STH90N55F4-2

N-channel 55 V, 0.0064 Ω, 90 A, H^2PAK 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.

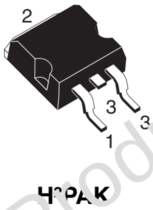


Figure 1. Internal schematic diagram

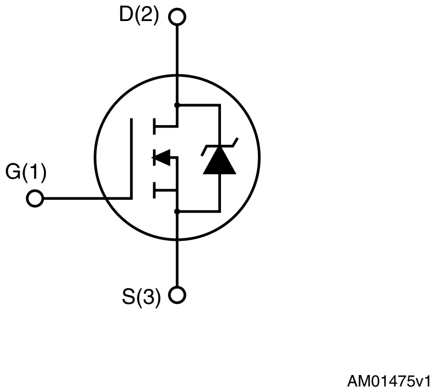


Table 1. Device summary

Order code	Marking	Packages	Packaging
STH90N55F4-2	90N55F4	H²PAK	Tape and reel

Contents

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 °C	90	A
I_D	Drain current (continuous) at T_C = 100 °C	65	A
I_{DM} (1)	Drain current (pulsed)	360	A
P_{TOT}	Total dissipation at T_C = 25 °C	150	W
	Derating factor	1	W/°C
E_{AS} (2)	Single pulse avalanche energy	290	mJ
T_{stg}	Storage temperature	– 55 to 175	°C
T_j	Max. operating junction temperature		

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

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1	°C/W
$R_{thj\text{-}a}$	Thermal resistance junction-ambient max	62.5	°C/W
T_l	Maximum lead temperature for soldering purpose	300	°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} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	4800 350 210	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 27.5 V, I_D = 90 A, V_{GS} = 10 V *Figure 14*	-	90 25 26	-	nC nC nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 27.5 V, I_D = 90 A R_G = 4.7 Ω V_{GS} = 10 V *Figure 13*	-	20 60	-	ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time	V_{DD} = 27.5 V, I_D = 90 A, R_G = 4.7 Ω, V_{GS} = 10 V *Figure 13*	-	55 30	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD} I_{SDM} [1]	Source-drain current Source-drain current (pulsed)		-		90 360	A A
V_{SD} [2]	Forward on voltage	I_{SD} = 90 A, V_{GS} = 0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 90 A, V_{DD} = 44 V di/dt = 100 A/µs, T_j = 150 °C *Figure 15*	-	50 105 4		ns nC 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

