



# STH250N55F3-6

N-channel 55 V, 2.2 mΩ, 180 A, H<sup>2</sup>PAK  
STripFET™ III Power MOSFET

## Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>w</sub>
STH250N55F3-6	55 V	2.6 mΩ	180 A <sup>(1)</sup>	300 W

1. Value limited by package

- Ultra low on-resistance
- 100% avalanche tested

## Application

Switching applications

## Description

This N-channel STripFET™ III Power MOSFET technology is among the latest improvements, which have been especially tailored to minimize on-state resistance providing superior switching performance.

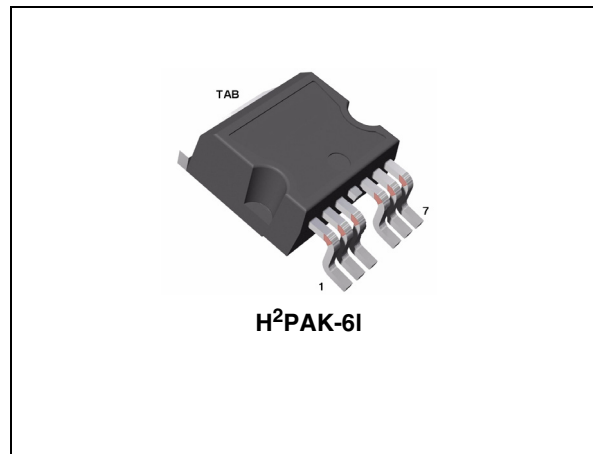


Figure 1. Internal schematic diagram

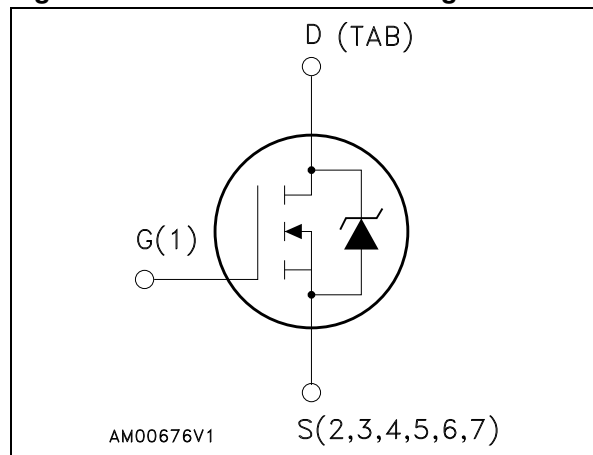


Table 1. Device summary

Order code	Marking	Package	Packaging
STH250N55F3-6	250N55F3	H <sup>2</sup> PAK	Tape and reel

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# 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	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	180	A
$I_D^{(1)}$	Drain current (continuous) at $T_C=100\text{ }^\circ\text{C}$	160	A
$I_{DM}^{(2)}$	Drain current (pulsed)	720	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
	Derating factor	2.0	W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	11	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	1000	mJ
$T_j$ $T_{stg}$	Operating junction temperature storage temperature	- 55 to 175	$^\circ\text{C}$

1. Current limited by package.
2. Pulse width limited by safe operating area.
3.  $I_{SD} \leq 120\text{ A}$ ,  $di/dt \leq 900\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$
4. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 60\text{ A}$ ,  $V_{DD} = 40\text{ V}$  (see Figure 16 and Figure 17)

