



STH90N55F4-2

N-channel 55 V, 0.0064 Ω , 90 A, H²PAK
STripFET™ DeepGATE™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STH90N55F4-2	55 V	< 0.008 Ω	90 A

- Exceptional dv/dt capability
- Extremely low on-resistance R_{DS(on)}
- 100% avalanche tested

Applications

- Switching applications

Description

The device is N-channel Power MOSFETs developed using ST's STripFET™ DeepGATE™ technology. The device has a new gate structure and is specially designed to minimize on-state resistance to provide superior switching performance.

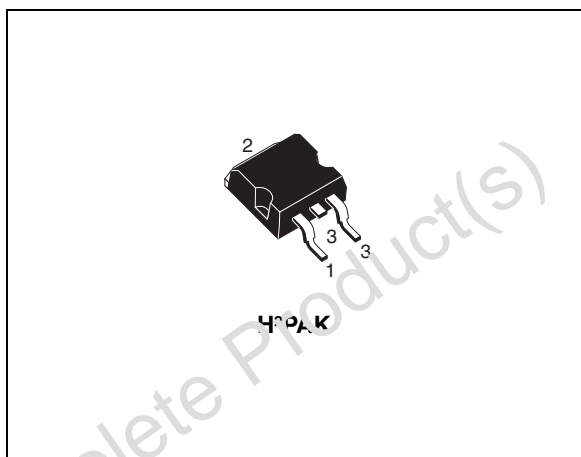


Figure 1. Internal schematic diagram

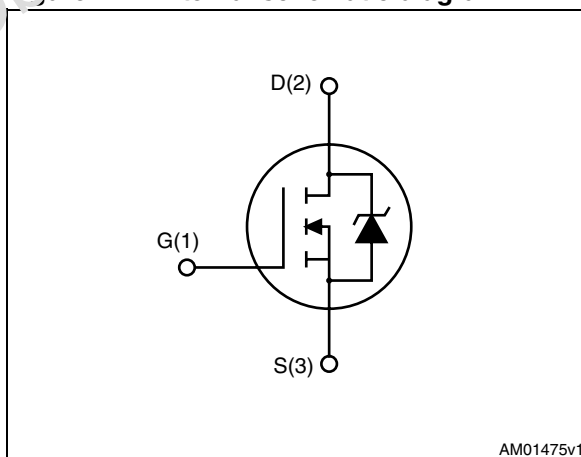


Table 1. Device summary

Order code	Marking	Packages	Packaging
STH90N55F4-2	90N55F4	H ² PAK	Tape and reel

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Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	55	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	90	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	65	A
$I_{DM}^{(1)}$	Drain current (pulsed)	360	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
	Derating factor	1	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	250	mJ
T_{stg}	Storage temperature	- 55 to 175	$^\circ\text{C}$
T_j	Max. operating junction temperature		

1. Pulse width limited by safe operating area
2. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 32.5\text{ A}$, $V_{DD} = 45\text{ V}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1	$^\circ\text{C}/\text{W}$
R_{thj-a}	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

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	I _D = 250 μA, V _{GS} = 0	55			V
I _{DSS}	Zero gate voltage Drain current (V _{GS} = 0)	V _{DS} = max rating V _{DS} = max rating, T _C = 125 °C			1 100	μA 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 μA	2		4	V
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10 V, I _D = 45 A		0.0064	0.008	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance			4800		pF
C _{oss}	Output capacitance	V _{DS} = 25 V, f = 1 MHz, V _{GS} = 0	-	350	-	pF
C _{rss}	Reverse transfer capacitance			210		pF
Q _g	Total gate charge	V _{DD} = 27.5 V, I _D = 90 A, V _{GS} = 10 V		90		nC
Q _{gs}	Gate-source charge	V _{GS} = 10 V <i>Figure 14</i>	-	25	-	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} = 27.5 V, I _D = 90 A R _G = 4.7 Ω, V _{GS} = 10 V	-	20	-	ns
t _r	Rise time	<i>Figure 13</i>		60		ns
t _{d(off)}	Turn-off-delay time	V _{DD} = 27.5 V, I _D = 90 A, R _G = 4.7 Ω, V _{GS} = 10 V	-	55	-	ns
t _f	Fall time	<i>Figure 13</i>		30		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	$I_{SD} = 90 \text{ A}$, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 90 \text{ A}$, $V_{DD} = 44 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$, $T_j = 150 \text{ }^\circ\text{C}$ Figure 15	-	50		ns
Q_{rr}	Reverse recovery charge			105		nC
I_{RRM}	Reverse recovery current			4		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

