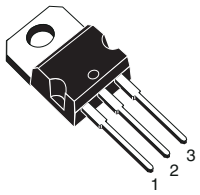
STH180N10F3-2
STP180N10F3

N-channel 100 V, 3.9 mΩ, 180 A STripFET™ Power MOSFET H²PAK, TO-220

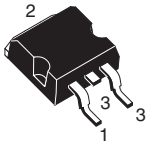
Features

Order codes	V_{DSS}	$R_{DS(on)}$ max.	I_D
STH180N10F3-2	100 V	4.5 mΩ	180 A
STP180N10F3	100 V	5.1 mΩ	120 A

- Ultra low on-resistance
- 100% avalanche tested



TO-220



H²PAK

Application

High current switching applications

Description

These devices are the latest refinement of STMicroelectronics unique “single feature size” strip-based process with less critical alignment steps and therefore a remarkable manufacturing reproducibility. The resulting transistor shows extremely high packing density for low on resistance, rugged avalanche characteristics and low gate charge.

Figure 1. Internal schematic diagram

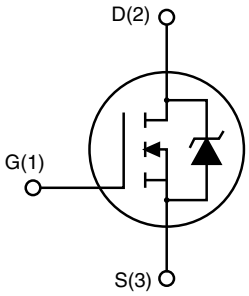


Table 1. Device summary

Order codes	Marking	Package	Packaging
STH180N10F3-2	180N10F3	H²PAK	Tape and reel
STP180N10F3	180N10F3	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220	H²PAK	
V_{DS}	Drain-source voltage (V_{GS}=0)	100		V
V_{GS}	Gate-source voltage	± 20		V
I_D (1)	Drain current (continuous) at T_C = 25°C	120	180	A
I_D (1)	Drain current (continuous) at T_C=100°C	110	120	A
I_{DM} (2)	Drain current (pulsed)	480	720	A
P_{TOT}	Total dissipation at T_C = 25°C	315		W
	Derating factor	2.1		W/°C
dv/dt	Peak diode recovery voltage slope	20		V/ns
E_{AS} (3)	Single pulse avalanche energy	350		mJ
T_j T_{stg}	Operating junction temperature storage temperature	- 55 to 175		°C

1. Current limited by package.
2. Pulse width limited by safe operating area.
3. Starting Tj = 25 °C, I_D = 80 A, V_{DD} = 50 V.

Table 3. Thermal data

Symbol	Parameter	TO-220	H²PAK	Unit
Rthj-case	Thermal resistance junction-case	0.48		°C/W
Rthj-a	Thermal resistance junction-ambient max	62.5		°C/W
Rthj-pcb(1)	Thermal resistance junction-ambient max		35	°C/W
T_l	Maximum lead temperature for soldering purpose	300		°C

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

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	100			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS}= max rating, V_{DS}= max rating, @125°C			10 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±20 V			±200	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= 60 A H²PAK TO-220		3.9 4.5	4.5 5.1	mΩ mΩ

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	-	6665 786 49	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 50 V, I_D = 120 A, V_{GS} = 10 V (see *Figure 17*)	-	114.6 38.8 31.9	-	nC nC nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 50 V, I_D = 60 A R_G = 4.7 Ω V_{GS} = 10 V (see *Figure 16*, *Figure 21*)	-	25.6 97.1 99.9 6.9	-	ns ns 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)		-		120 480	A A
V_{SD}(2)	Forward on voltage	I_{SD}=120 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 A, di/dt = 100 A/µs, V_{DD}=80 V, Tj=150°C (see *Figure 18*)	-	83.4 295.7 7.1		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220