**Table 3. Thermal data**

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

1. When mounted on FR-4 board, on 1inch<sup>2</sup>, 2oz Cu.

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	55			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{max rating}$ , $V_{DS} = \text{max rating}$ , @ $125\text{ °C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 200$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10$ , $I_D = 60\text{ A}$		2.2	2.6	$\text{m}\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	6800	-	pF
$C_{oss}$	Output capacitance			1450		
$C_{rss}$	Reverse transfer capacitance			15		
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 27.5\text{ V}$ , $I_D = 60\text{ A}$ $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 13</a> , <a href="#">Figure 18</a> )	-	25	-	ns
$t_r$	Rise time			150		ns
$t_{d(off)}$	Turn-off delay time			110		ns
$t_f$	Fall time			50		ns
$Q_g$	Total gate charge	$V_{DD} = 44\text{ V}$ , $I_D = 120\text{ A}$ , $V_{GS} = 10\text{ V}$ , (see <a href="#">Figure 14</a> )	-	100	-	nC
$Q_{gs}$	Gate-source charge			30		nC
$Q_{gd}$	Gate-drain charge			26		nC

**Table 6. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)		-		180 720	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=120\text{ A}$ , $V_{GS}=0$	-		1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=120\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 35\text{ V}$ , $T_j=150\text{ }^\circ\text{C}$ (see <a href="#">Figure 15</a> )	-	60 0.11 3.5		ns $\mu\text{C}$ A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