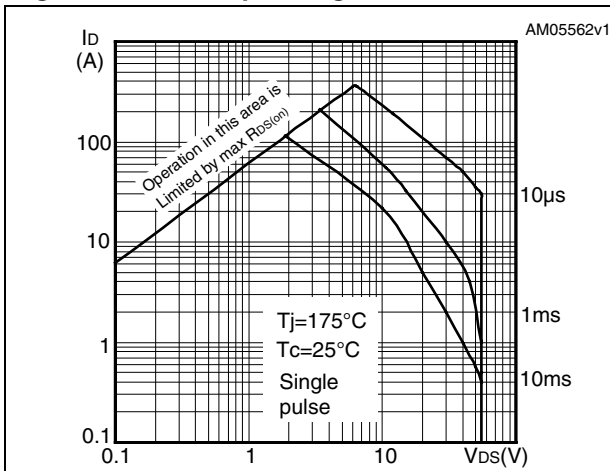


Figure 3. Thermal impedance

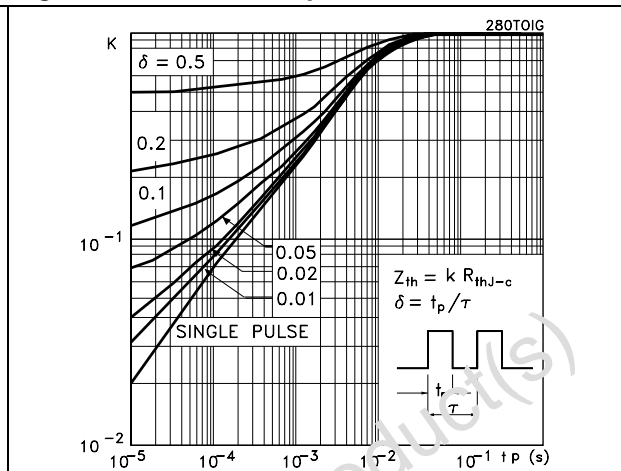


Figure 4. Output characteristics

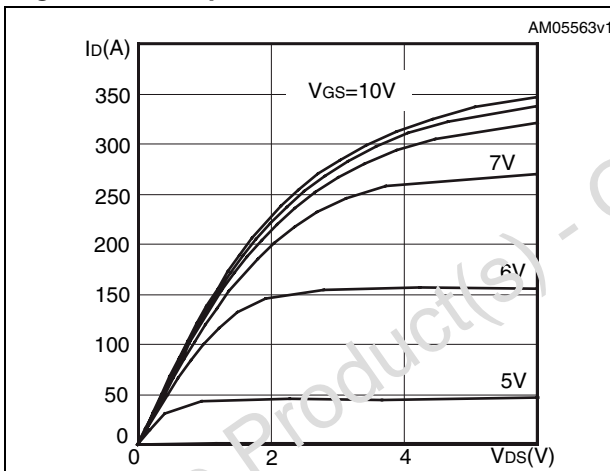


Figure 5. Transfer characteristics

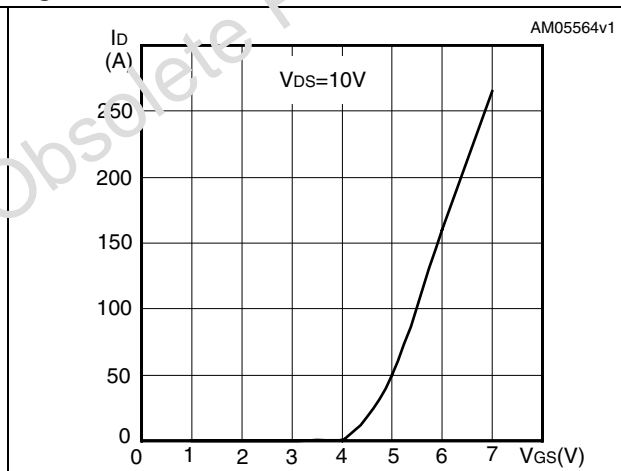


Figure 6. Normalized BV_{DSS} vs temperature

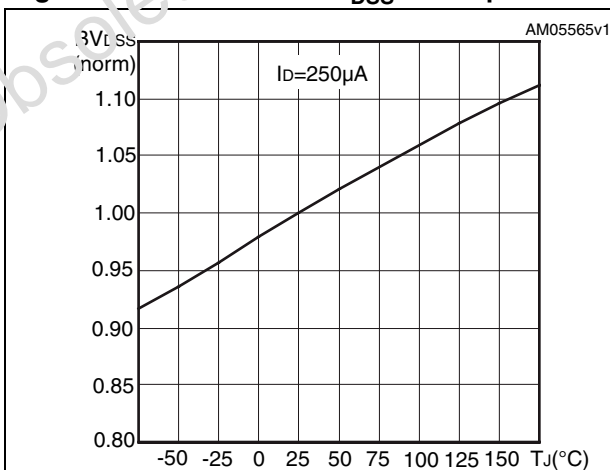


Figure 7. Static drain-source on resistance