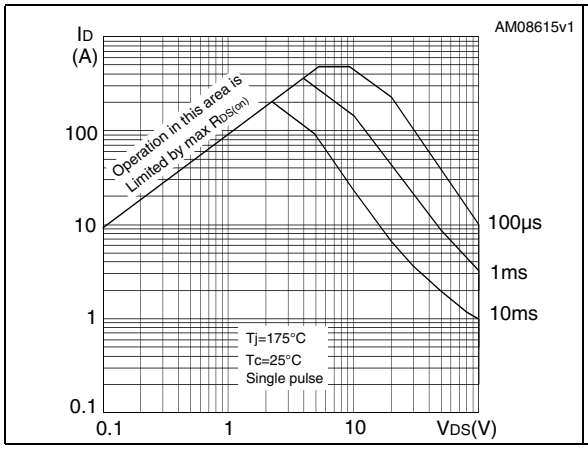


Figure 3. Thermal impedance for TO-220

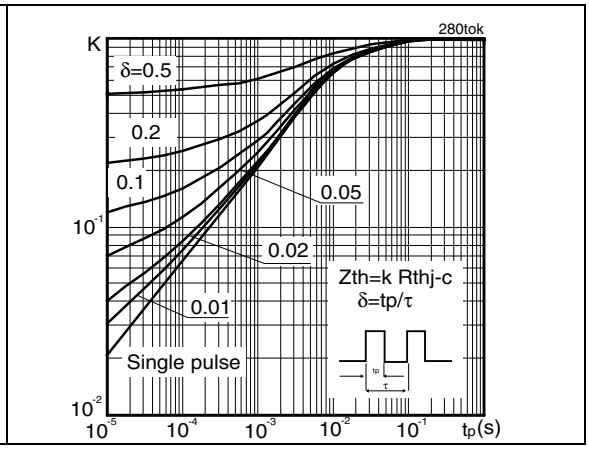


Figure 4. Safe operating area for H²PAK

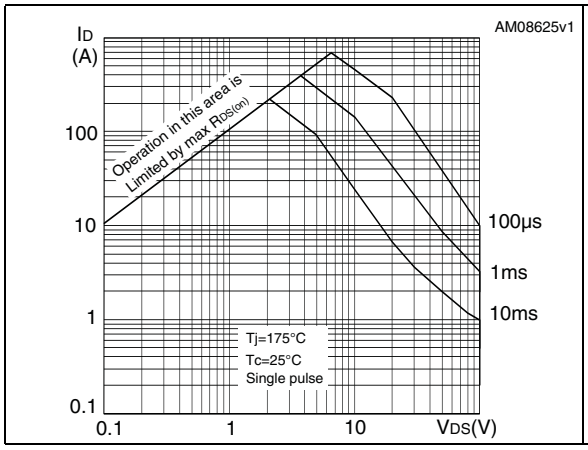


Figure 5. Thermal impedance for H²PAK

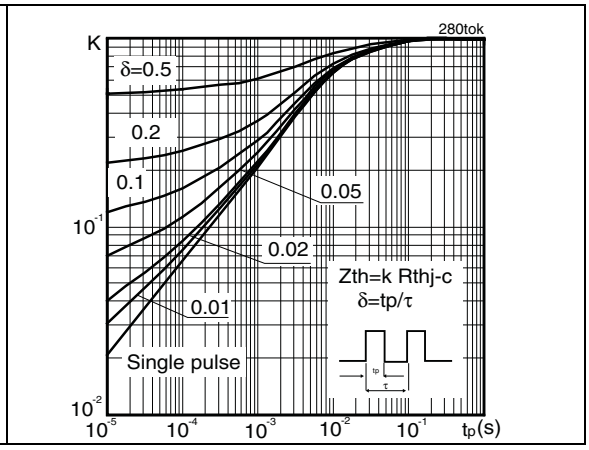


Figure 6. Output characteristics

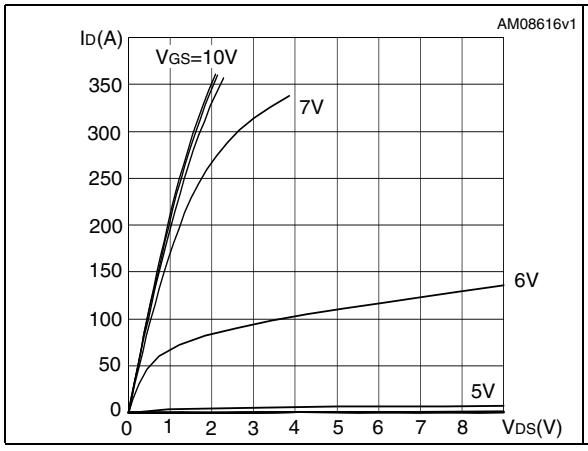