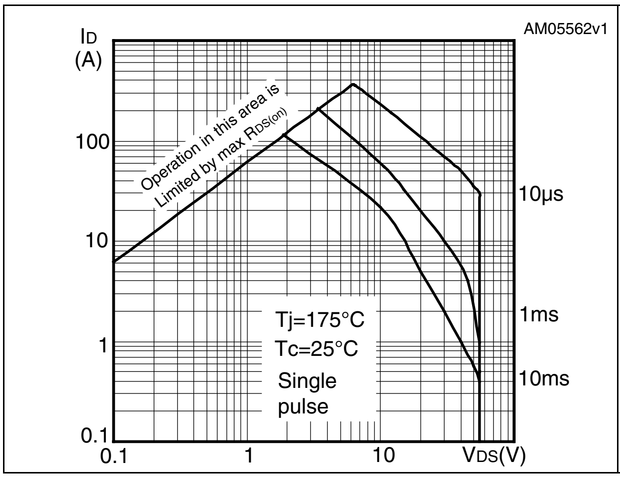


Figure 3. Thermal impedance

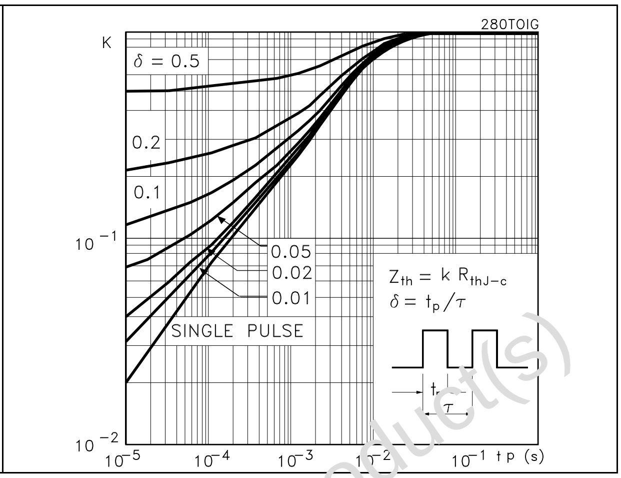


Figure 4. Output characteristics

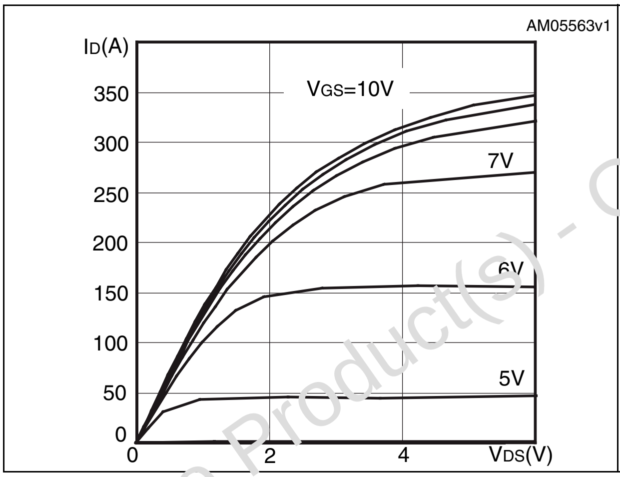


Figure 5. Transfer characteristics

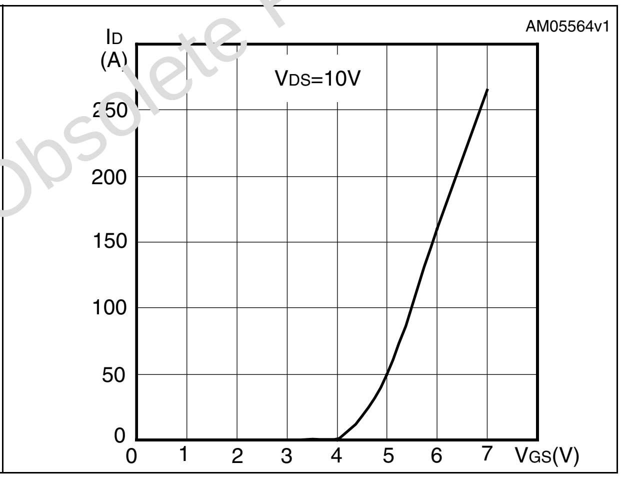


Figure 6. Normalized BV_{DSS} vs temperature