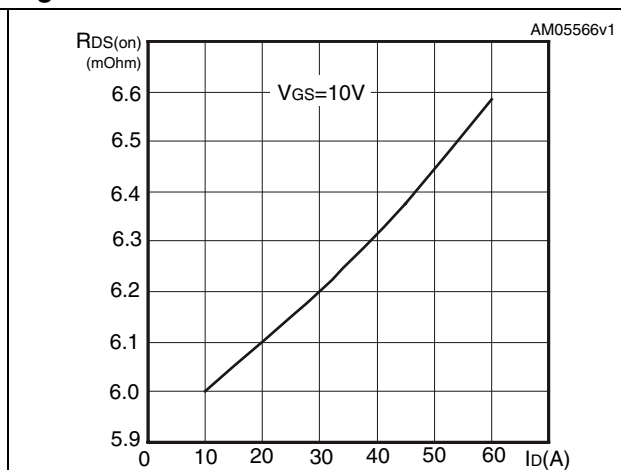


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

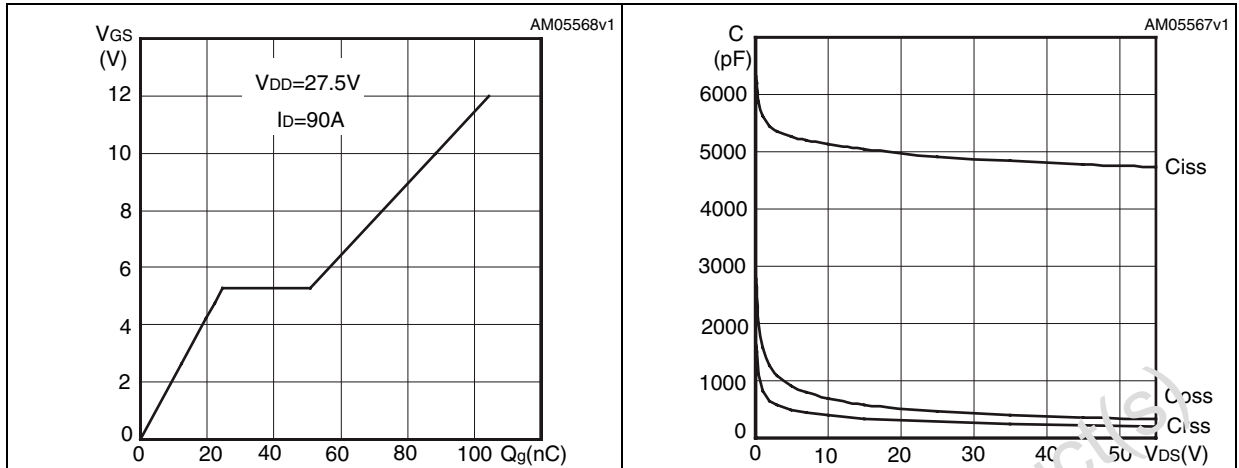


Figure 10. Normalized on resistance vs temperature

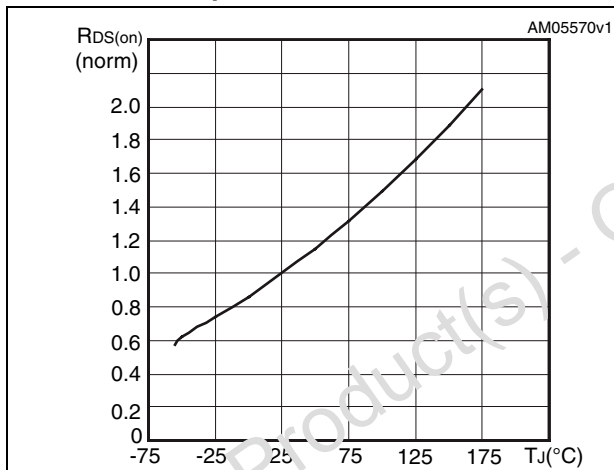


Figure 11. Normalized gate threshold voltage vs temperature

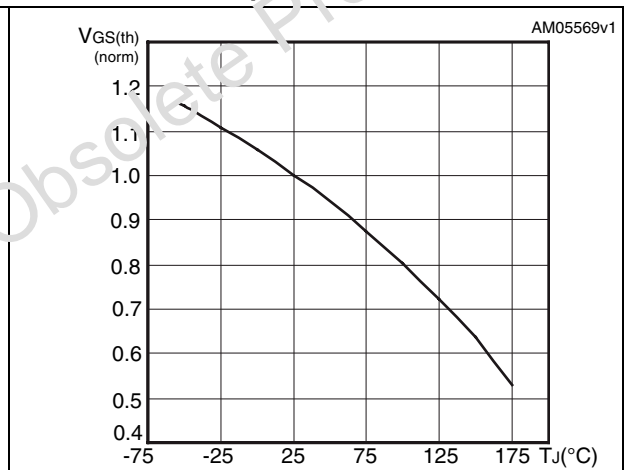
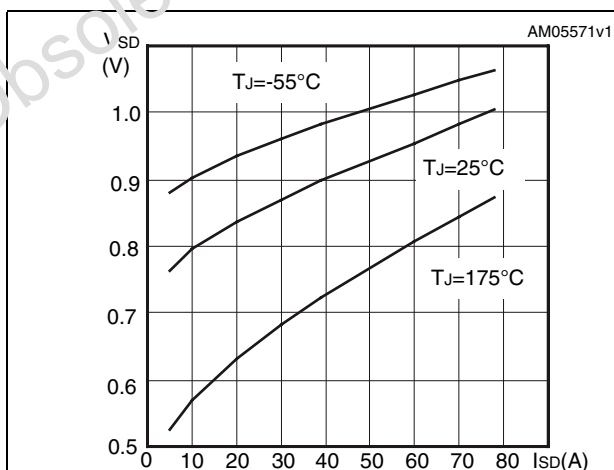


