



# STH85N15F4-2 STP85N15F4

N-channel 150 V, 0.015  $\Omega$ , 85 A TO-220, H<sup>2</sup>PAK  
STripFET™ DeepGATE™ Power MOSFET

Preliminary data

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STH85N15F4-2	150 V	< 18.6 m $\Omega$	85 A
STP85N15F4	150 V	< 19 m $\Omega$	85 A

- Extremely low on-resistance R<sub>DS(on)</sub>
- 100% avalanche tested

## Application

- Switching applications

## Description

This STripFET™ DeepGATE™ Power MOSFET technology is among the latest improvements, which have been especially tailored to minimize on-state resistance, with a new gate structure, providing superior switching performance.

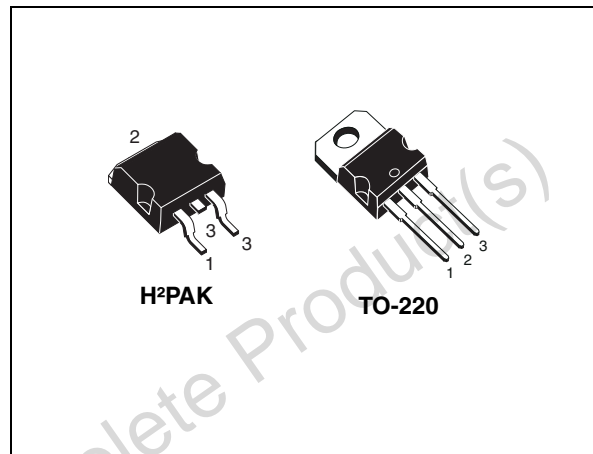
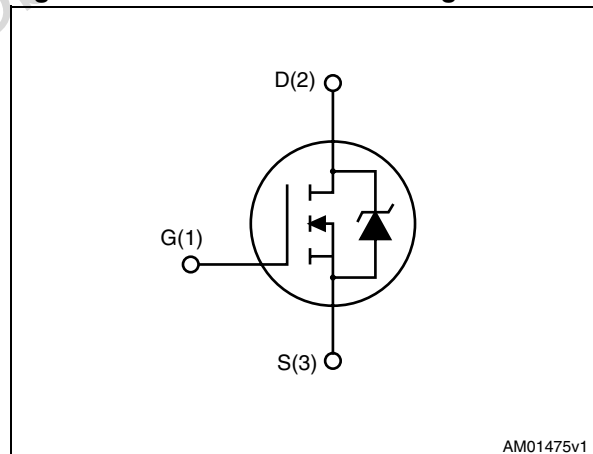


Figure 1. Internal schematic diagram



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Table 1. Device summary

Order codes	Marking	Package	Packaging
STH85N15F4-2	85N15F4	H <sup>2</sup> PAK	Tape and reel
STP85N15F4	85N15F4	TO-220	Tube

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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 ( $V_{GS} = 0$ )	150	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	85	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	60	A
$I_{DM}^{(1)}$	Drain current (pulsed)	340	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
	Derating factor	2.0	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	TBD	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  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 50\text{ A}$ ,  $V_{DD} = 25\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		TO-220	H <sup>2</sup> PAK	
$R_{thj-case}$	Thermal resistance junction-case max	0.5		$^\circ\text{C/W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb max	--	35 <sup>(1)</sup>	$^\circ\text{C/W}$
$R_{thj-a}$	Thermal resistance junction-ambient max	62.5	--	$^\circ\text{C/W}$
$T_l$	Maximum lead temperature for soldering purpose	300		$^\circ\text{C}$

1. When mounted on 1inch<sup>2</sup> FR-4 board, 2 oz 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	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	150			V
$I_{DSS}$	Zero gate voltage Drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$ , $T_C = 125\text{ °C}$			1	$\mu\text{A}$
					100	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			100	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	$V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$	TO220	15.5	19	m $\Omega$
			H <sup>2</sup> PAK	15.0	18.6	