Figure 7. Transfer characteristics

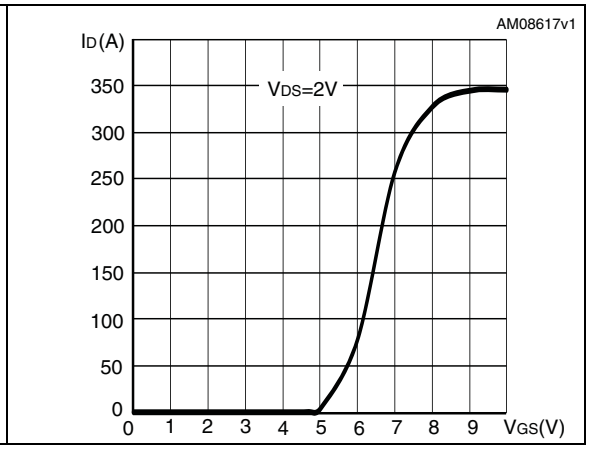


Figure 8. Static drain-source on resistance for TO-220

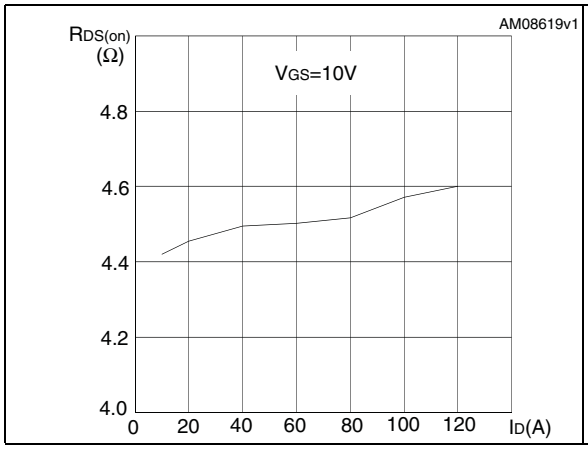


Figure 9. Static drain-source on resistance for H²PAK

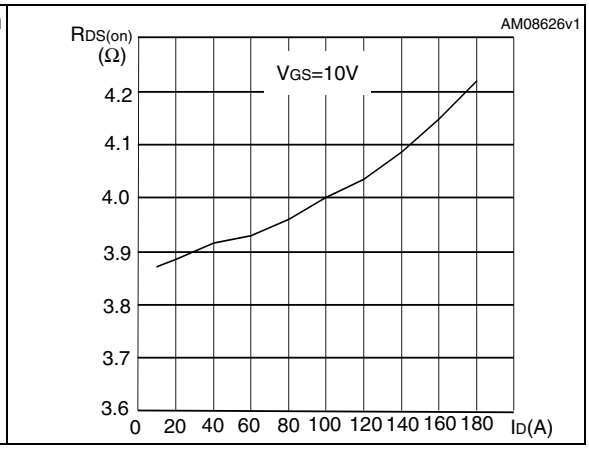


Figure 10. Gate charge vs gate-source voltage

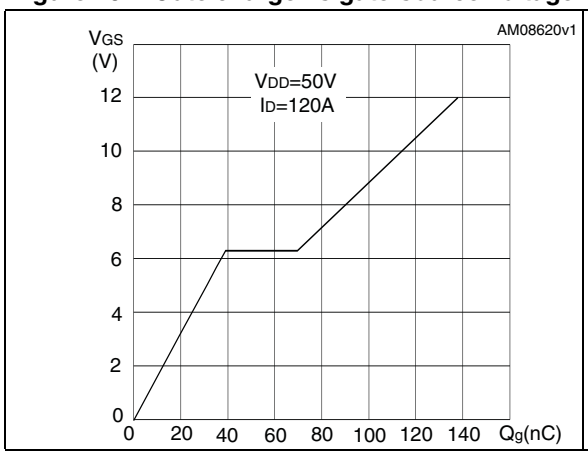


Figure 11. Capacitance variations