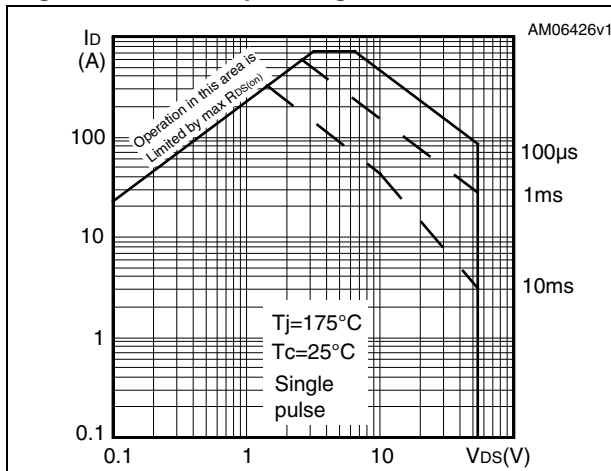


Figure 3. Thermal impedance

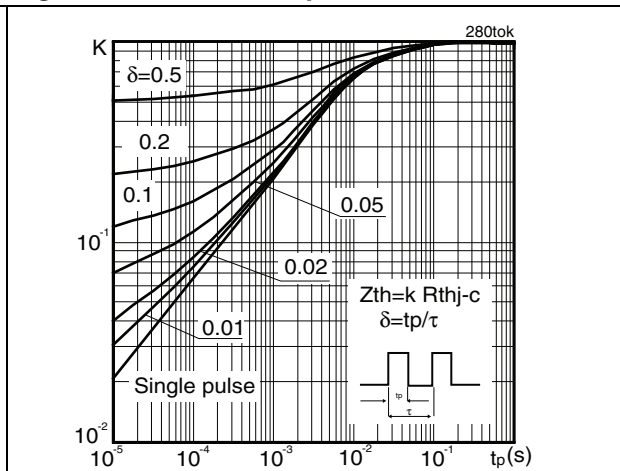


Figure 4. Output characteristics

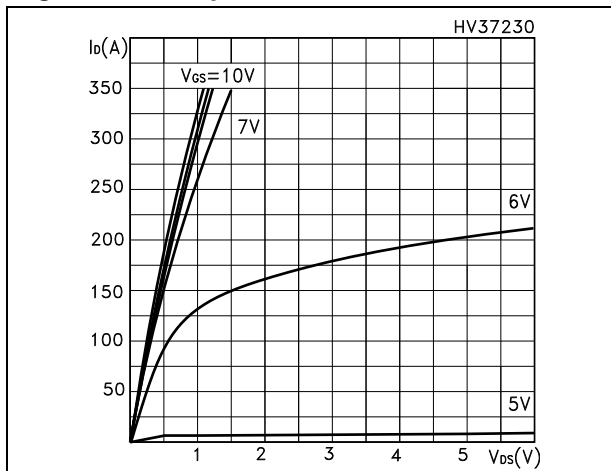


Figure 5. Transfer characteristics

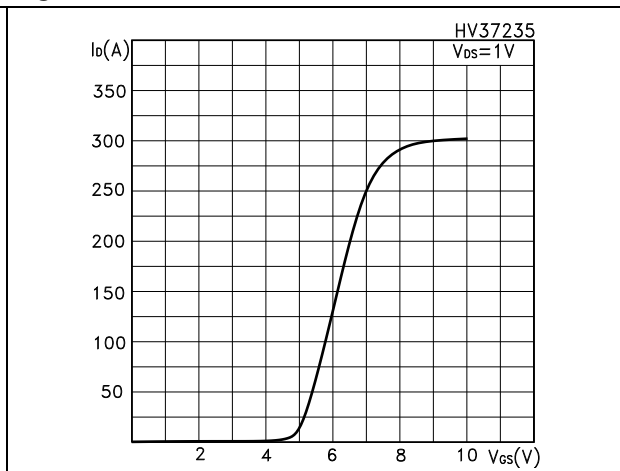


Figure 6. Normalized  $B_{V_{DSS}}$  vs temperature

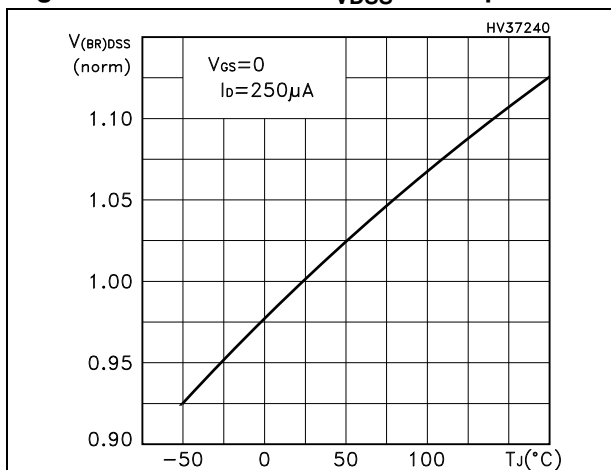