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

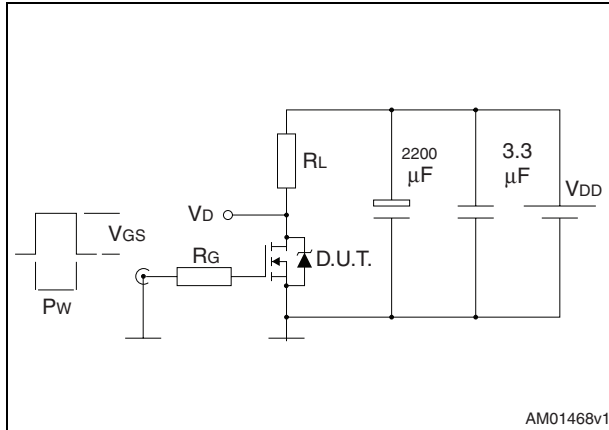


Figure 14. Gate charge test circuit

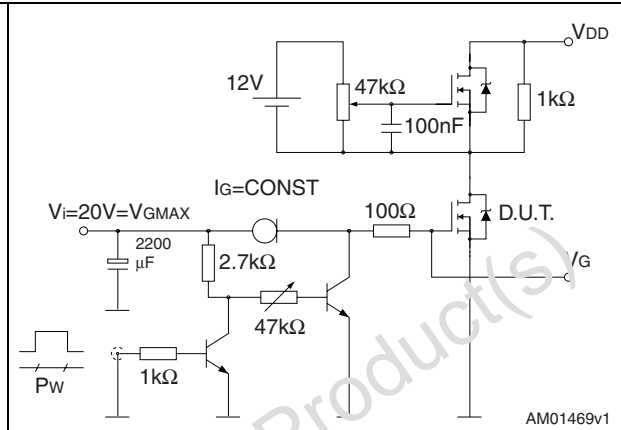


Figure 15. Test circuit for inductive load switching and diode recovery times

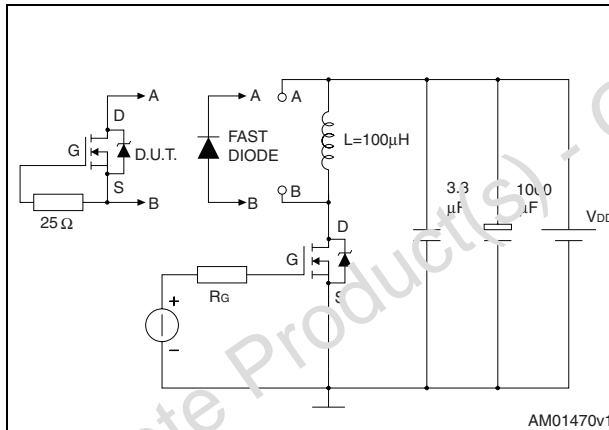


Figure 16. Unclamped inductive load test circuit

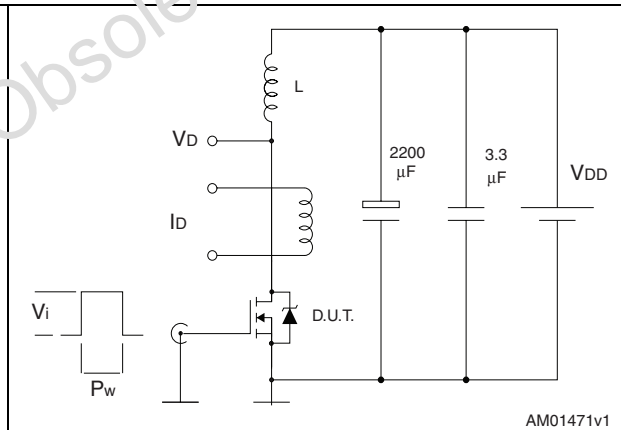


Figure 17. Unclamped inductive waveform

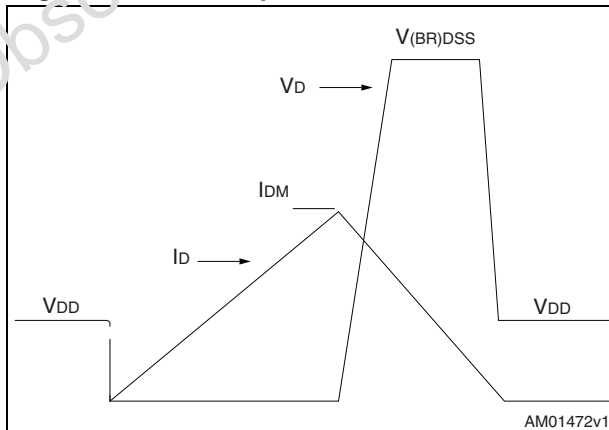
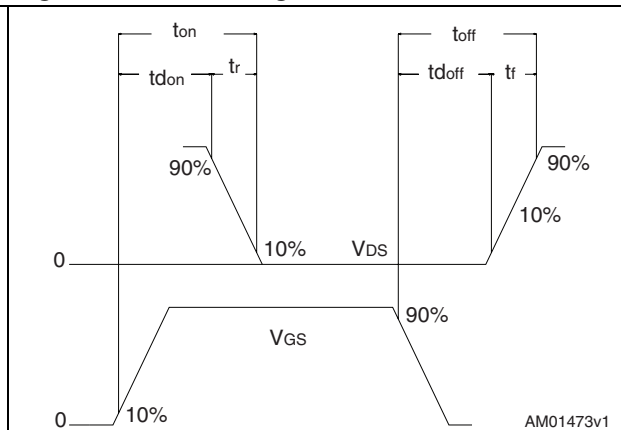


Figure 18. Switching time waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® 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.

Obsolete Product(s) - Obsolete Product(s)

Table 8. H²PAK 2 leads 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		7.50
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. H²PAK 2 leads drawing

