

Automotive-grade N-channel 40 V, 1.4 mΩ typ., 180 A STripFET™ F3 Power MOSFET in H²PAK-6 package

Datasheet – production data

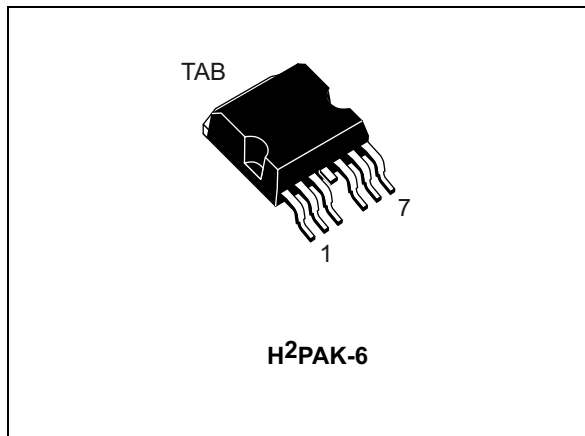
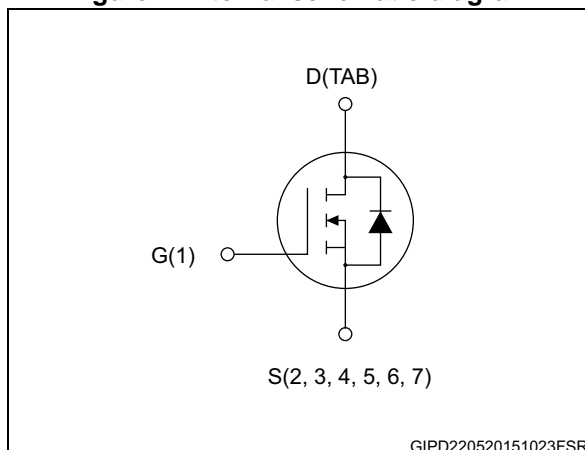


Figure 1. Internal schematic diagram



Features

Order codes	V _{DS}	R _{DS(on)} max	I _D
STH270N4F3-6	40 V	1.7 mΩ	180 A

- Designed for automotive applications and AEC-Q101 qualified
- Conduction losses reduced
- Low profile, very low parasitic inductance, high current package

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	Package	Packaging
STH270N4F3-6	270N4F3	H ² PAK-6	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-6 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	40	
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	180	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	180	A
$I_{DM}^{(2)}$	Drain current (pulsed)	720	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
$E_{AS}^{(3)}$	Single pulse avalanche energy	1000	mJ
T_{stg}	Storage temperature	- 55 to 175	$^\circ\text{C}$
T_j	Operating junction temperature		$^\circ\text{C}$

1. Current limited by package.
2. Pulse width limited by safe operating area
3. Starting $T_J=25^\circ\text{C}$, $I_D=80\text{ A}$, $V_{DD}=32\text{ V}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.5	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	35	$^\circ\text{C/W}$

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

2 Electrical characteristics

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

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 250\ \mu\text{A}$	40			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 40\ \text{V}$			10	μA
		$V_{GS} = 0, V_{DS} = 40\ \text{V}, T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\ \text{V}$			± 200	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\ \text{V}, I_D = 80\ \text{A}$		1.4	1.7	m Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\ \text{V}, f = 1\ \text{MHz}, V_{GS} = 0$	-	7400	-	pF
C_{oss}	Output capacitance		-	1800	-	pF
C_{rss}	Reverse transfer capacitance		-	50	-	pF
Q_g	Total gate charge	$V_{DD} = 20\ \text{V}, I_D = 160\ \text{A}, V_{GS} = 10\ \text{V}$ (see Figure 14)	-	110	150	nC
Q_{gs}	Gate-source charge		-	30	-	nC
Q_{gd}	Gate-drain charge		-	25	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\ \text{V}, I_D = 80\ \text{A}, R_G = 4.7\ \Omega, V_{GS} = 10\ \text{V}$ (see Figure 2)	-	25	-	ns
t_r	Rise time		-	180	-	ns
$t_{d(off)}$	Turn-off delay time		-	110	-	ns
t_f	Fall time		-	45	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		180	A
$I_{SDM}^{(2)}$	Source-drain current (pulsed)		-		720	A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD} = 180 \text{ A}, V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 160 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 32 \text{ V}, T_J = 150 \text{ }^\circ\text{C}$ (see Figure 15)	-	70		ns
Q_{rr}	Reverse recovery charge		-	225		nC
I_{RRM}	Reverse recovery current		-	3.2		A