Figure 7. Static drain-source on resistance

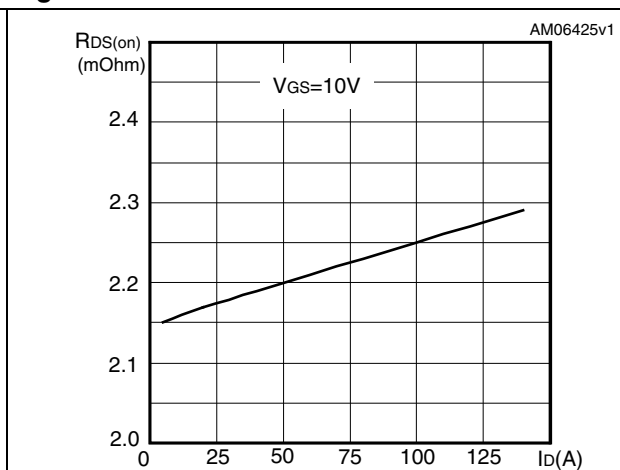


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

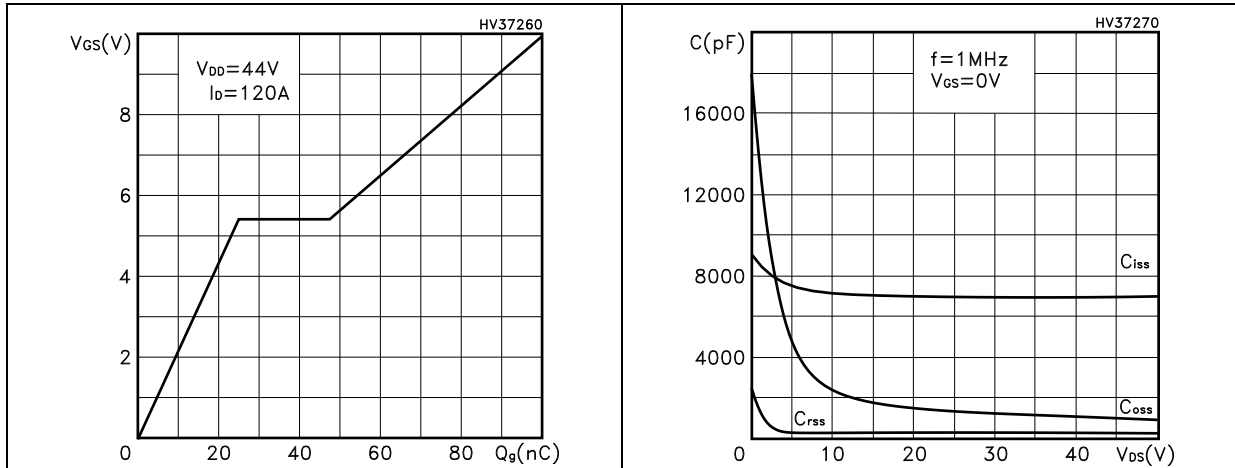


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

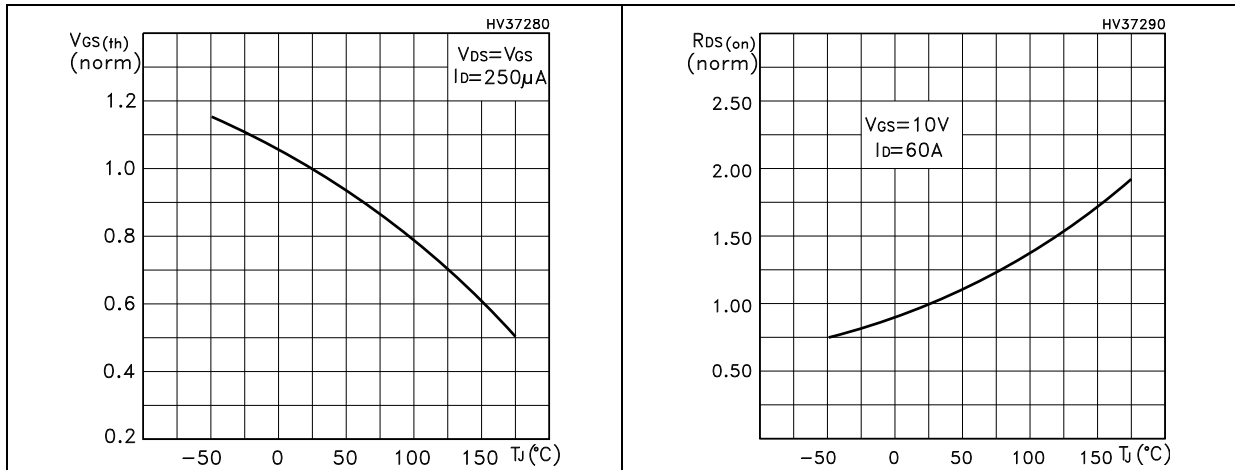
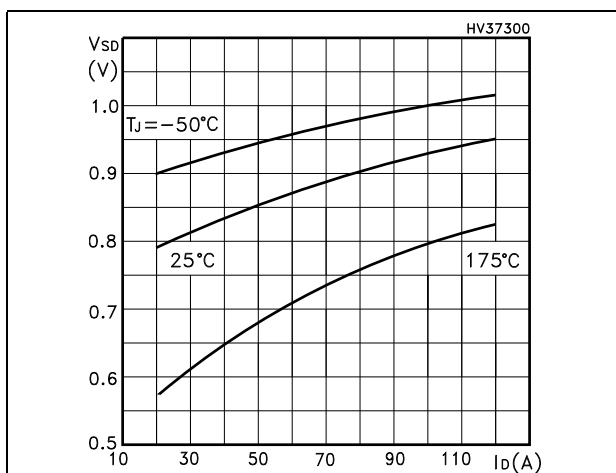
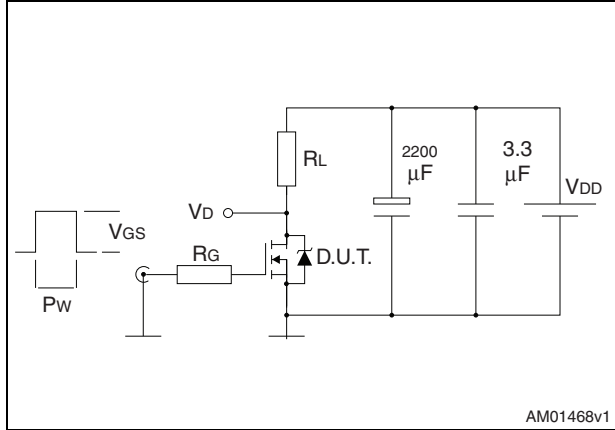