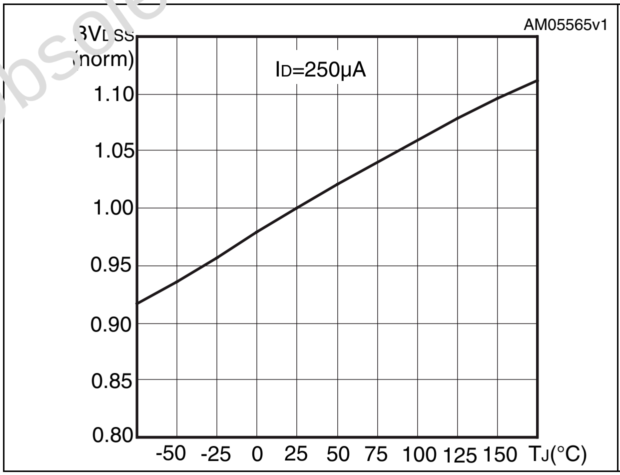


Figure 7. Static drain-source on resistance

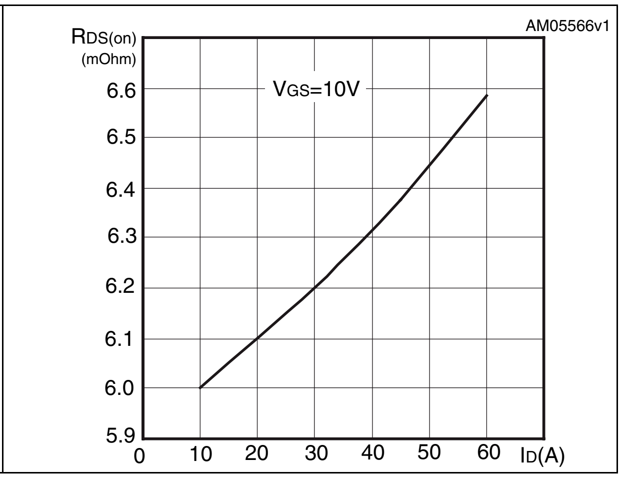


Figure 8. Gate charge vs gate-source voltage

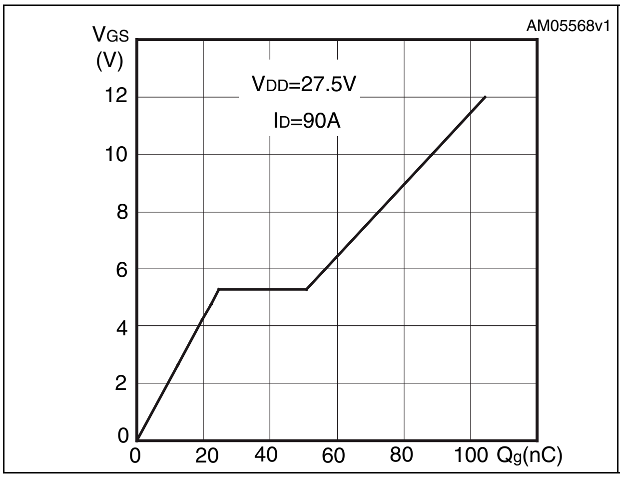


Figure 9. Capacitance variations

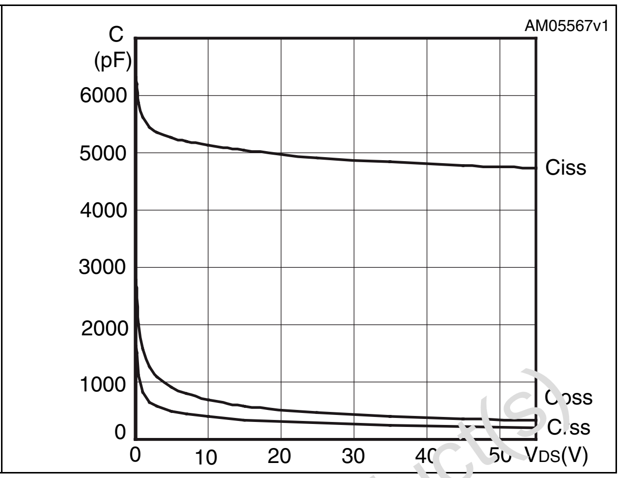


