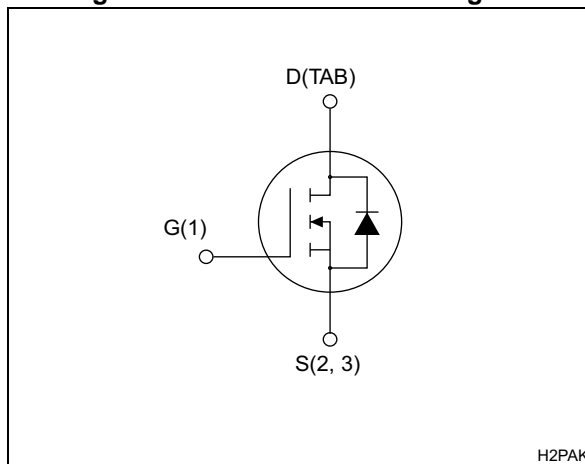


Figure 1. Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STH170N8F7-2	80 V	0.0037 Ω	120 A	250 W

- 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
STH170N8F7-2	170N8F7	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
5	Packing information	12
6	Revision history	14



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
$I_D^{(1)}$	Drain current (continuous)	120	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	120	A
I_{DM}	Drain current (pulsed)	480	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	250	W
T_J	Operating junction temperature	-55 to 175	$^\circ\text{C}$
T_{stg}	Storage temperature		$^\circ\text{C}$

1. Limited by package and rated according to R_{thj-c} .

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.6	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	$^\circ\text{C}/\text{W}$

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

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
I_{AV}	Not-repetitive avalanche current, (pulse width limited by T_{jmax})	35	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AV}$, $V_{DD} = 50\text{ V}$)	615	mJ

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 250\ \mu A$	80			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 80\ V$			1	μA
		$V_{GS} = 0, V_{DS} = 80\ V,$ $T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0, V_{GS} = +20\ V$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on- resistance	$V_{GS} = 10\ V, I_D = 60\ A$		0.0028	0.0037	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{GS} = 0, V_{DS} = 40\ V,$ $f = 1\ \text{MHz},$	-	8710	-	pF
C_{oss}	Output capacitance		-	1330	-	pF
C_{rss}	Reverse transfer capacitance		-	78	-	pF
Q_g	Total gate charge	$V_{DD} = 40\ V, I_D = 120\ A$	-	120	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\ V$	-	43	-	nC
Q_{gd}	Gate-drain charge	Figure 14	-	26	-	nC

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 40\ V, I_D = 60\ A,$ $R_G = 4.7\ \Omega, V_{GS} = 10\ V$ Figure 13	-	38	-	ns
t_r	Rise time		-	53	-	ns
$t_{d(off)}$	Turn-off delay time		-	79	-	ns
t_f	Fall time		-	37	-	ns

Table 8. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		120	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		480	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 120 \text{ A}, V_{GS} = 0$	-		1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = 120 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 64 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	54		ns
Q_{rr}	Reverse recovery charge		-	78		nC
I_{RRM}	Reverse recovery current		-	2.9		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