Figure 12. Source-drain diode forward characteristics

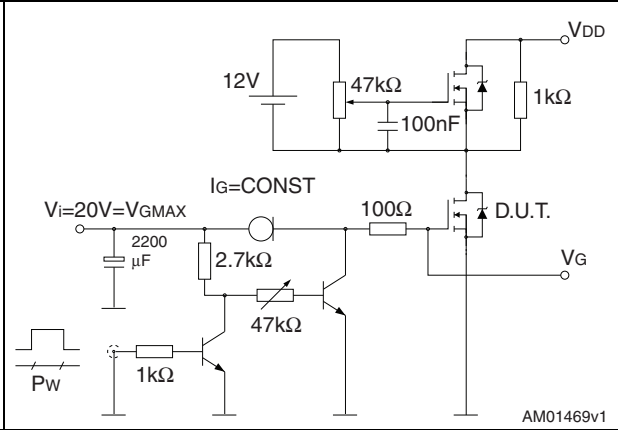


### 3 Test circuits

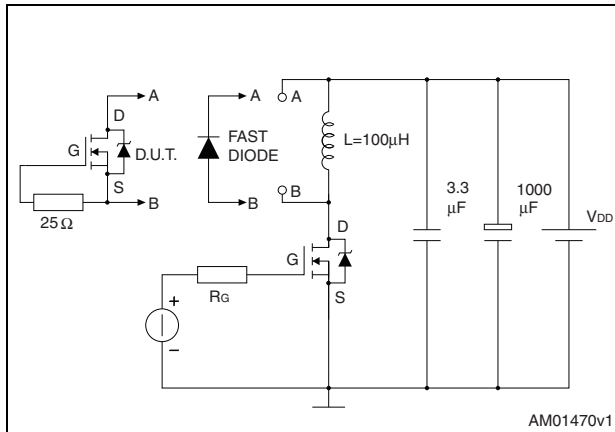
**Figure 13. Switching times test circuit for resistive load**