Figure 10. Normalized on resistance vs temperature

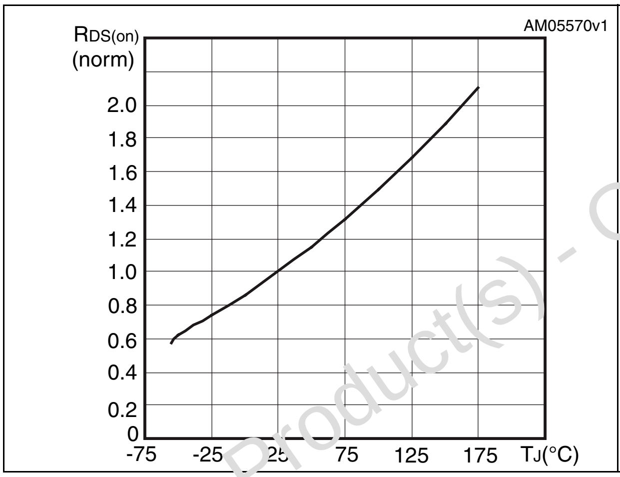


Figure 11. Normalized gate threshold voltage vs temperature

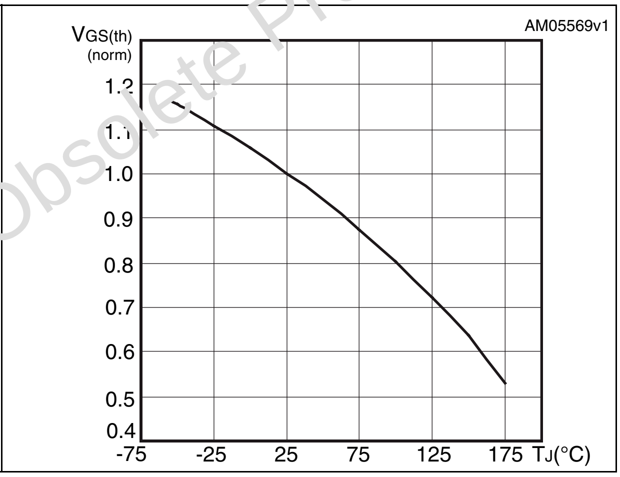
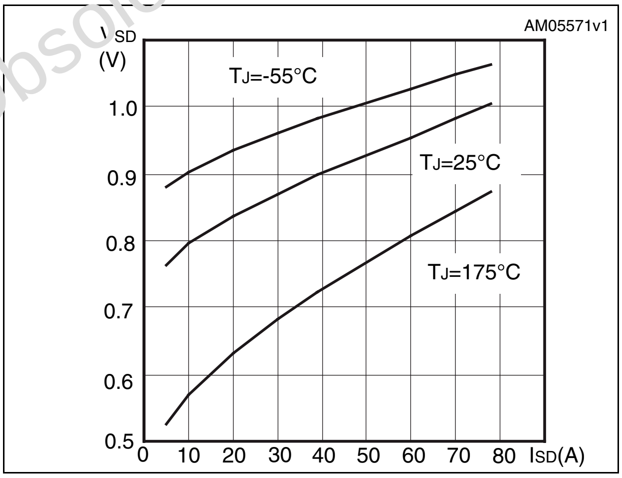
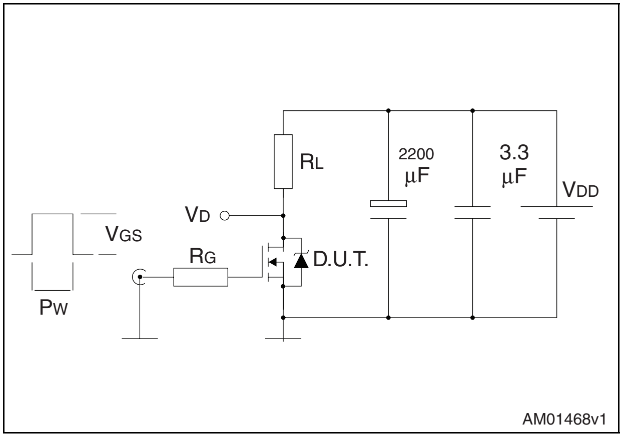