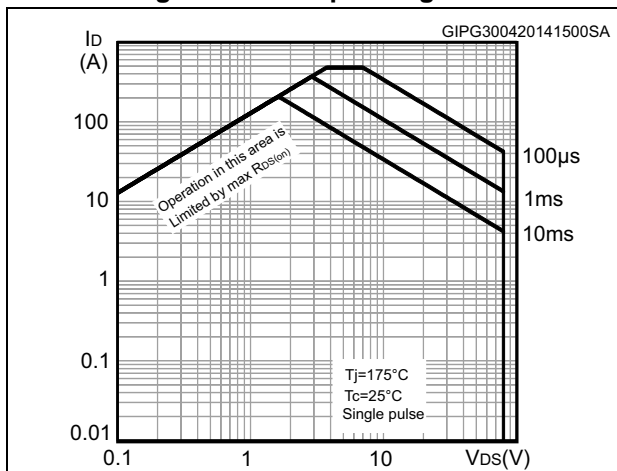


Figure 3. Thermal impedance

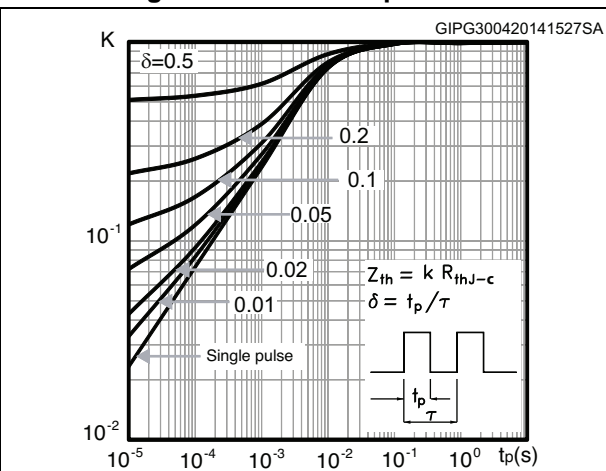


Figure 4. Output characteristics

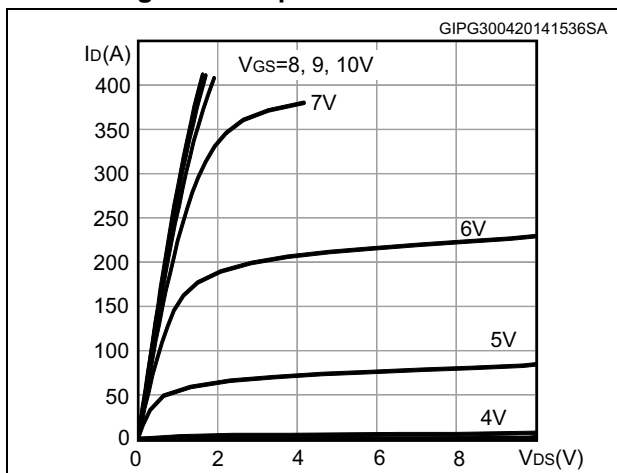


Figure 5. Transfer characteristics

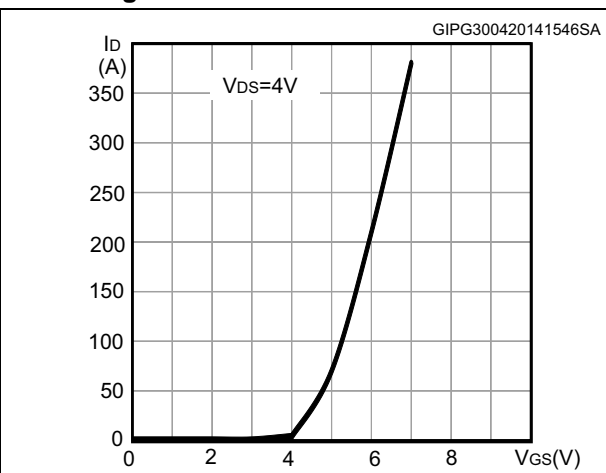