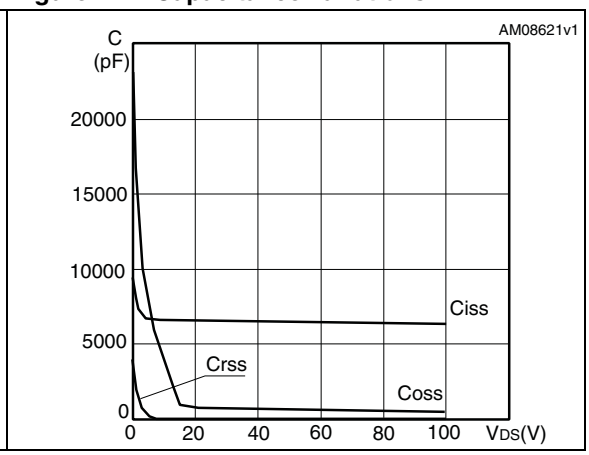


Figure 12. Normalized gate threshold voltage vs temperature

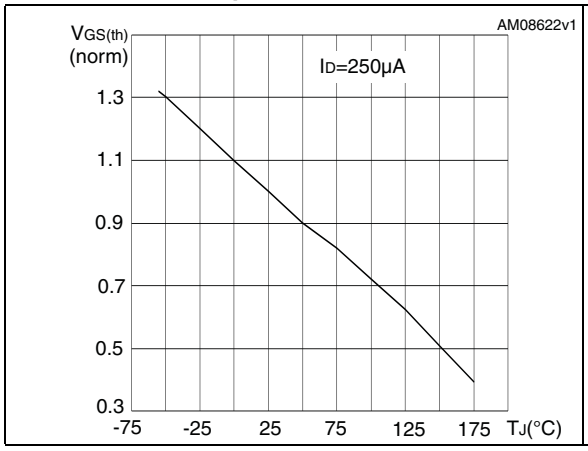


Figure 13. Normalized on resistance vs temperature

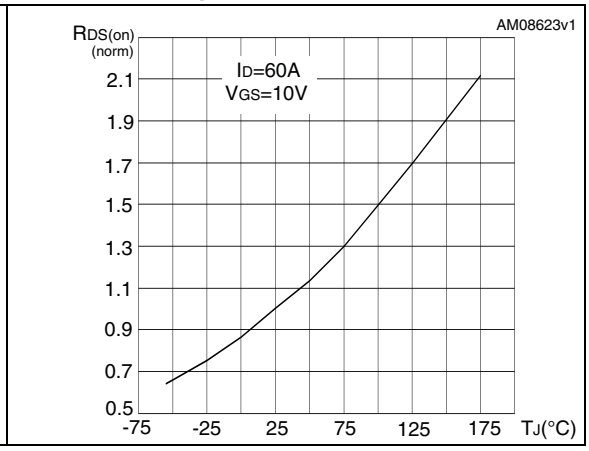


Figure 14. Source-drain diode forward characteristics

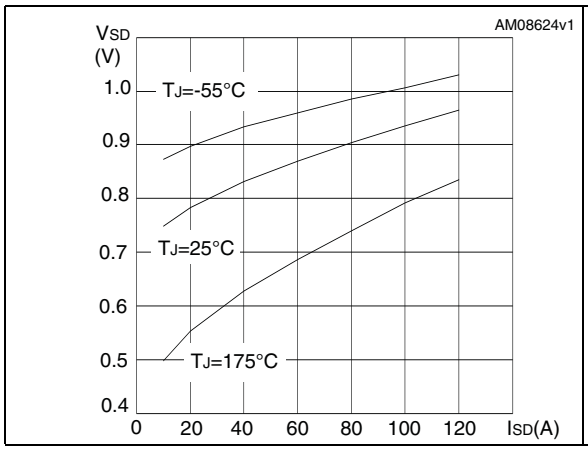
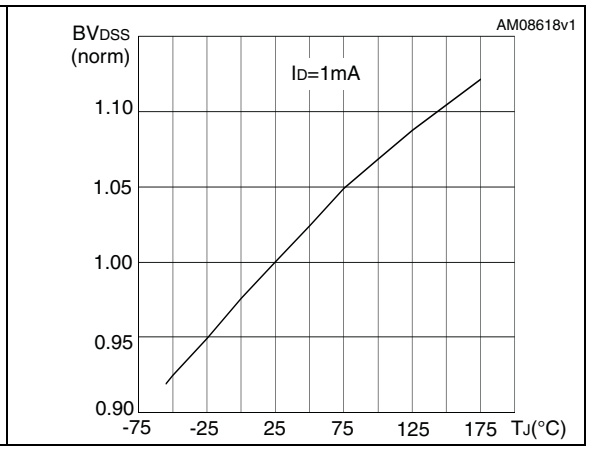