1. Current limited by package
2. Pulse width limited by safe operating area.
3. Pulsed: pulse duration=300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

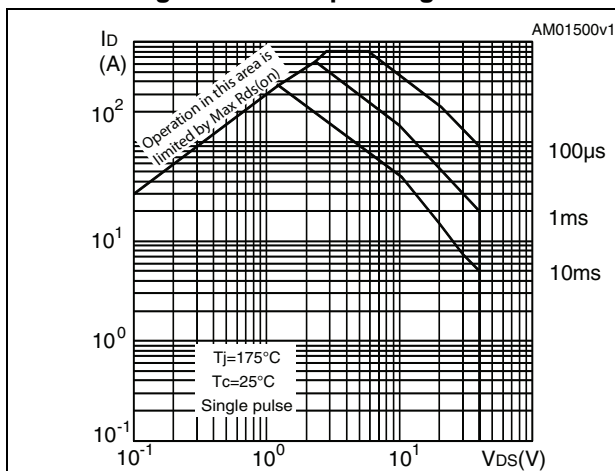


Figure 3. Thermal impedance

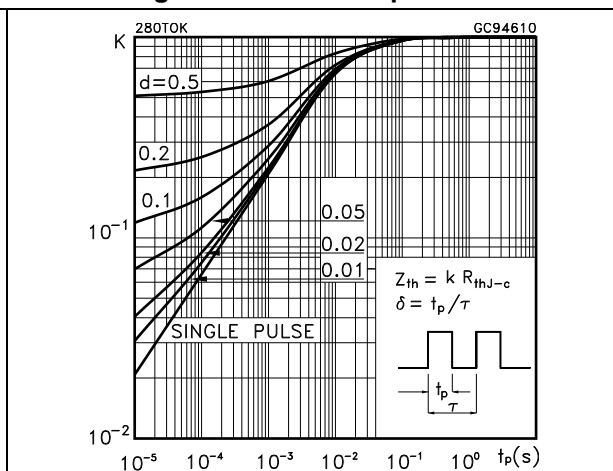


Figure 4. Output characteristics

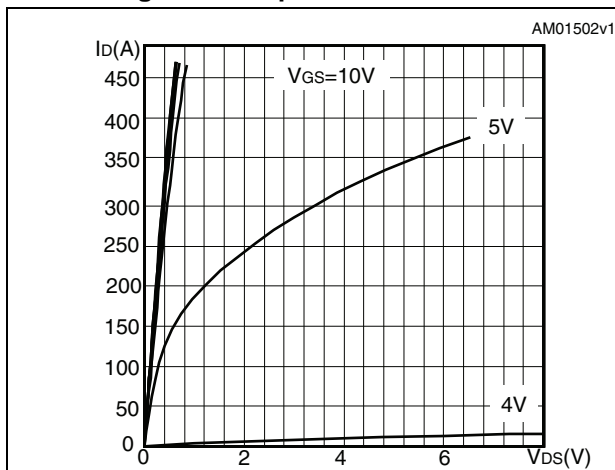


Figure 5. Transfer characteristics

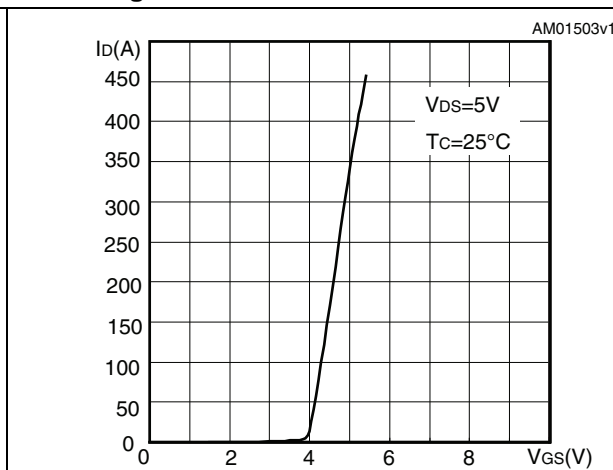


Figure 6. Gate charge vs gate-source voltage