Figure 6. Gate charge vs gate-source voltage

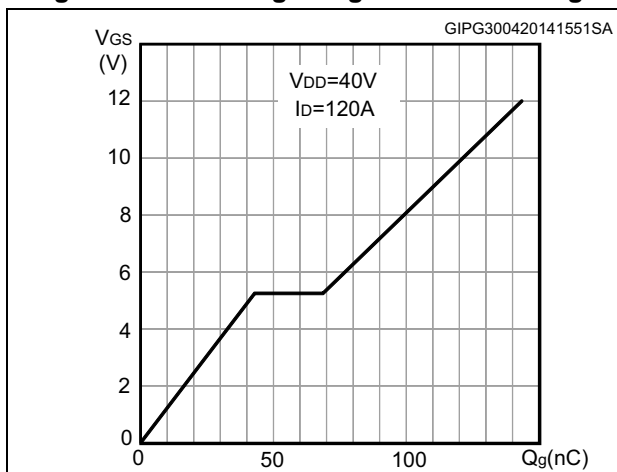


Figure 7. Static drain-source on-resistance

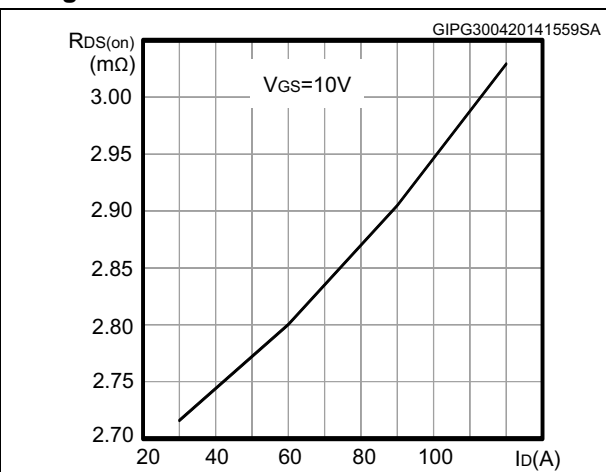


Figure 8. Capacitance variations

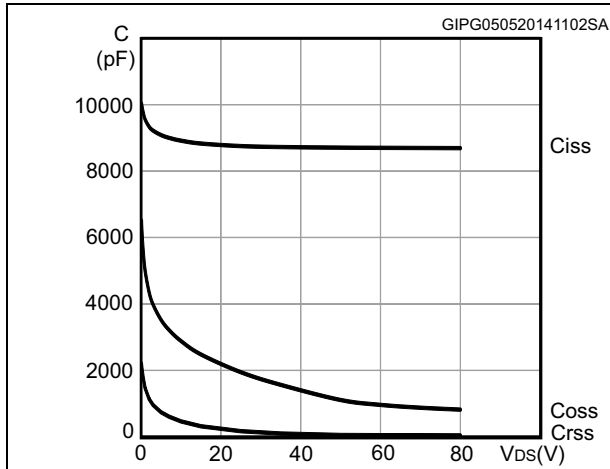


Figure 9. Normalized gate threshold voltage vs temperature