Figure 15. Normalized B_{VDSS} vs temperature



3 Test circuits

Figure 16. Switching times test circuit for resistive load

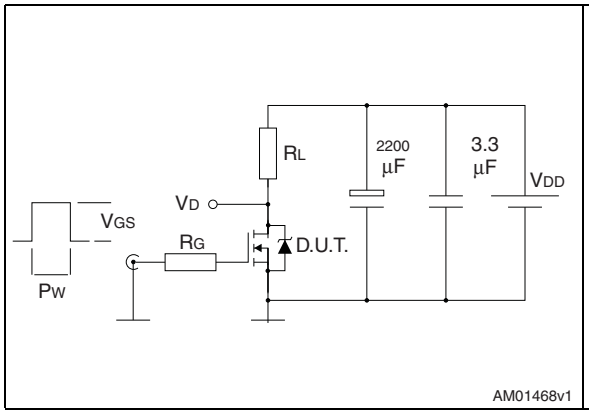


Figure 17. Gate charge test circuit

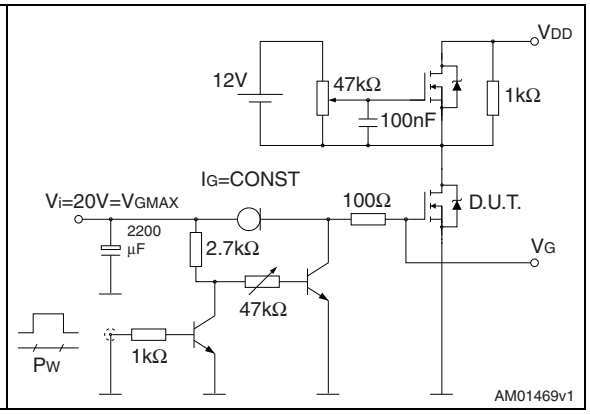


Figure 18. Test circuit for inductive load switching and diode recovery times

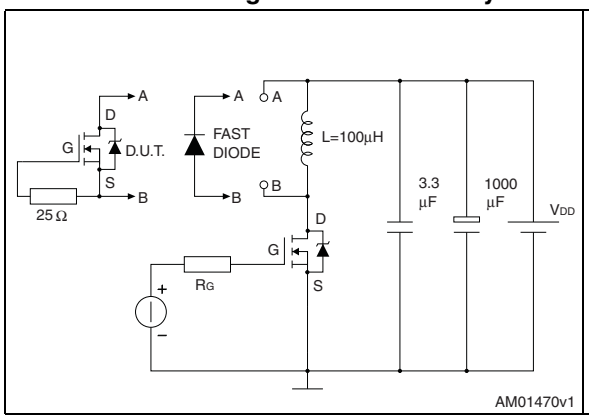


Figure 19. Unclamped inductive load test circuit

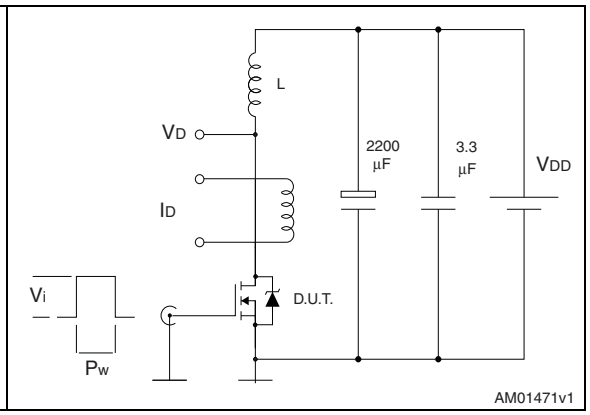


Figure 20. Unclamped inductive waveform

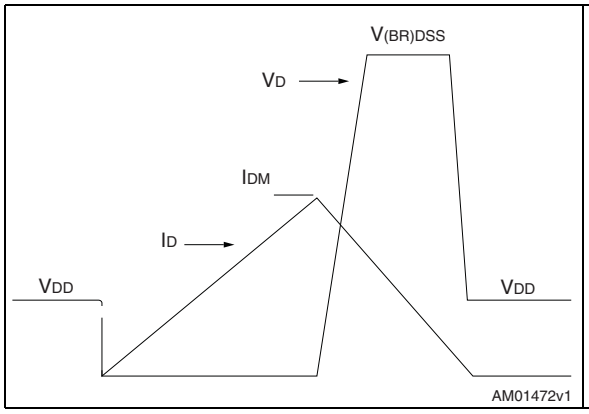
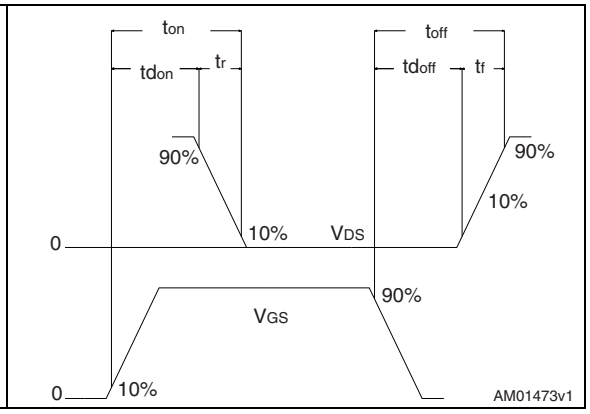