Figure 12. Source-drain diode forward characteristics



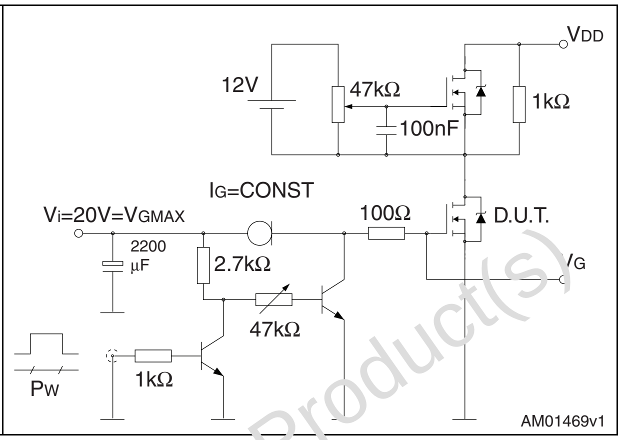
3 Test circuits

Figure 13. Switching times test circuit for resistive load



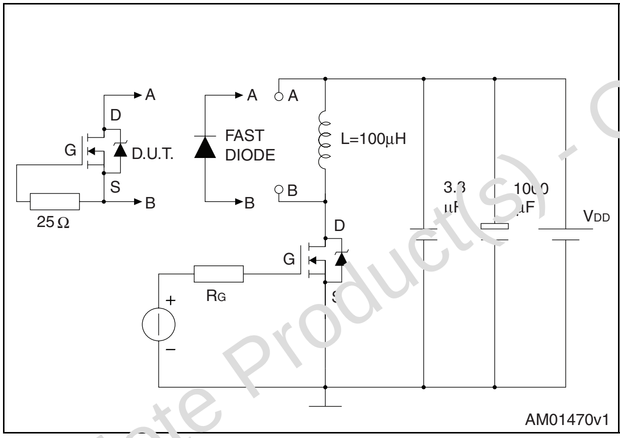
AM01468v1

Figure 14. Gate charge test circuit



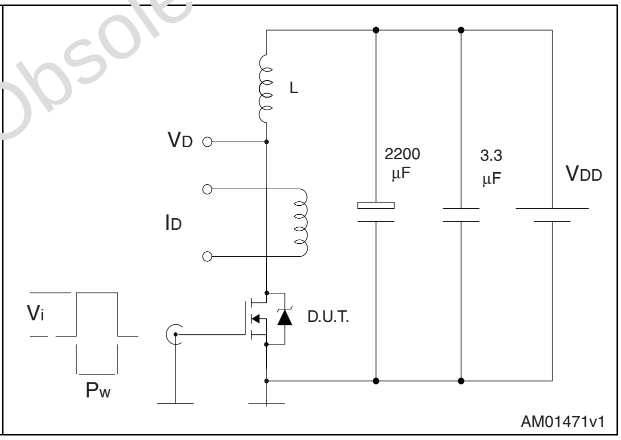
AM01469v1

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



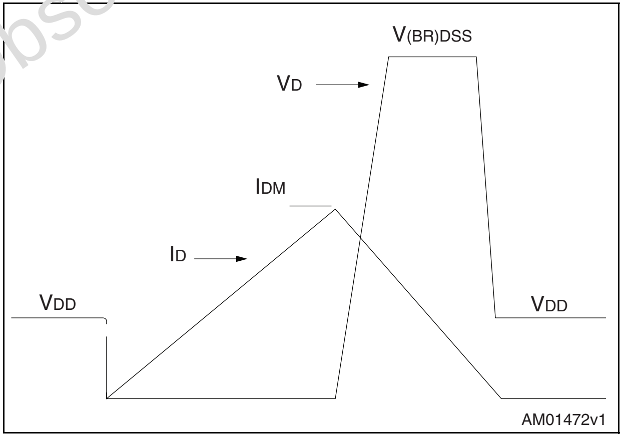
AM01470v1

Figure 16. Unclamped inductive load test circuit



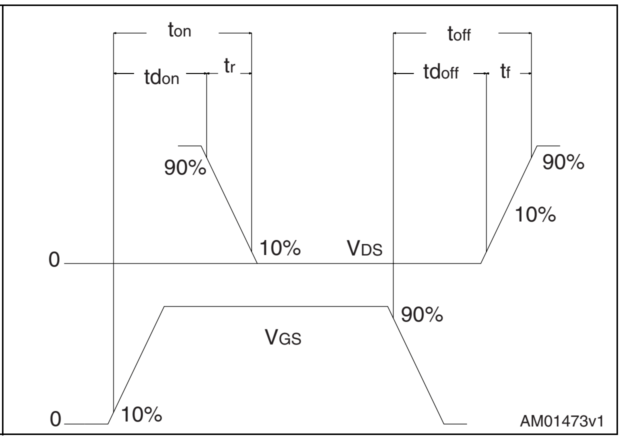
AM01471v1

Figure 17. Unclamped inductive waveform



AM01472v1

Figure 18. Switching time waveform



AM01473v1

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.

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		7.80
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 19. H²PAK 2 leads drawing