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance		-	8320	-	pF
$C_{oss}$	Output capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	600	-	pF
$C_{rss}$	Reverse transfer capacitance		-	230	-	pF
$Q_g$	Total gate charge	$V_{DD} = 80\text{ V}$ , $I_D = 85\text{ A}$ , $V_{GS} = 10\text{ V}$ (see Figure 3)	-	140	-	nC
$Q_{gs}$	Gate-source charge		-	TBD	-	nC
$Q_{gd}$	Gate-drain charge		-	TBD	-	nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time	$V_{DD} = 75\text{ V}$ , $I_D = 40\text{ A}$ $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 2)	-	TBD	-	ns
	Rise time		-	TBD	-	ns
$t_{d(off)}$ $t_f$	Turn-off-delay time	$V_{DD} = 75\text{ V}$ , $I_D = 40\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 2)	-	TBD	-	ns
	Fall time		-	TBD	-	ns

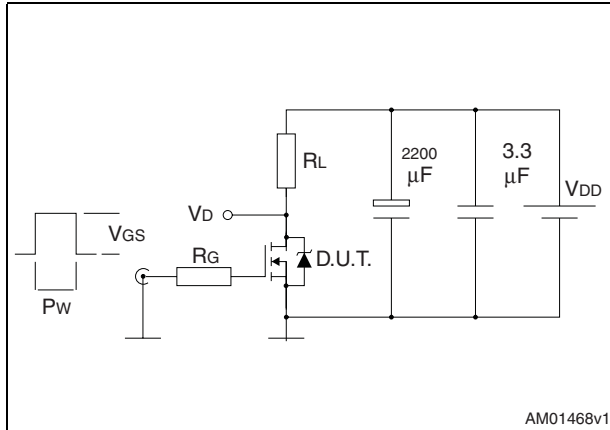
Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		85	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		340	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 85 \text{ A}, V_{GS} = 0$	-		TBD	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 85 \text{ A}, V_{DD} = 25 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s},$ $T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 4)</i>	-	TBD		ns
$Q_{rr}$	Reverse recovery charge			TBD		nC
$I_{RRM}$	Reverse recovery current			TBD		A

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

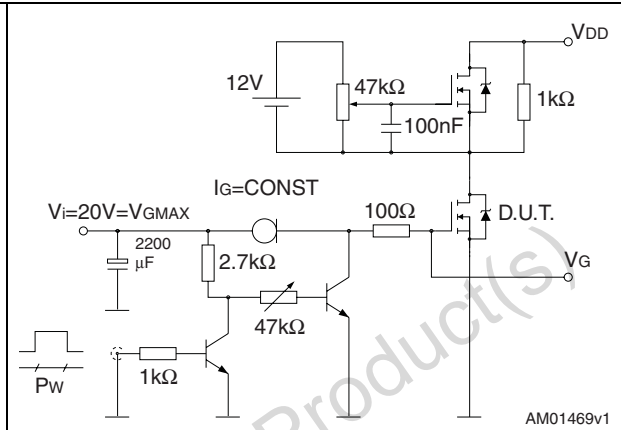
### 3 Test circuits

**Figure 2. Switching times test circuit for resistive load**



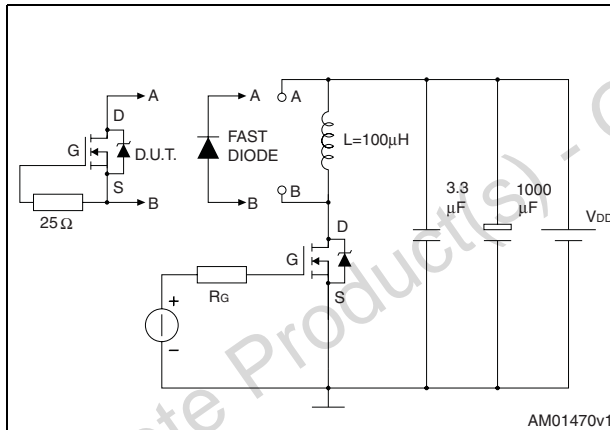
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**Figure 3. Gate charge test circuit**