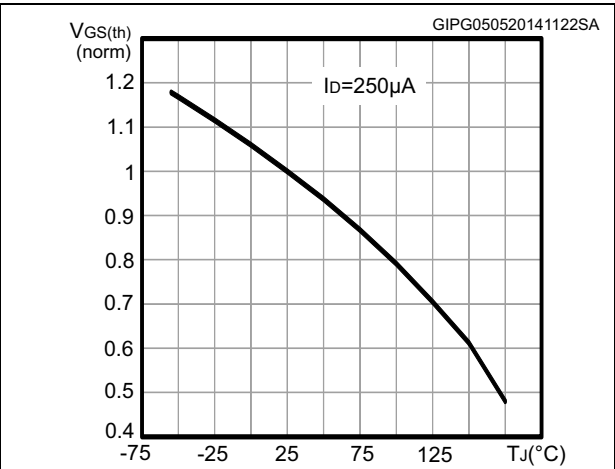


Figure 10. Normalized on-resistance vs temperature

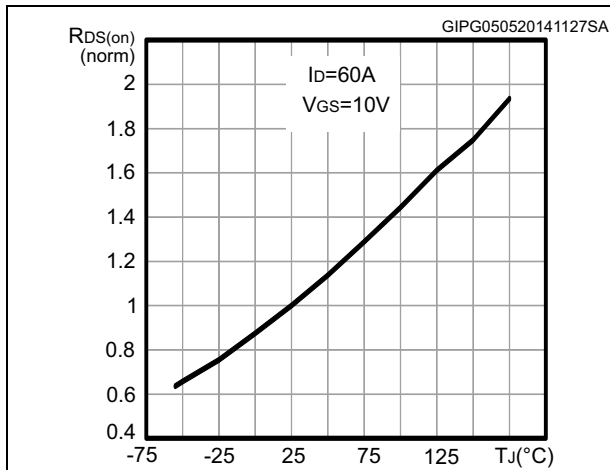


Figure 11. Normalized $V_{(BR)DSS}$ vs temperature

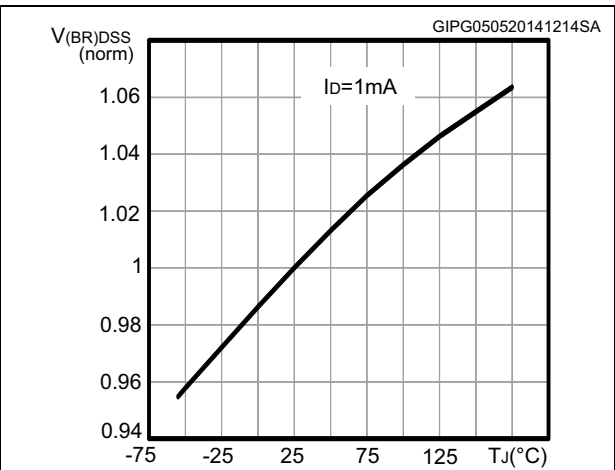
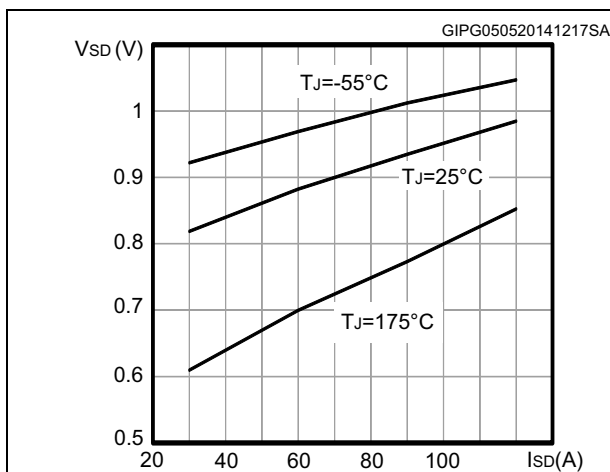