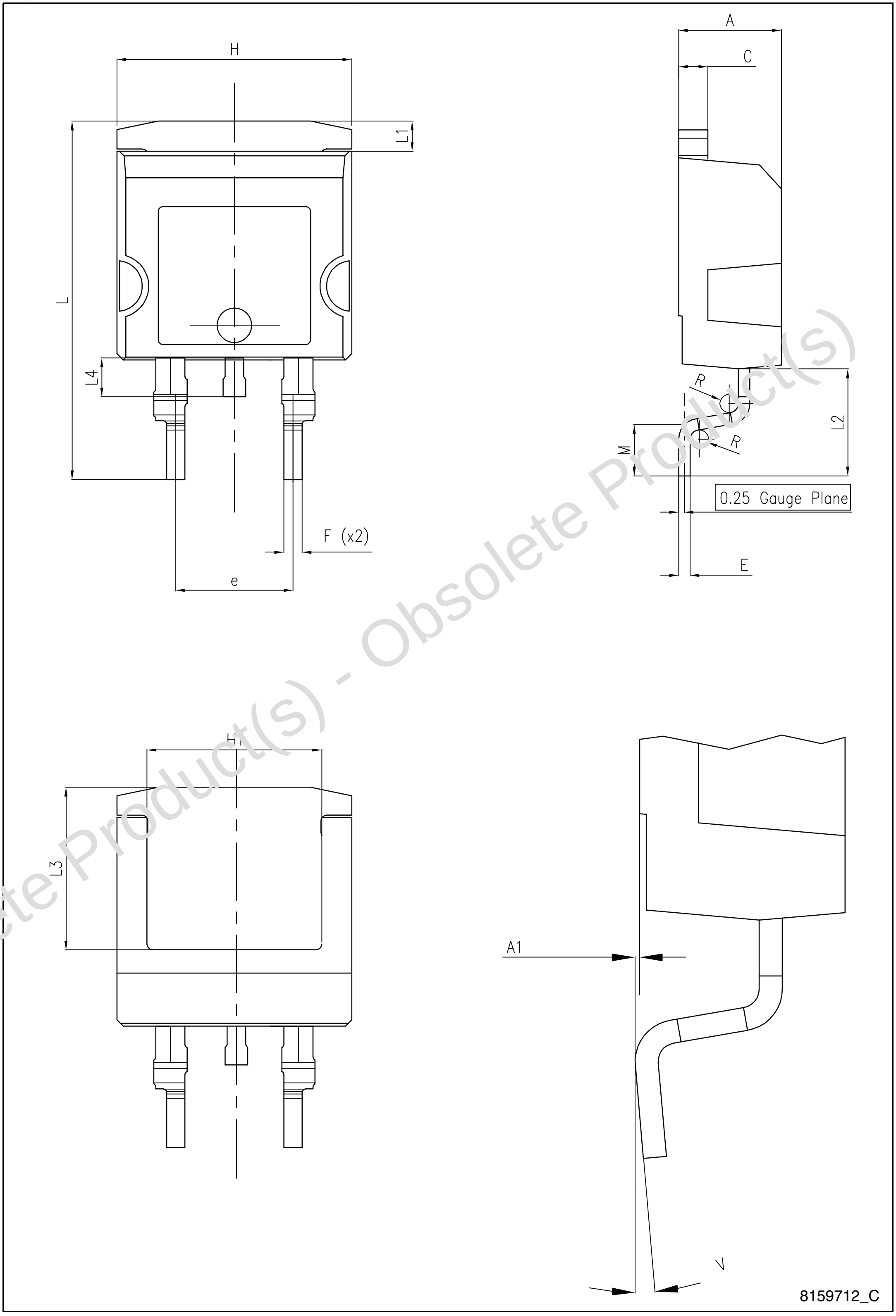