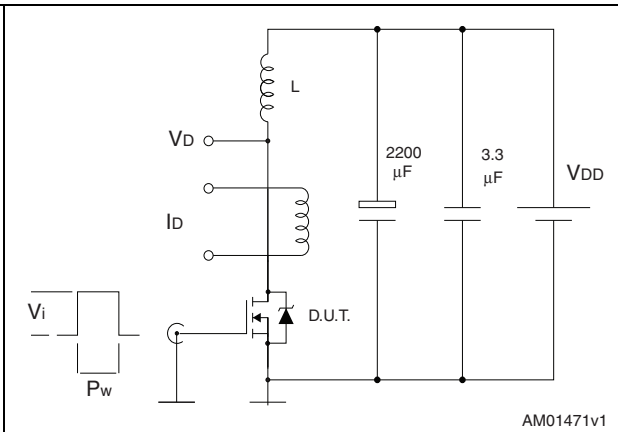
**Figure 14. Gate charge test circuit**



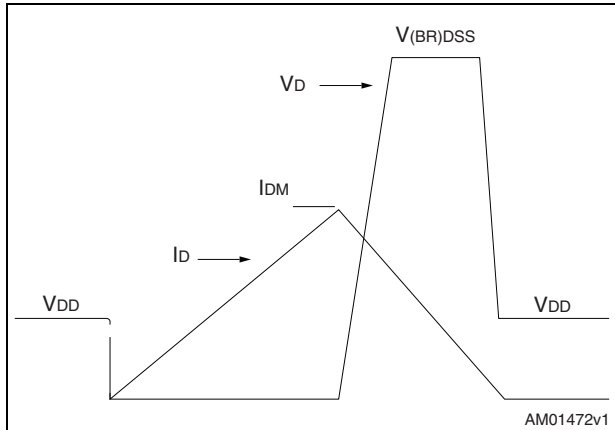
**Figure 15. Test circuit for inductive load switching and diode recovery times**



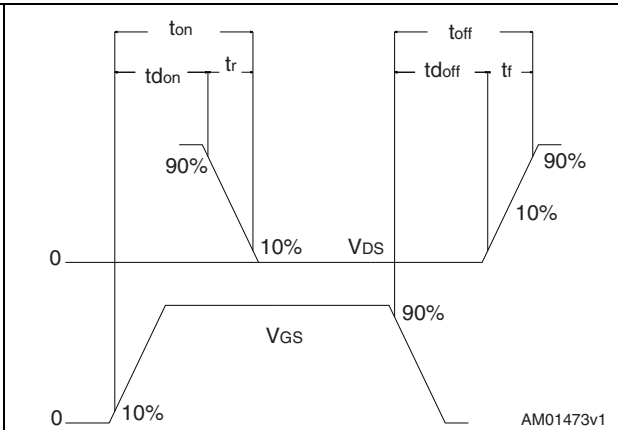
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**





## 4 Package 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](http://www.st.com). ECOPACK is an ST trademark.

**Table 7. H<sup>2</sup>PAK-6 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	7.80		8.20
L	14.75		15.25
L1	1.27		1.40
L2	4.35		4.95
L3	7.45		7.85
L4	1.5		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 19. H<sup>2</sup>PAK-6 drawing