Figure 12. Source-drain diode forward characteristics



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

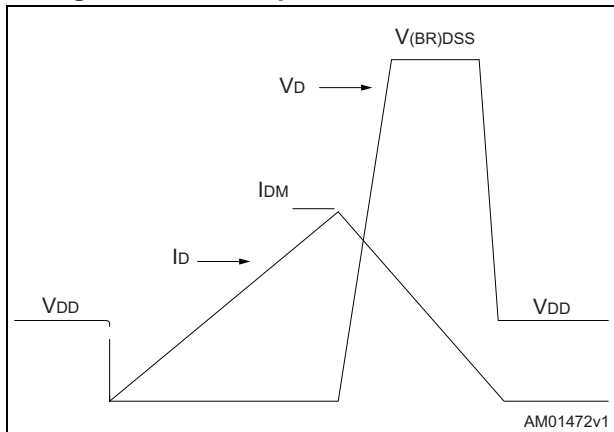
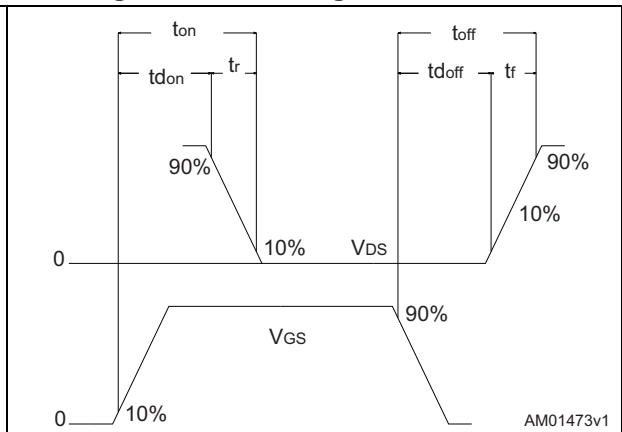
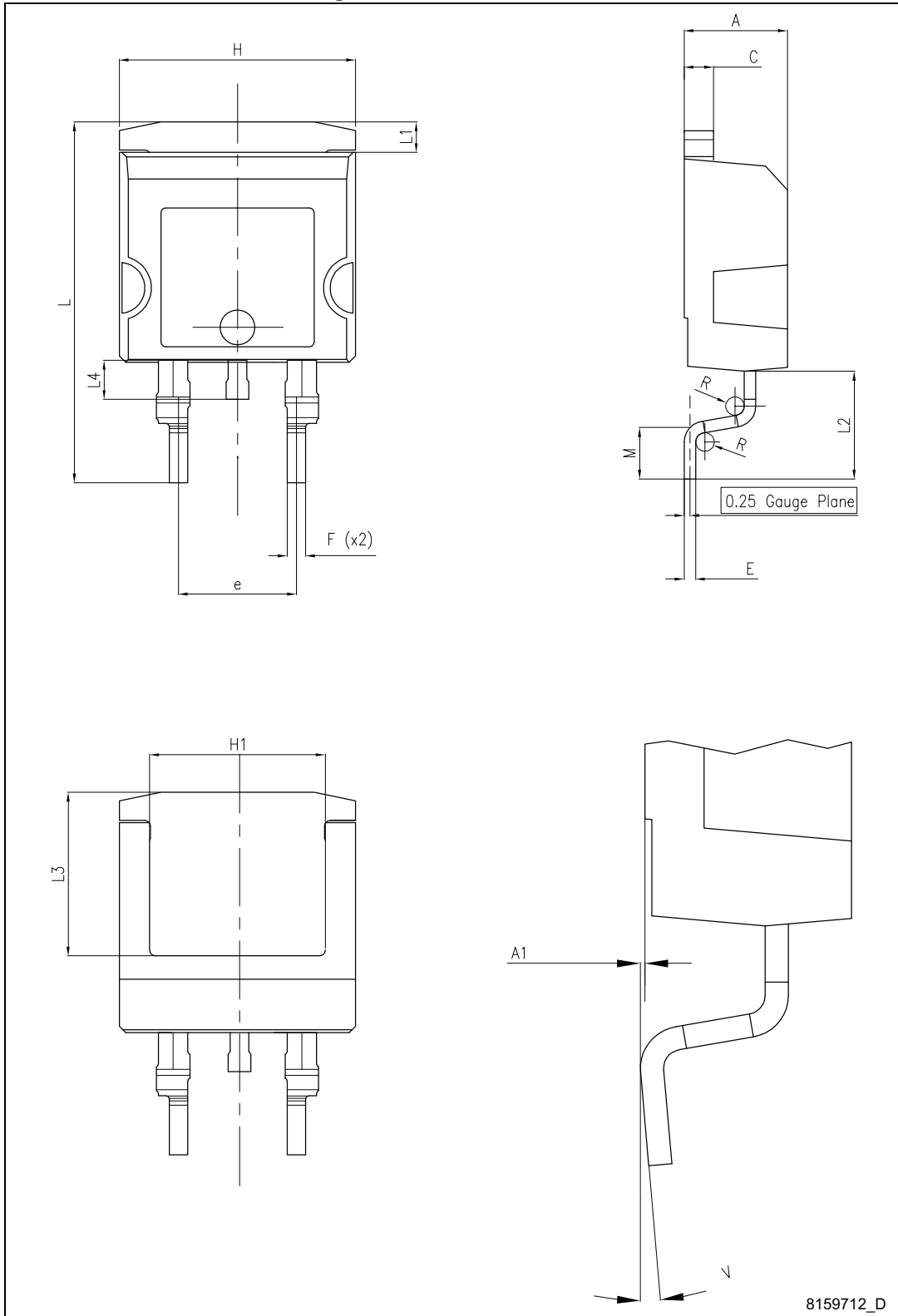