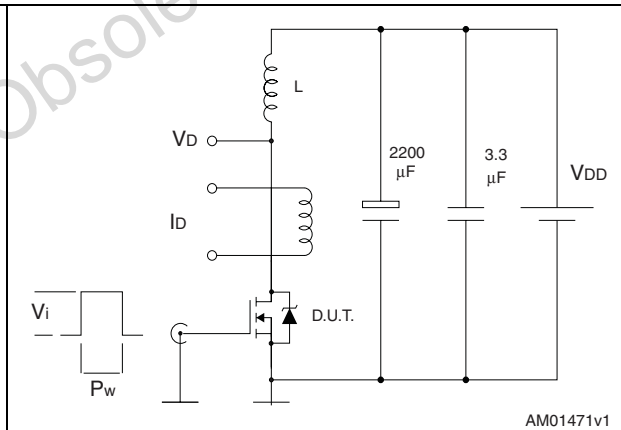
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**Figure 4. Test circuit for inductive load switching and diode recovery times**



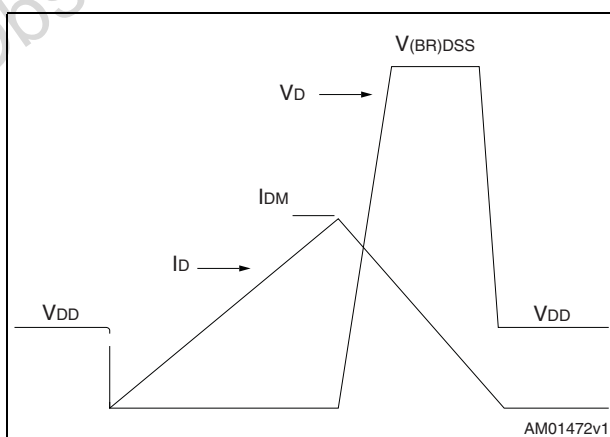
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**Figure 5. Unclamped inductive load test circuit**



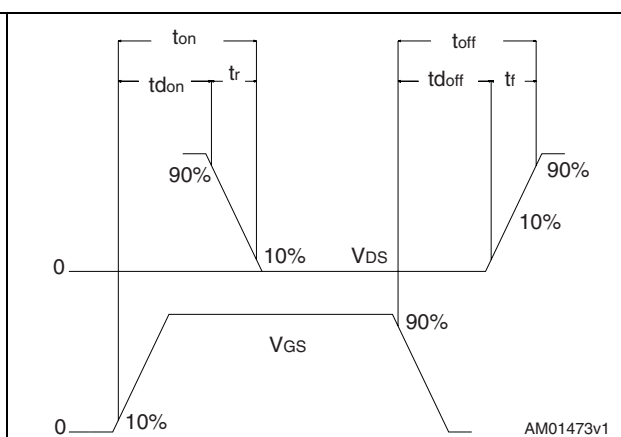
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**Figure 6. Unclamped inductive waveform**



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**Figure 7. Switching time waveform**



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## 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 8. TO-220 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 8. TO-220 drawing