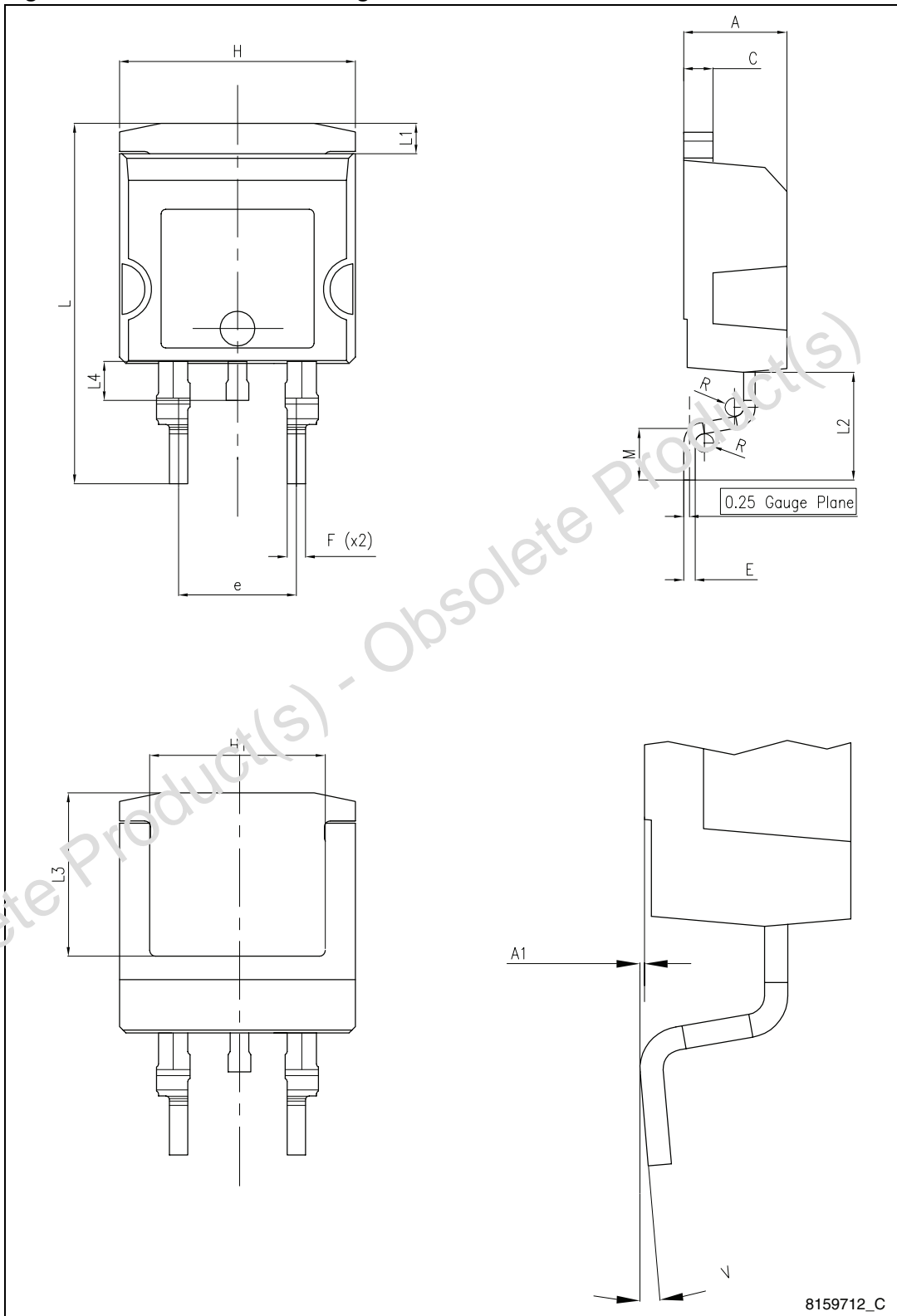