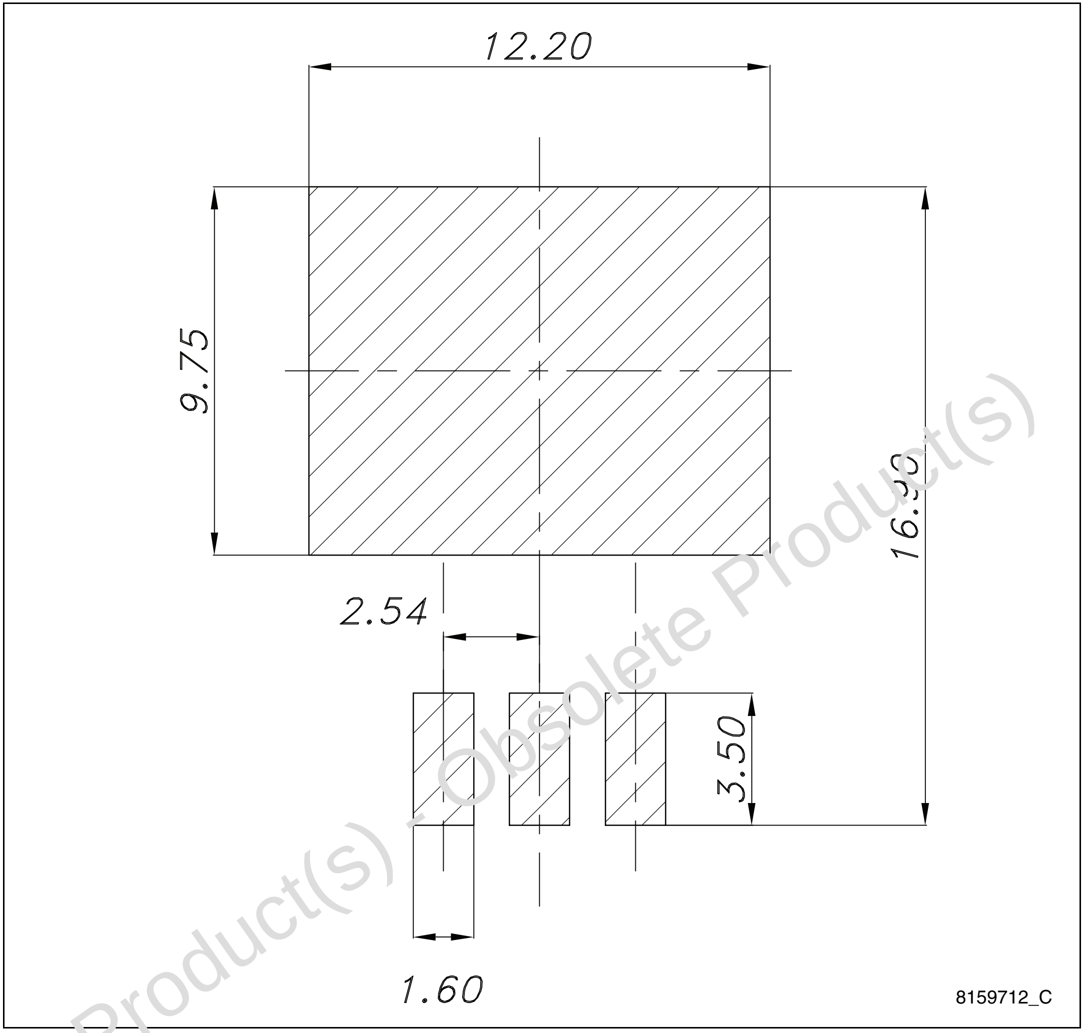