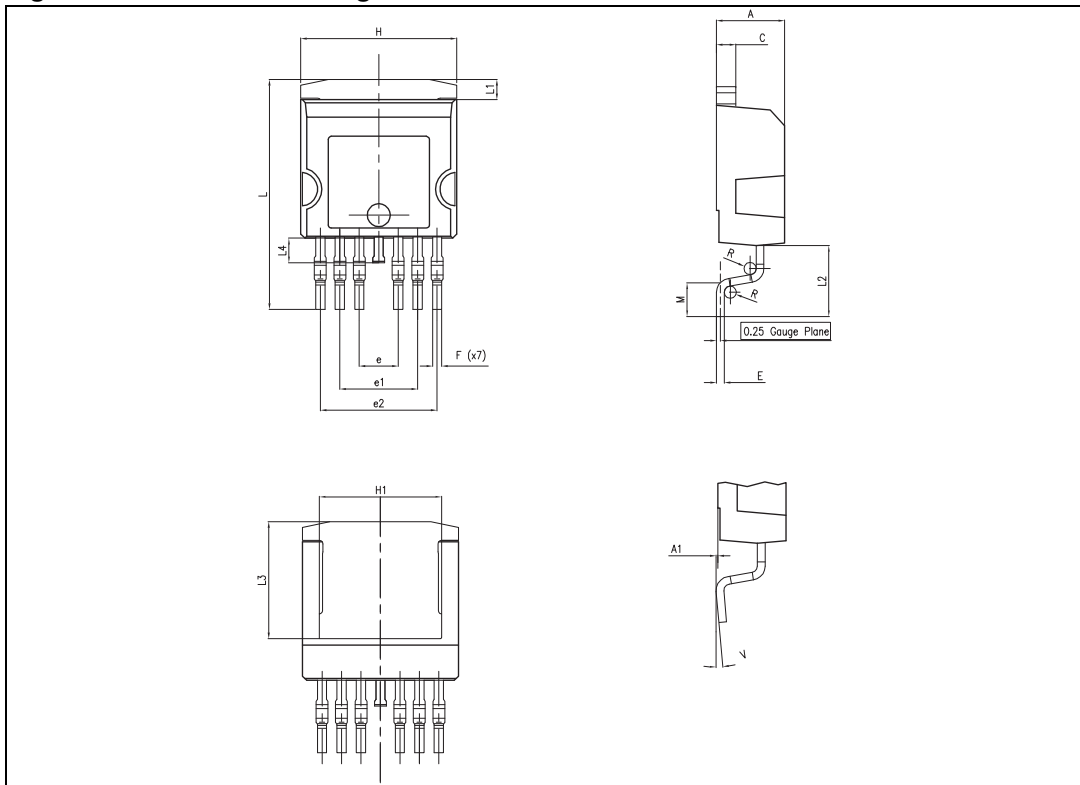
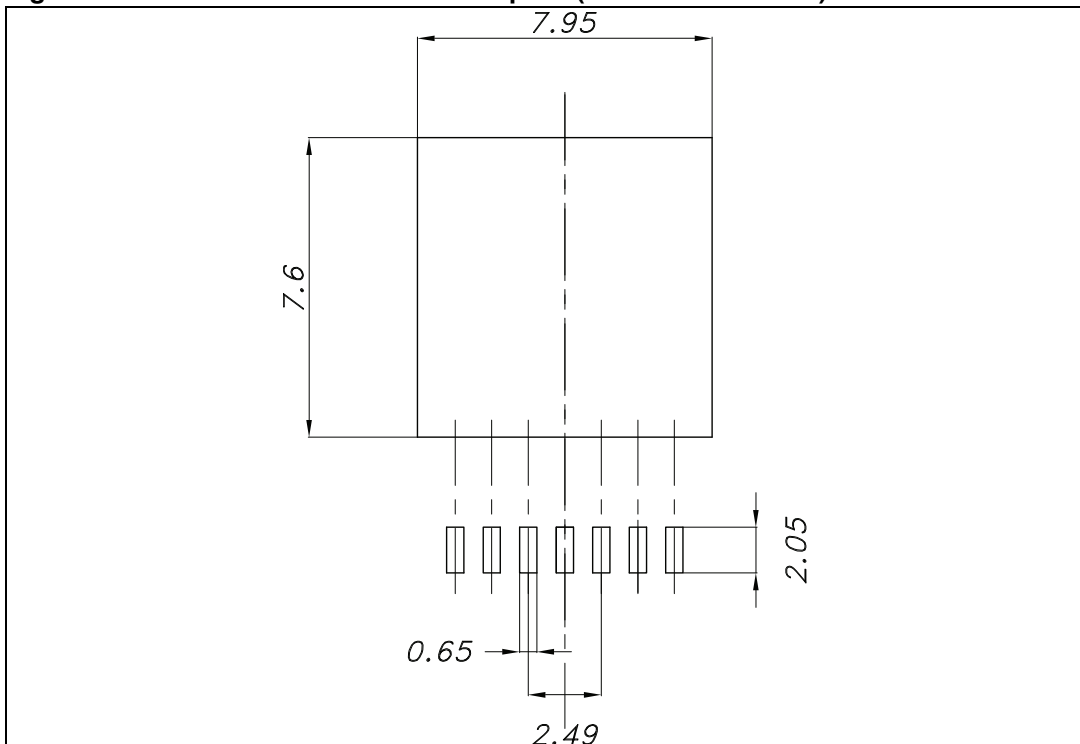
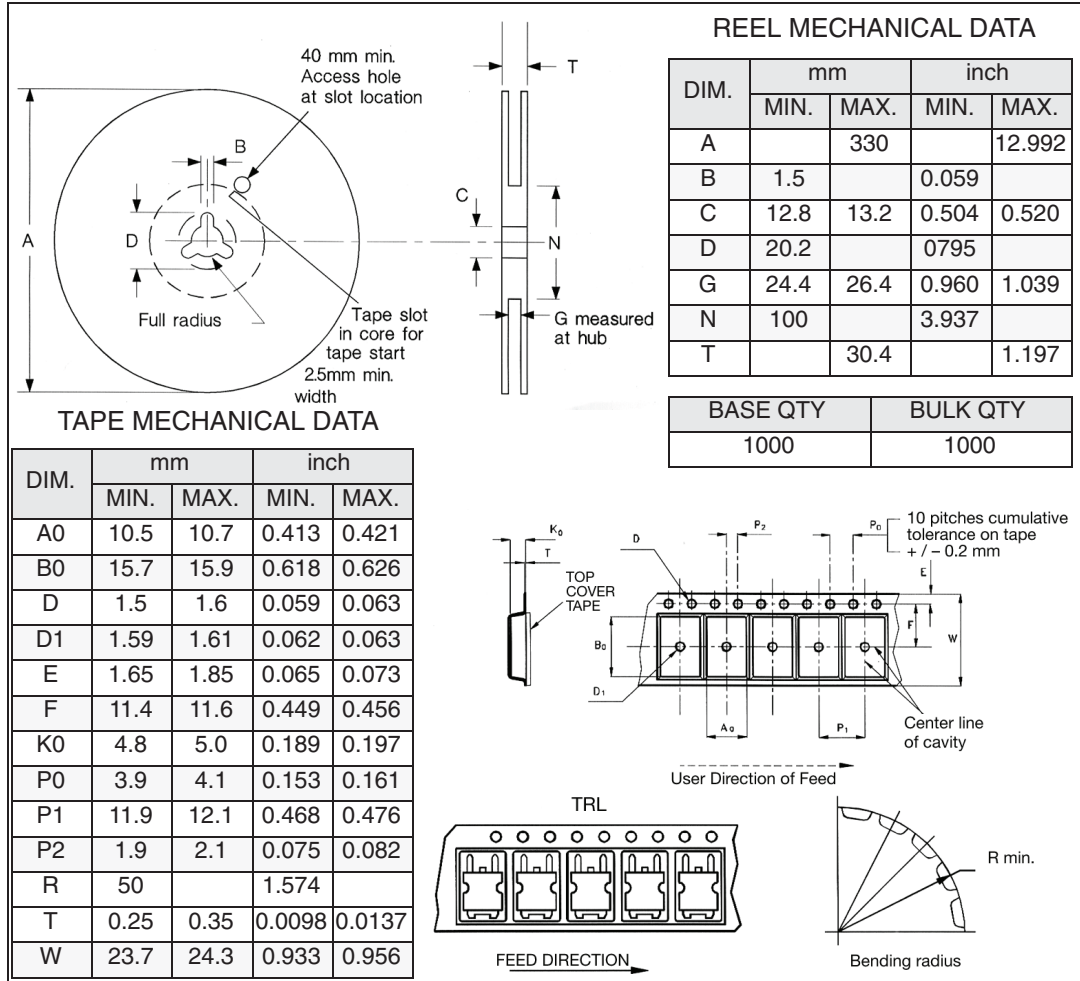


Figure 20. H<sup>2</sup>PAK-6 recommended footprint (dimensions in mm)



# 5 Packaging mechanical data

Figure 21. H<sup>2</sup>PAK-6 tape and reel



## 6 Revision history

**Table 8. Revision history**

Date	Revision	Changes
01-Oct-2010	1	First release

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