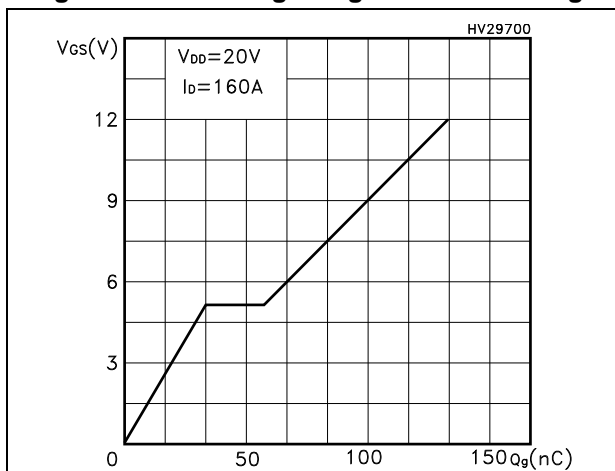


Figure 7. Static drain-source on-resistance

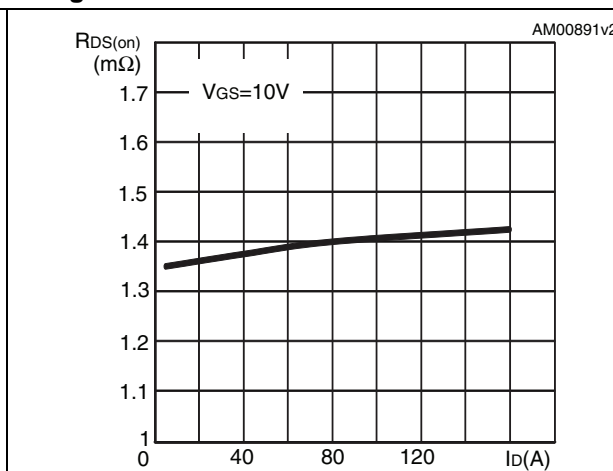


Figure 8. Capacitance variations

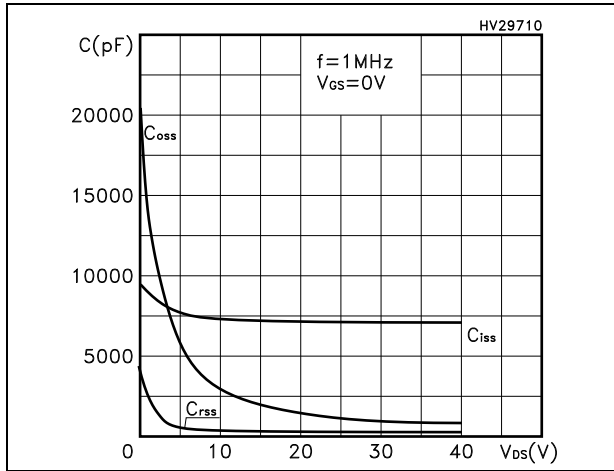


Figure 9. Normalized gate threshold voltage vs temperature

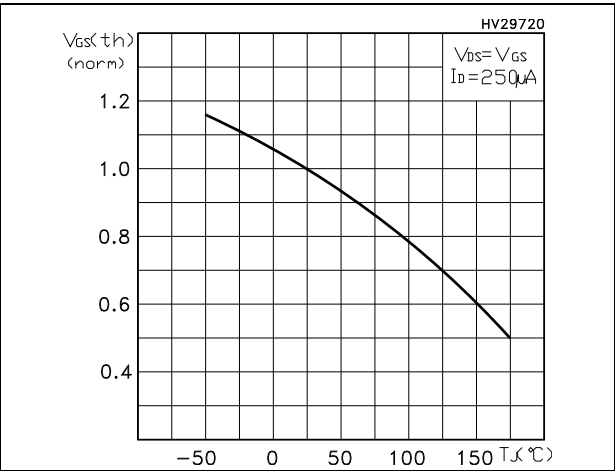


Figure 10. Normalized on-resistance vs temperature

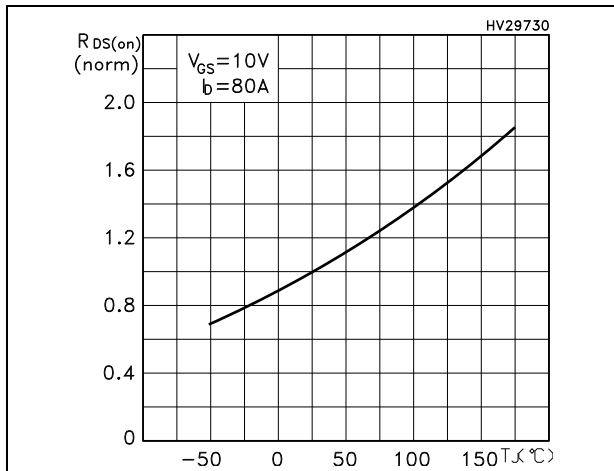


Figure 11. Normalized V_{(BR)DSS} vs temperature