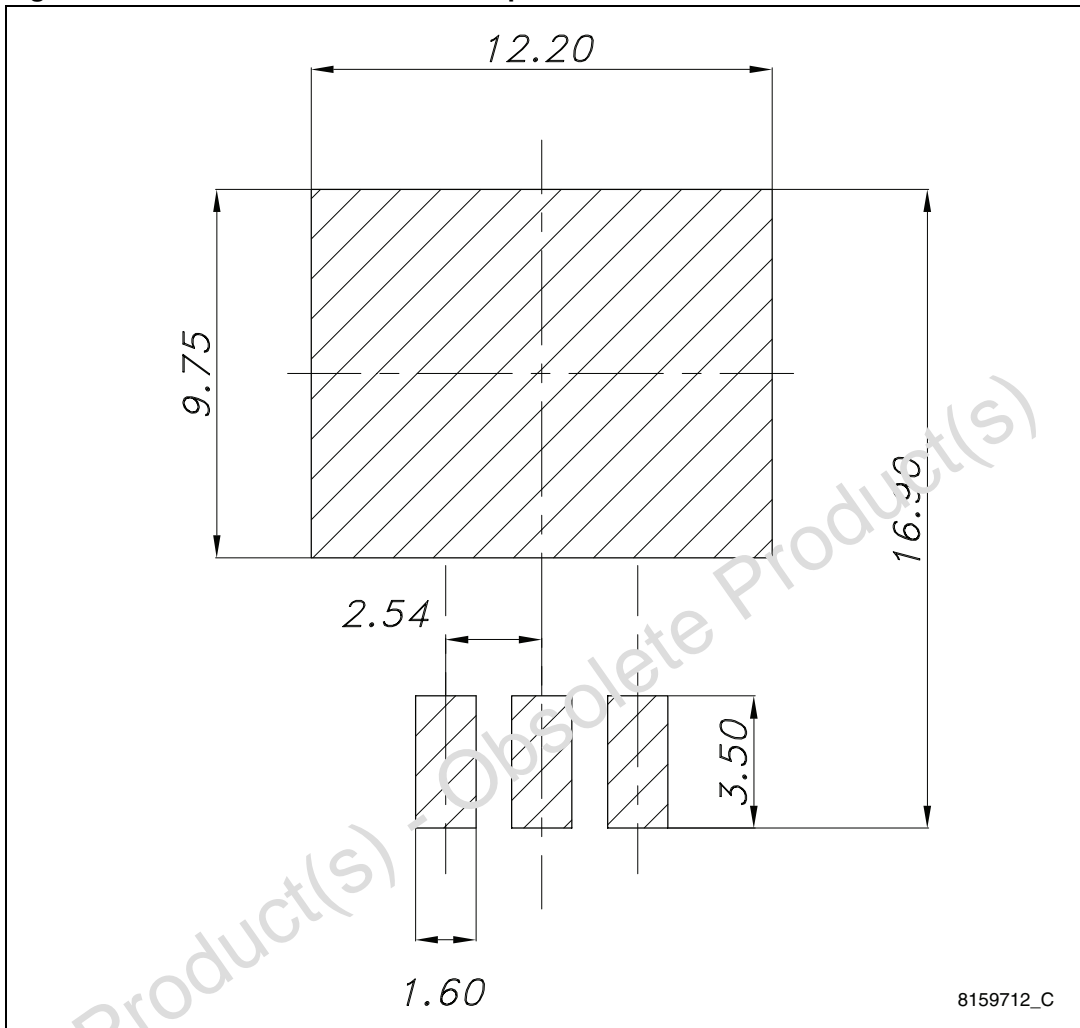