Figure 18. Switching time waveform



4 Package information

Figure 19. H²PAK-2 outline



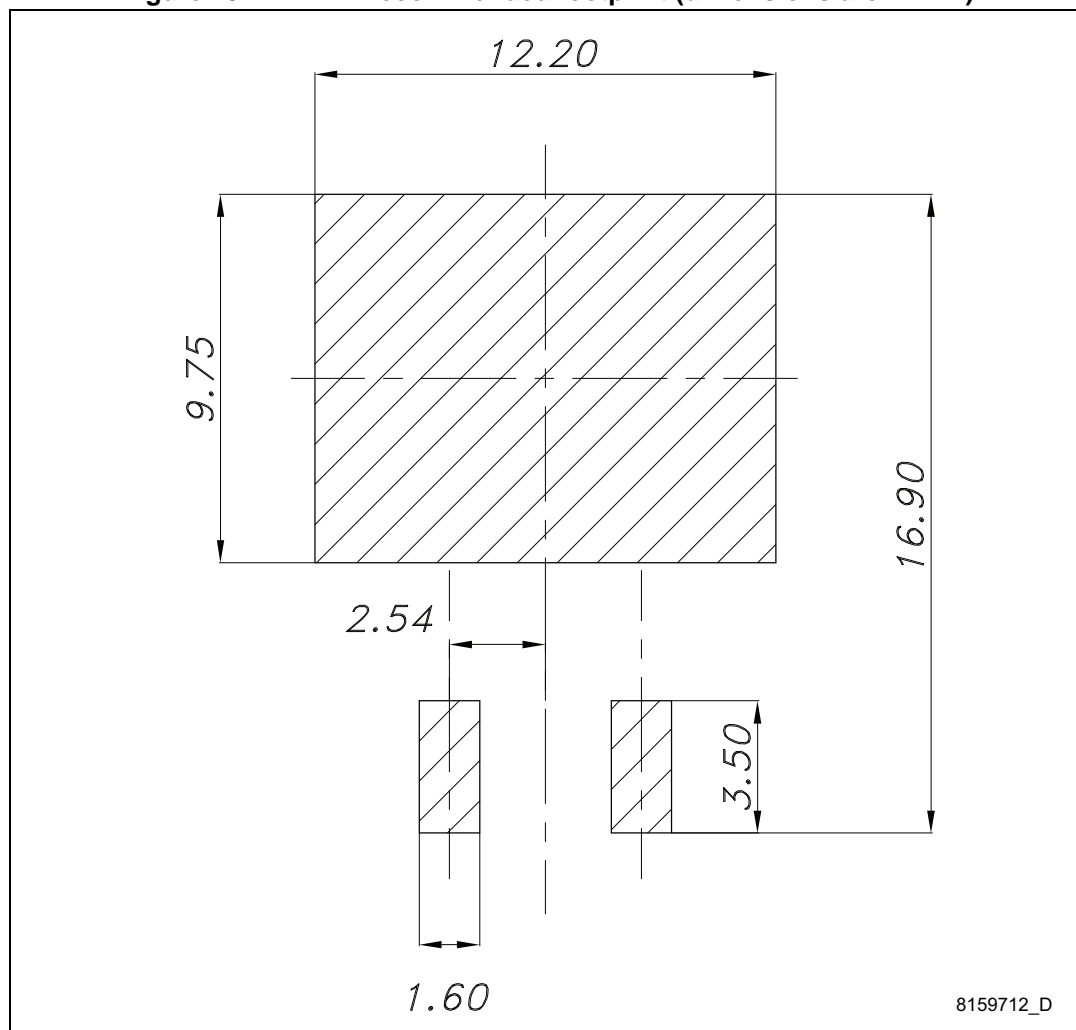
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Table 9. H²PAK-2 mechanical data

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 (dimensions are in mm)