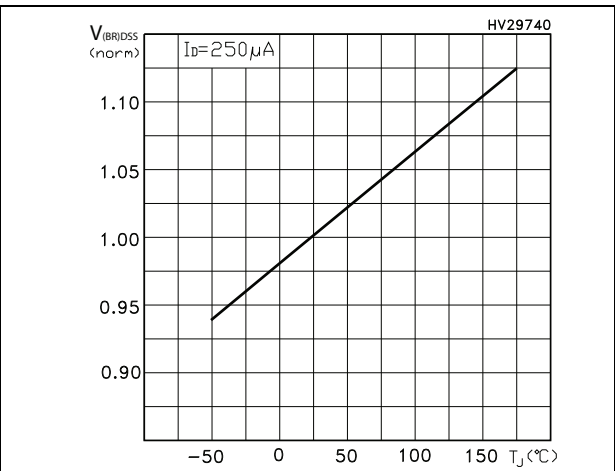
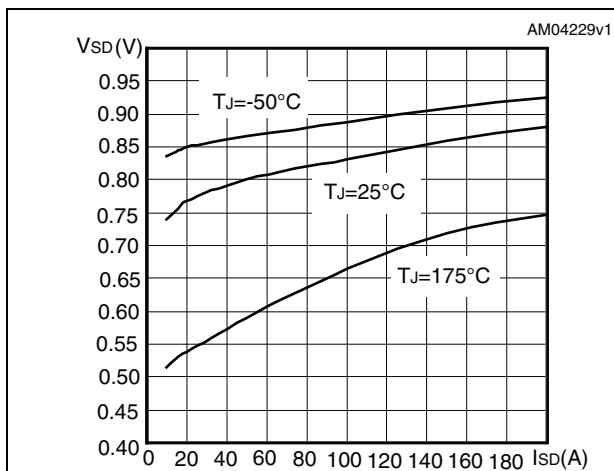
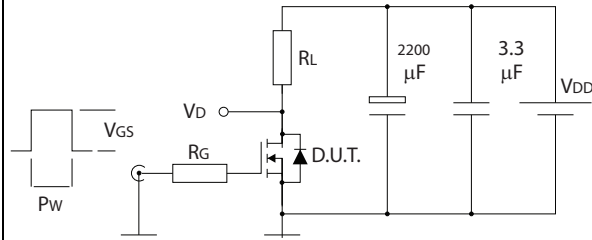


Figure 12. Drain-source diode forward characteristics



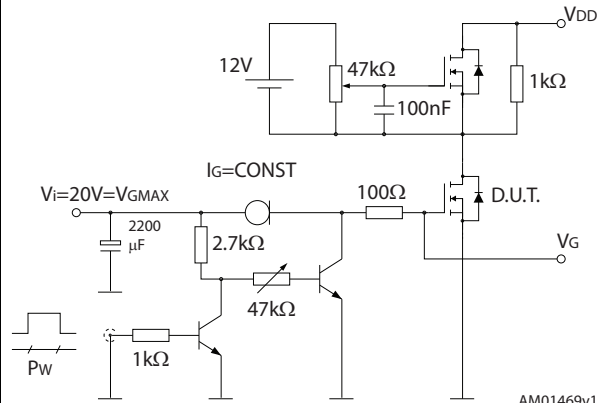
3 Test circuits

Figure 13. Switching times test circuit for resistive load



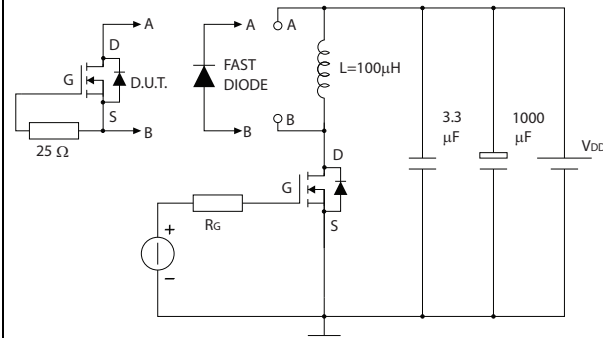
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Figure 14. Gate charge test circuit