Figure 20. H²PAK 2 recommended footprint



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

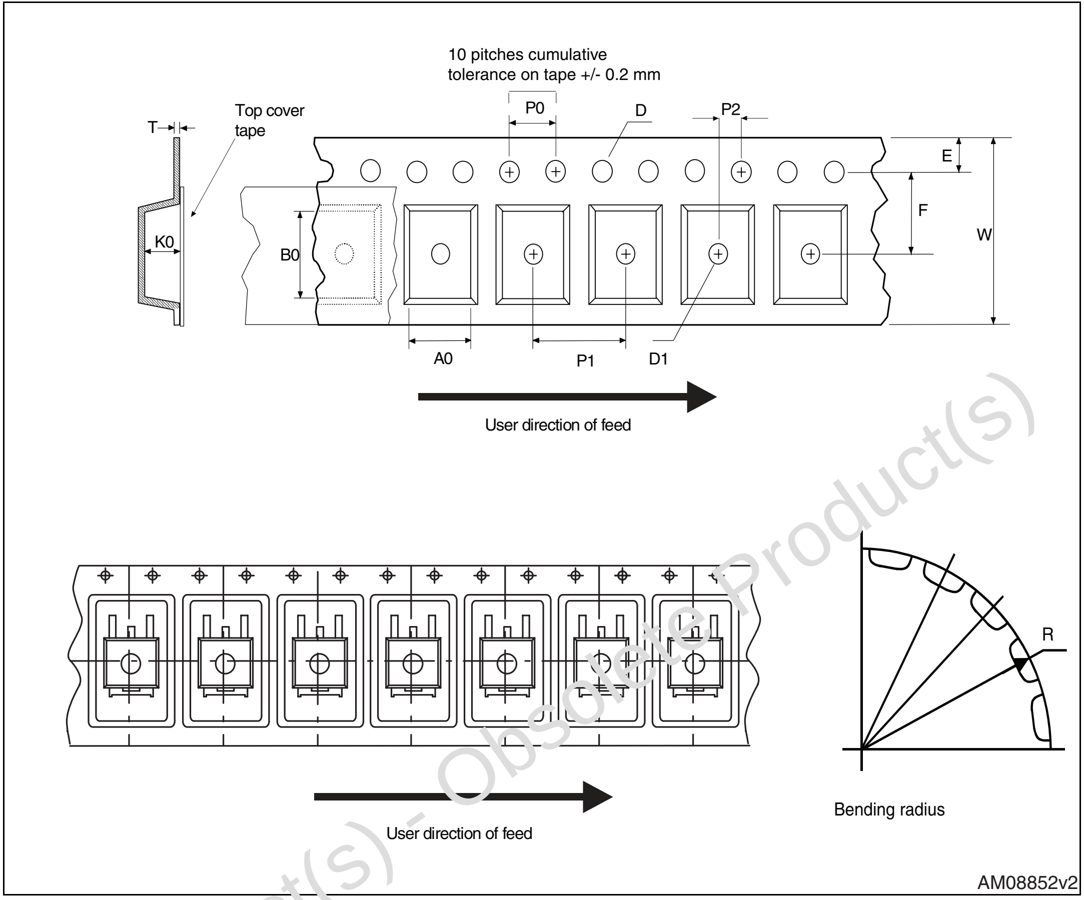
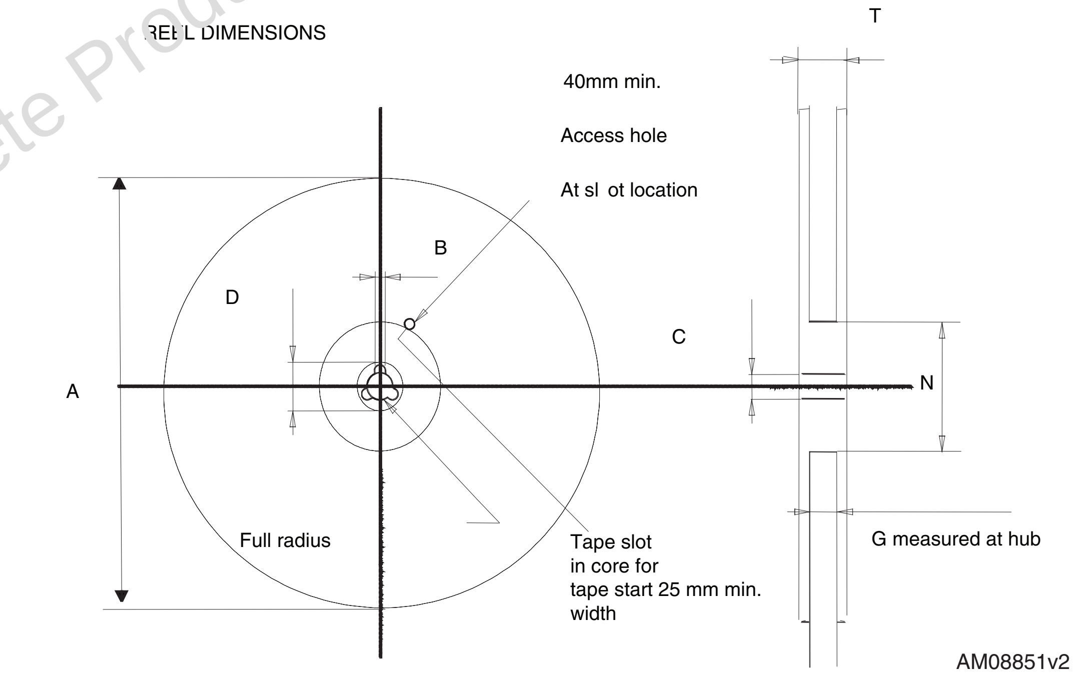


Figure 22. Reel



6 Revision history

Table 10. Document revision history

Date	Revision	Changes
08-Jun-2009	1	First release
01-Mar-2010	2	– Document status promoted from preliminary data to datasheet. – Removed package D^2PAK – Added new package, mechanical data: H^2PAK
16-Mar-2011	3	Updated *Table 5* and *Table 6*.
11-Aug-2011	4	– The part number STP90N55F4 has been moved to a separate datasheet – Minor text changes

Obsolete Product(s) - Obsolete Product(s)

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2011 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan -
Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com