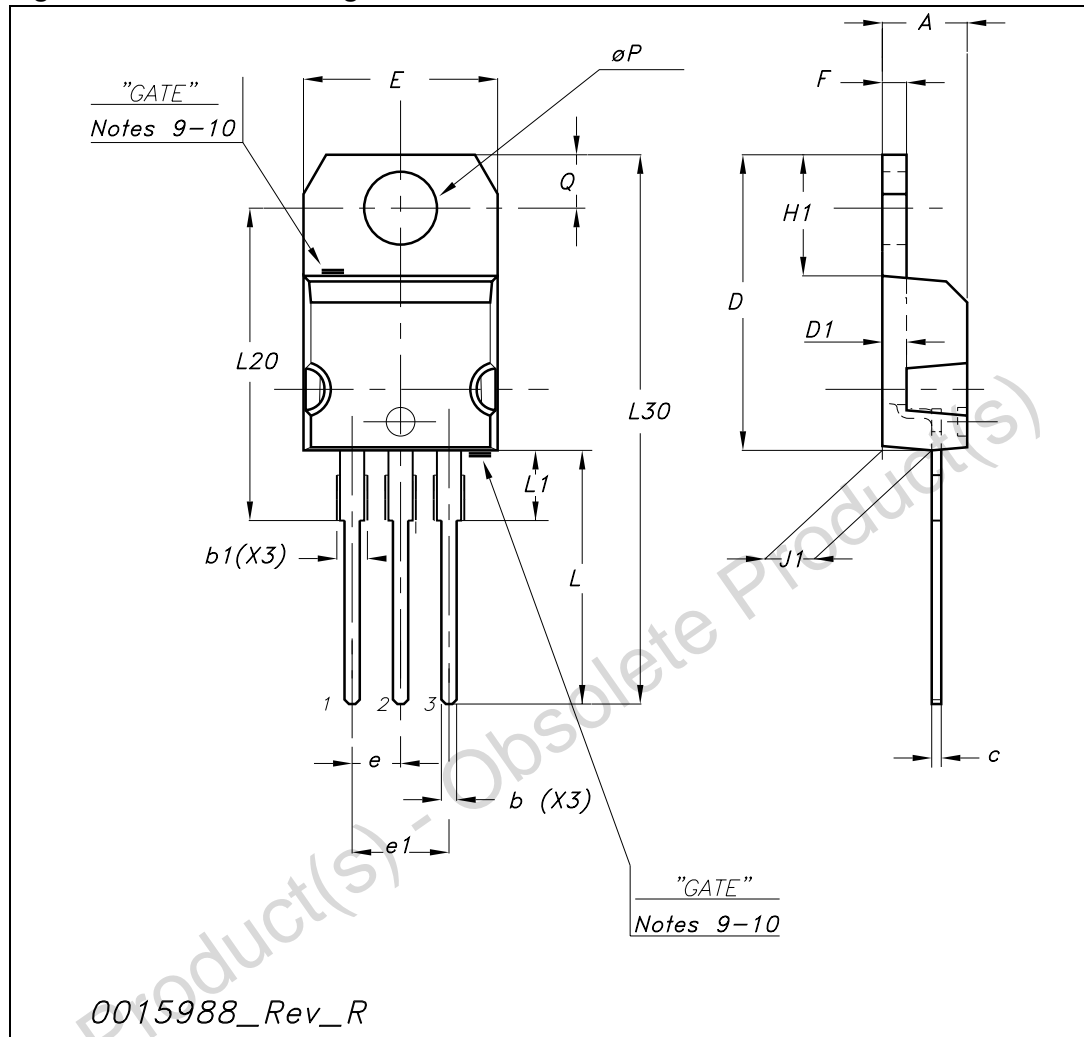




Table 9. H<sup>2</sup>PAK 2 leads mechanical data

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	7.171	-	7.971
L	15.30	-	15.80
L1	1.27	-	1.40
L2	4.93	-	5.23
L3	7.45	-	7.85
L4	1.5	-	1.7
M	2.6	-	2.9
R	0.20	-	0.60
V	0°	-	8°