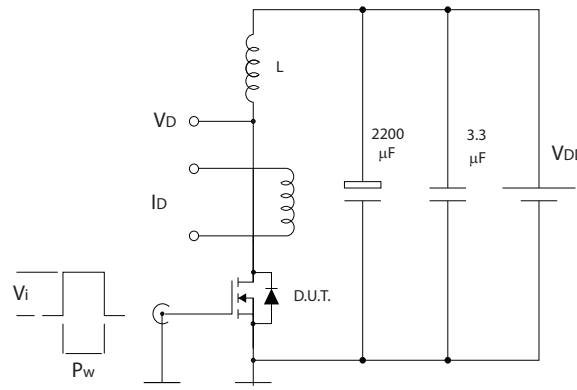
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Figure 15. Test circuit for inductive load switching and diode recovery times



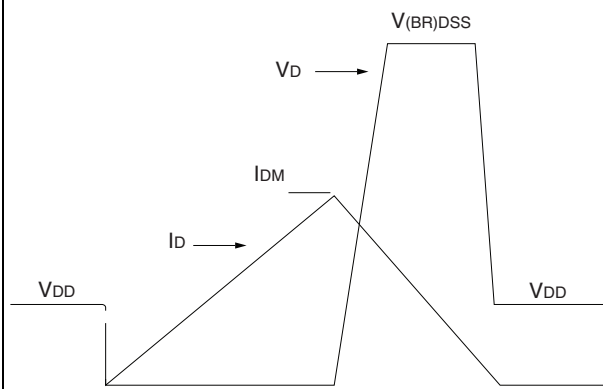
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Figure 16. Unclamped inductive load test circuit