Figure 20. H²PAK 2 recommended footprint



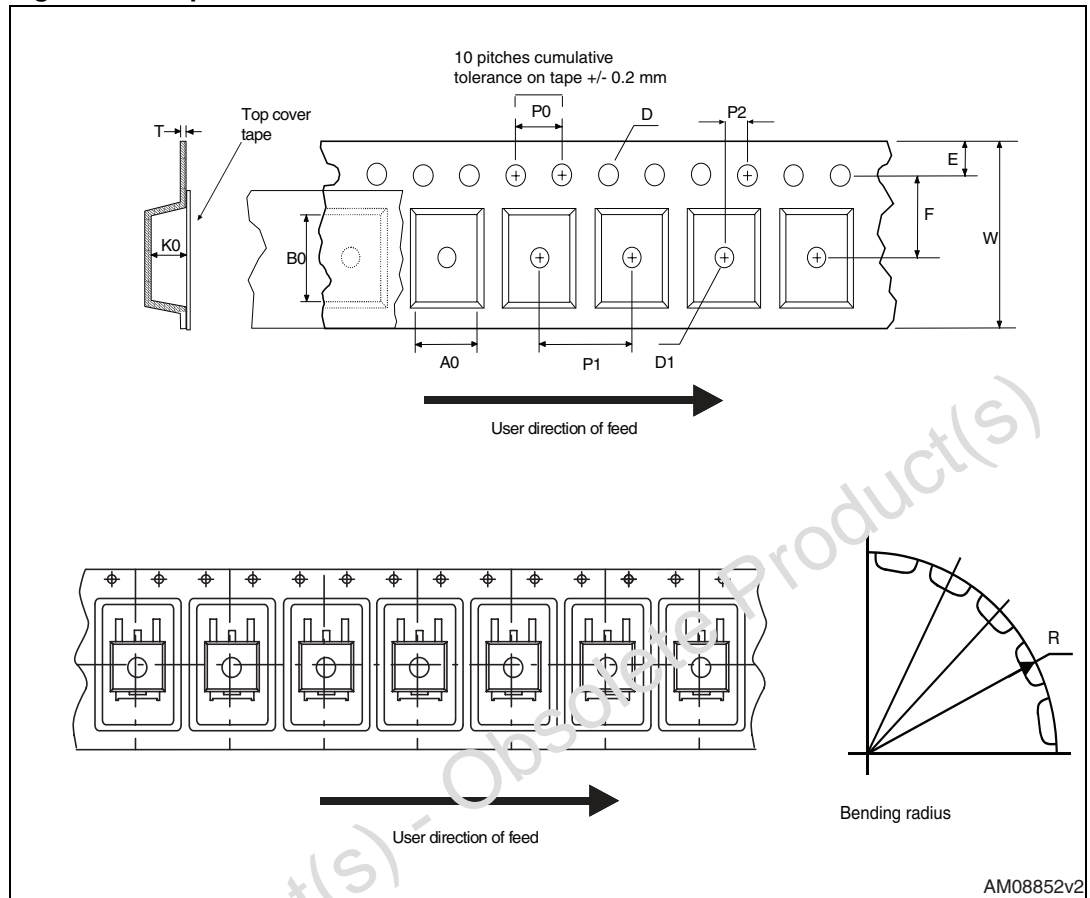
8159712_C

5 Packaging mechanical data

Table 9. H²PAK 2 leads tape and reel mechanical data

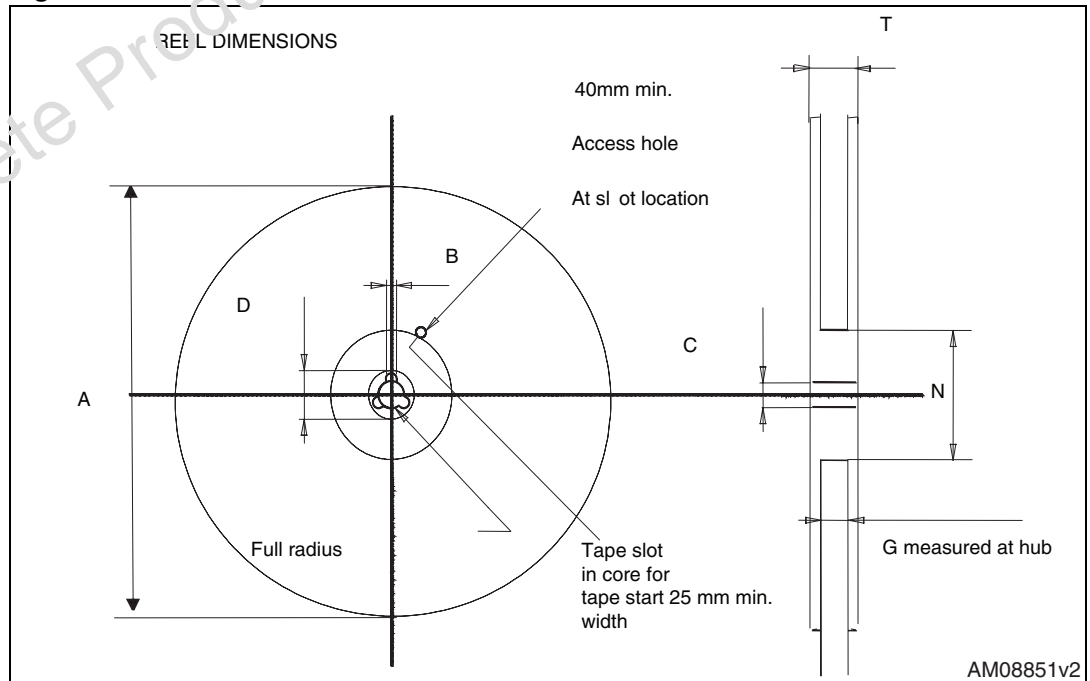
Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1		Base qty	1000
P2	1.9	2.1		Bulk qty	1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 21. Tape



AM08852v2

Figure 22. Reel



AM08851v2

6 Revision history

Table 10. Document revision history

Date	Revision	Changes
08-Jun-2009	1	First release
01-Mar-2010	2	<ul style="list-style-type: none">– Document status promoted from preliminary data to datasheet.– Removed package D²PAK– Added new package, mechanical data: H²PAK
16-Mar-2011	3	Updated Table 5 and Table 6 .
11-Aug-2011	4	<ul style="list-style-type: none">– The part number STP90N55F4 has been moved to a separate datasheet– Minor text changes

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