5 Packing information

Figure 21. Tape

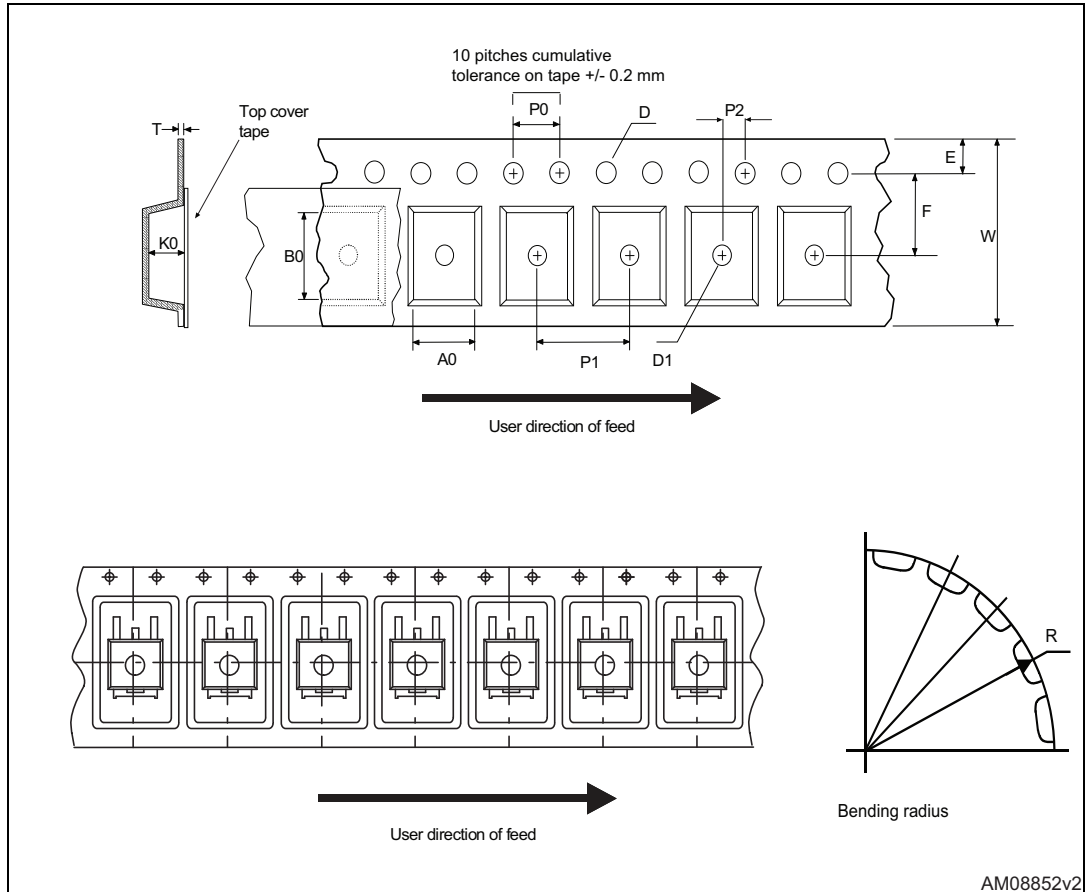


Figure 22. Reel

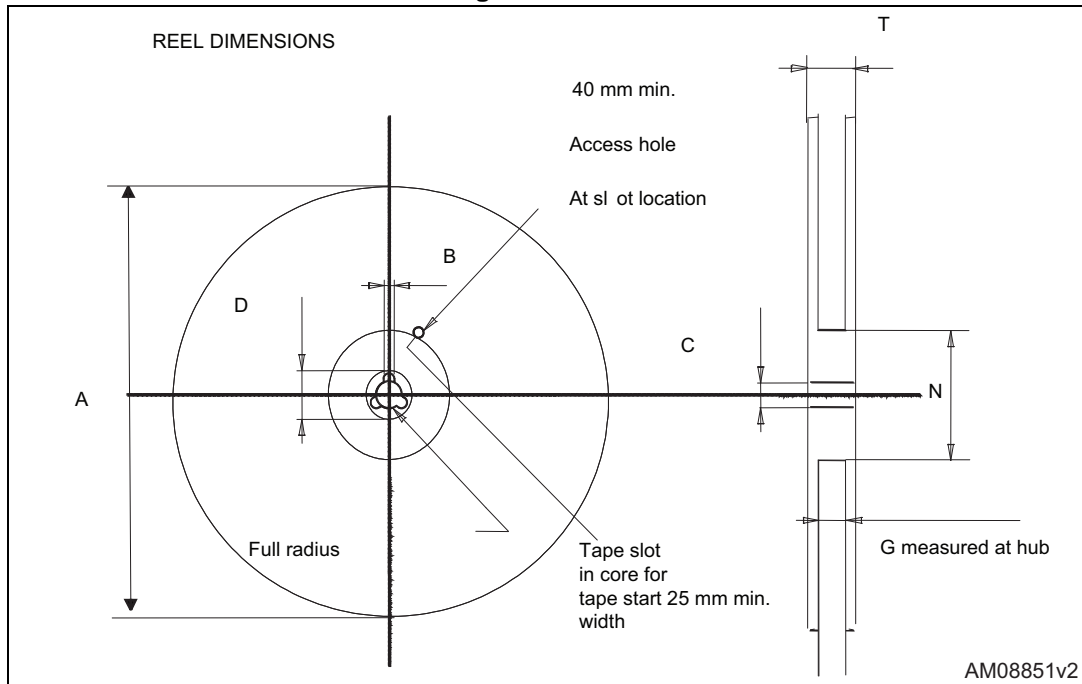


Table 10. H²PAK-2 tape and reel mechanical data

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			

6 Revision history

Table 11. Document revision history

Date	Revision	Changes
20-May-2014	1	First release.
20-Feb-2015	2	Document status promoted from preliminary to production data. Updated Section 4: Package information . Updated title, features and description in cover page.

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Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331