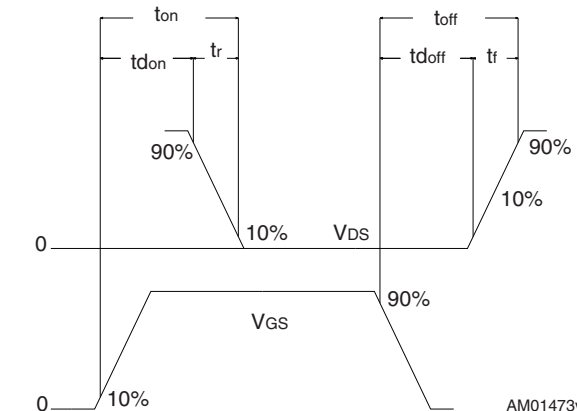
AM01471v1

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-6 package information

Figure 19. H²PAK-6 package outline

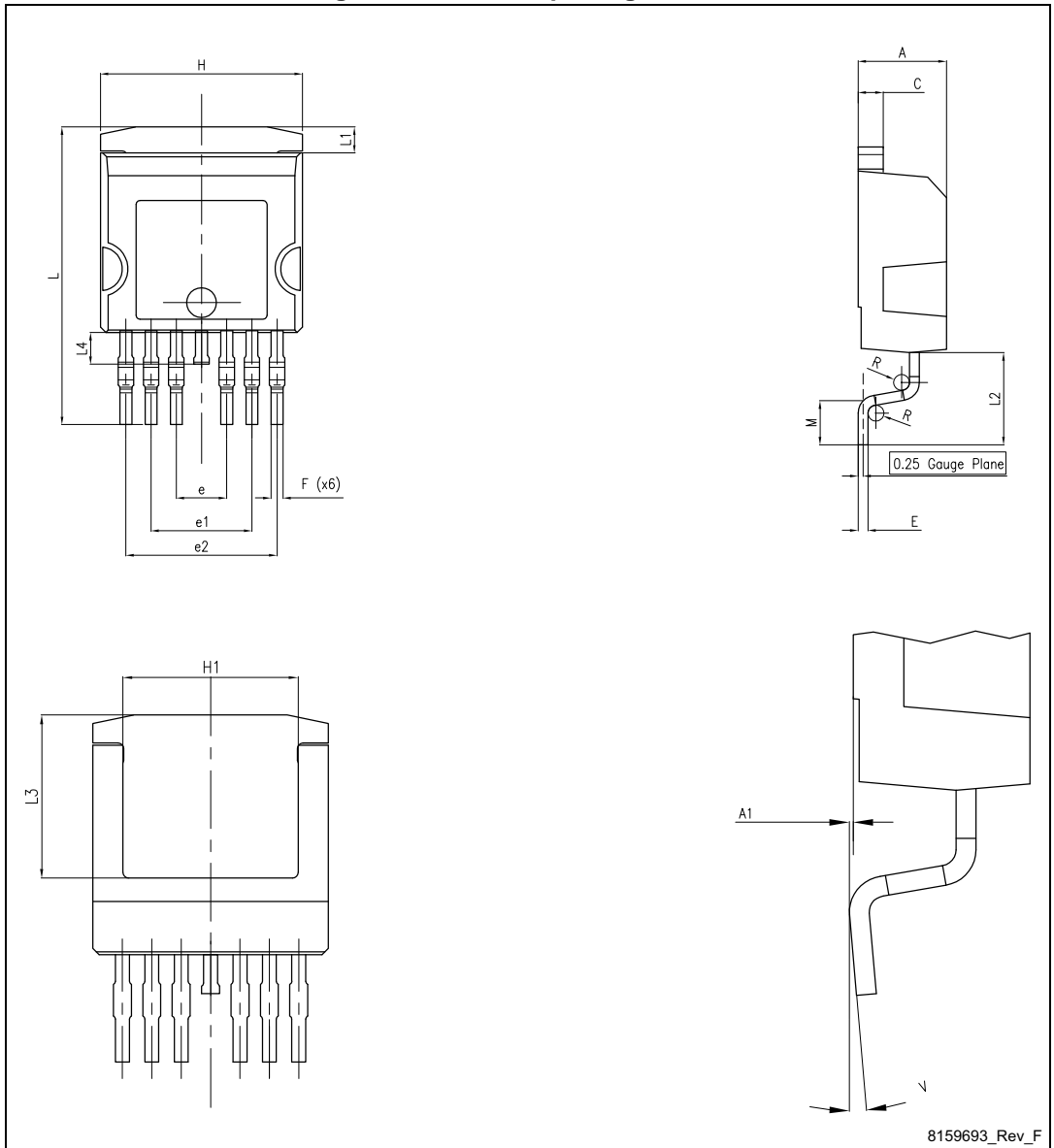
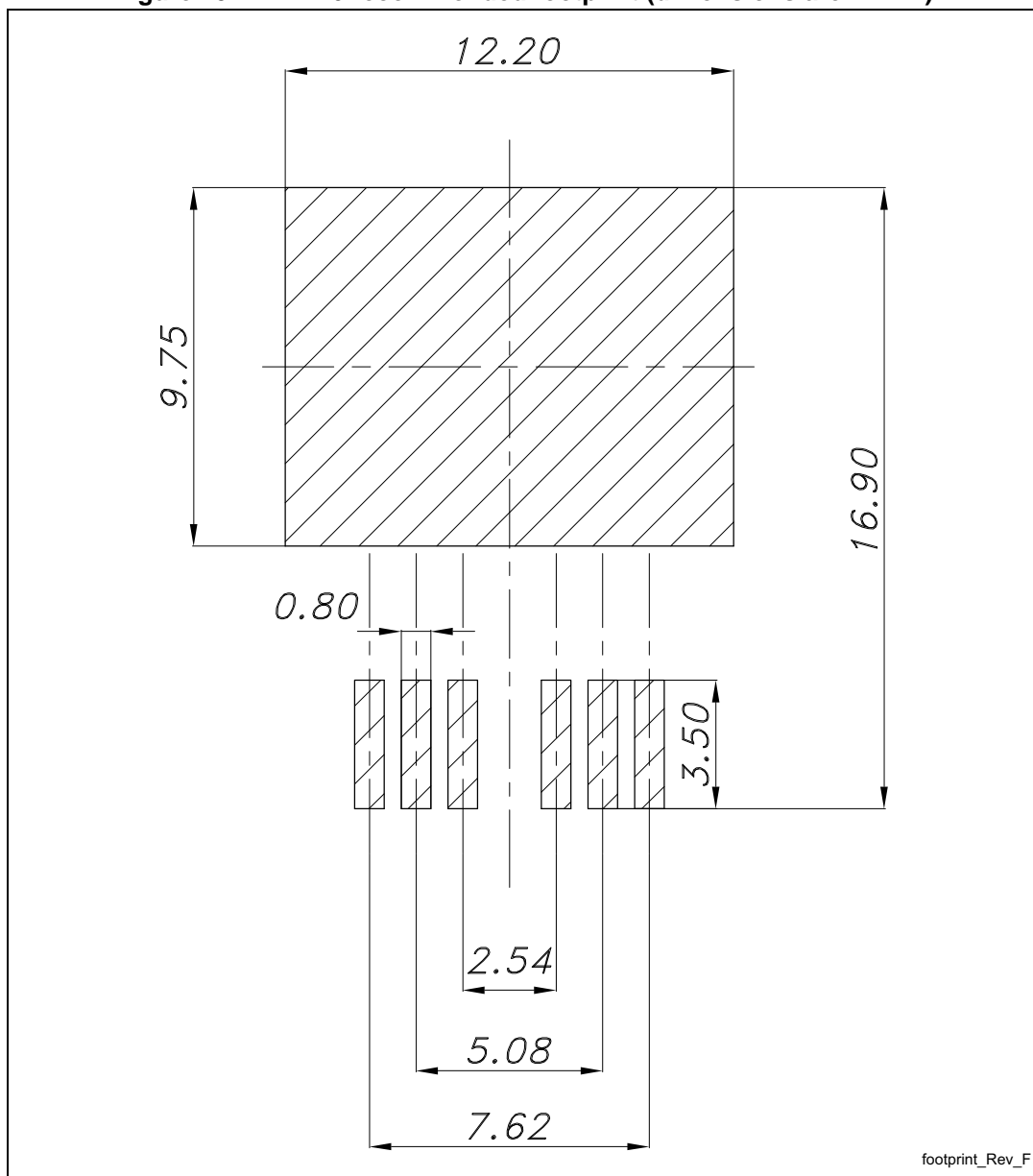