Figure 9. H<sup>2</sup>PAK 2 leads drawing

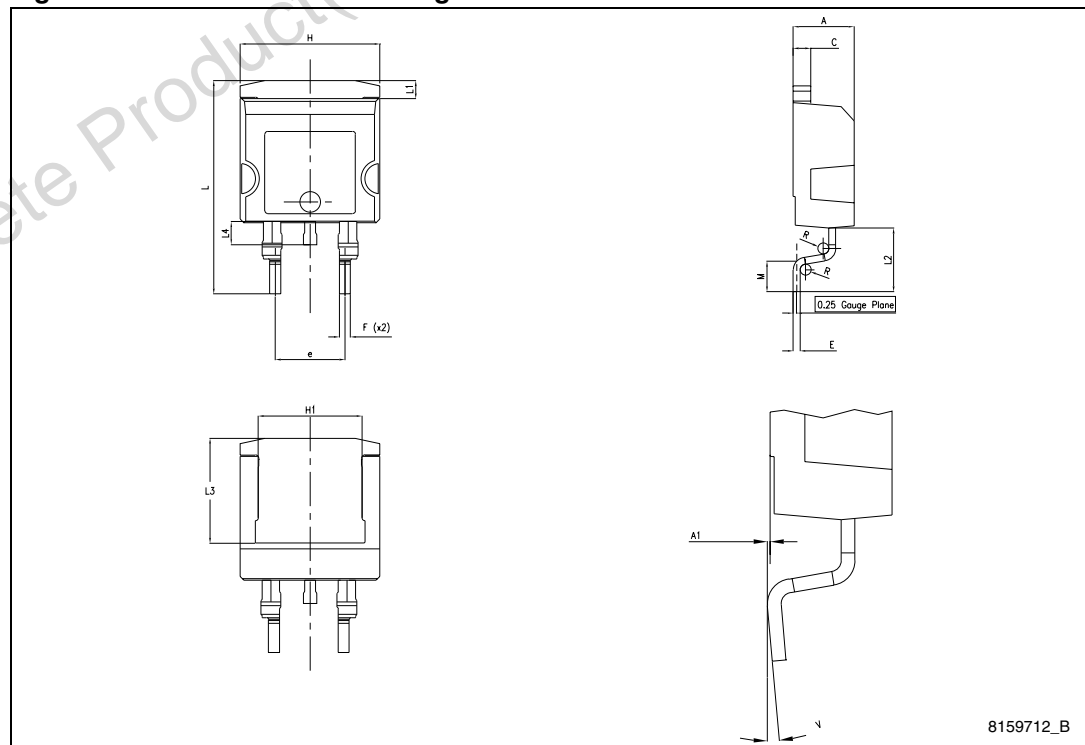
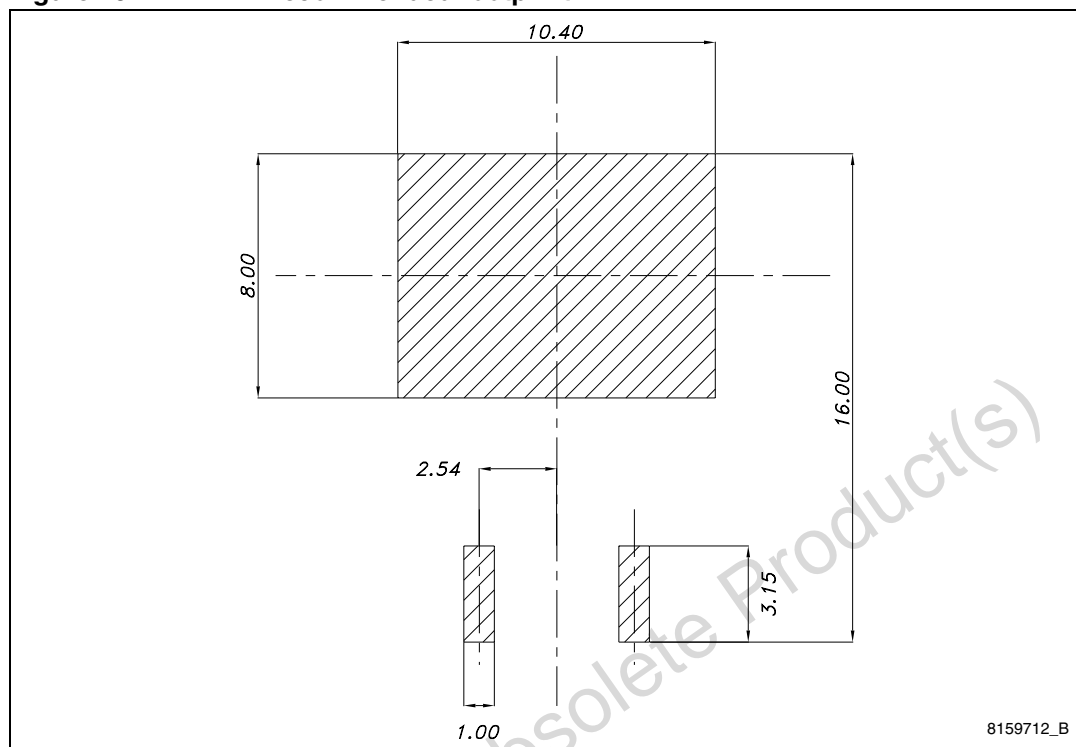


Figure 10. H<sup>2</sup>PAK 2 recommended footprint



## 5 Revision history

Table 10. Document revision history

Date	Revision	Changes
12-Jan-2009	1	First release
03-Jul-2009	2	Substituted D <sup>2</sup> PAK with H <sup>2</sup> PAK
07-Jul-2009	3	Status promoted from target specification to preliminary data

Obsolete Product(s) - Obsolete Product(s)

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