Table 8. H²PAK-6 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.80
A1	0.03		0.20
C	1.17		1.37
e	2.34		2.74
e1	4.88		5.28
e2	7.42		7.82
E	0.45		0.60
F	0.50		0.70
H	10.00		10.40
H1	7.40		7.80
L	14.75		15.25
L1	1.27		1.40
L2	4.35		4.95
L3	6.85		7.25
L4	1.5		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 20. H²PAK-6 recommended footprint (dimensions are in mm)



5 Packing information

Figure 21. Tape

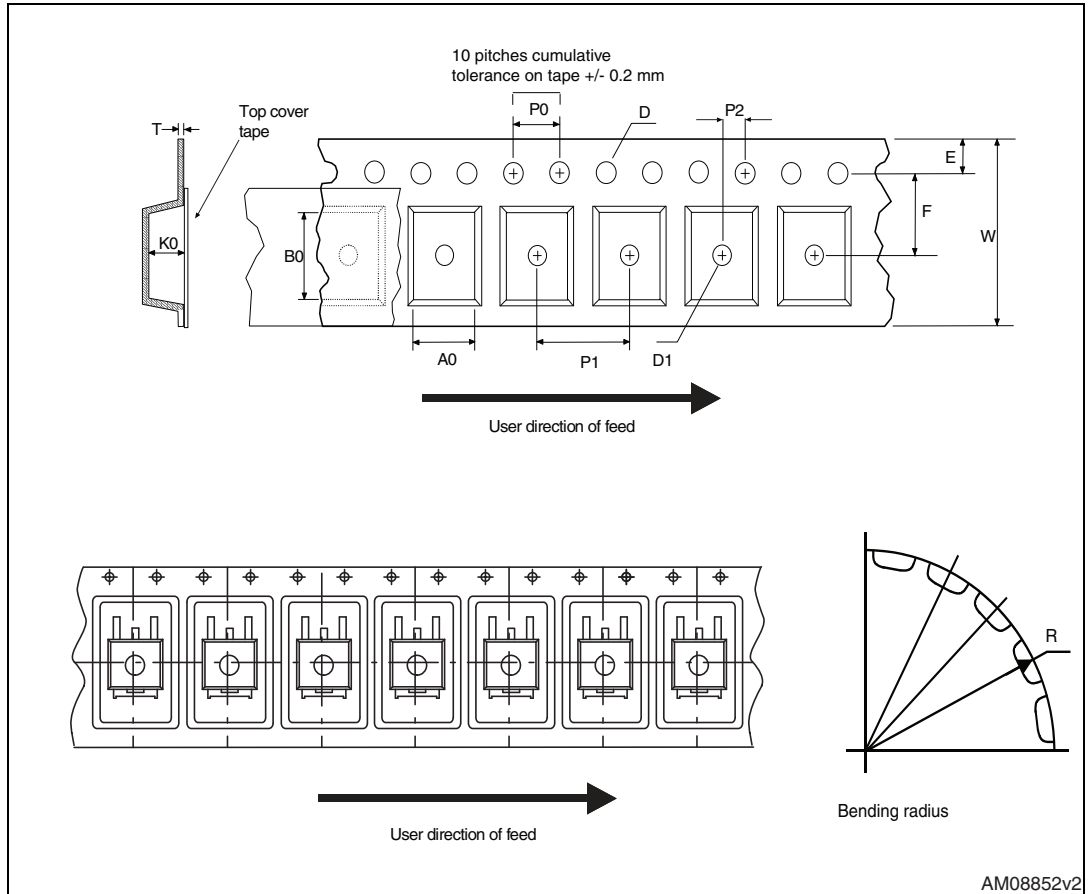
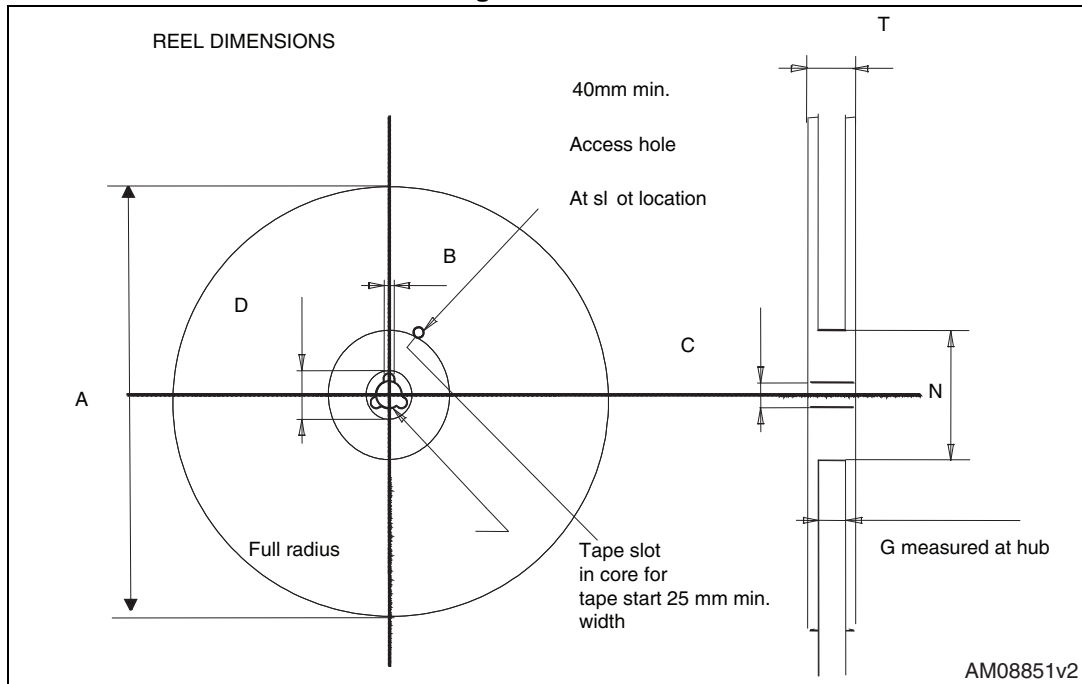


Figure 22. Reel



AM08851v2

Table 9. H²PAK-2 and H²PAK-6 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 10. Document revision history

Date	Revision	Changes
22-May-2015	1	First release. Part number previously included in datasheet DocID16957.

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