Figure 21. Switching time waveform



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.

Table 8. TO-220 type A 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	
∅P	3.75		3.85
Q	2.65		2.95

Figure 22. TO-220 type A drawing

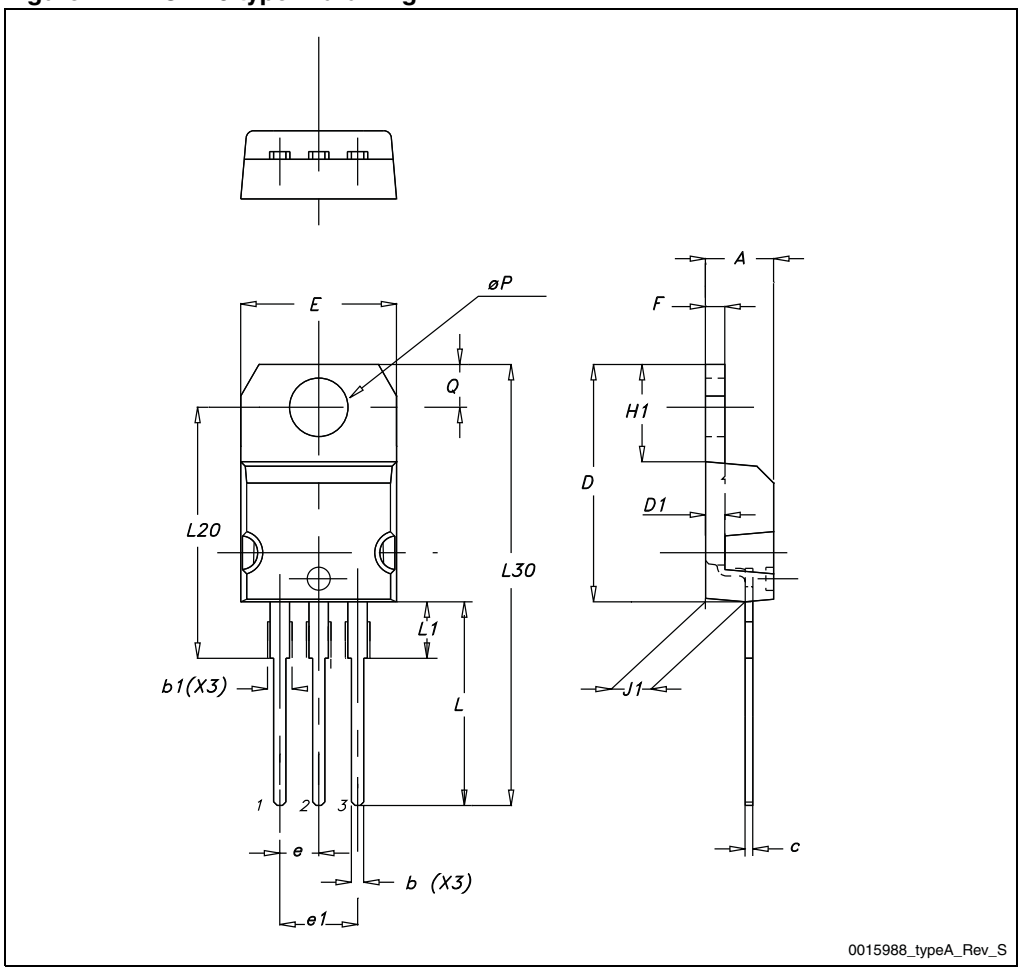


Table 9. H²PAK 2 leads mechanical data

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	7.171		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 23. H²PAK 2 leads drawing

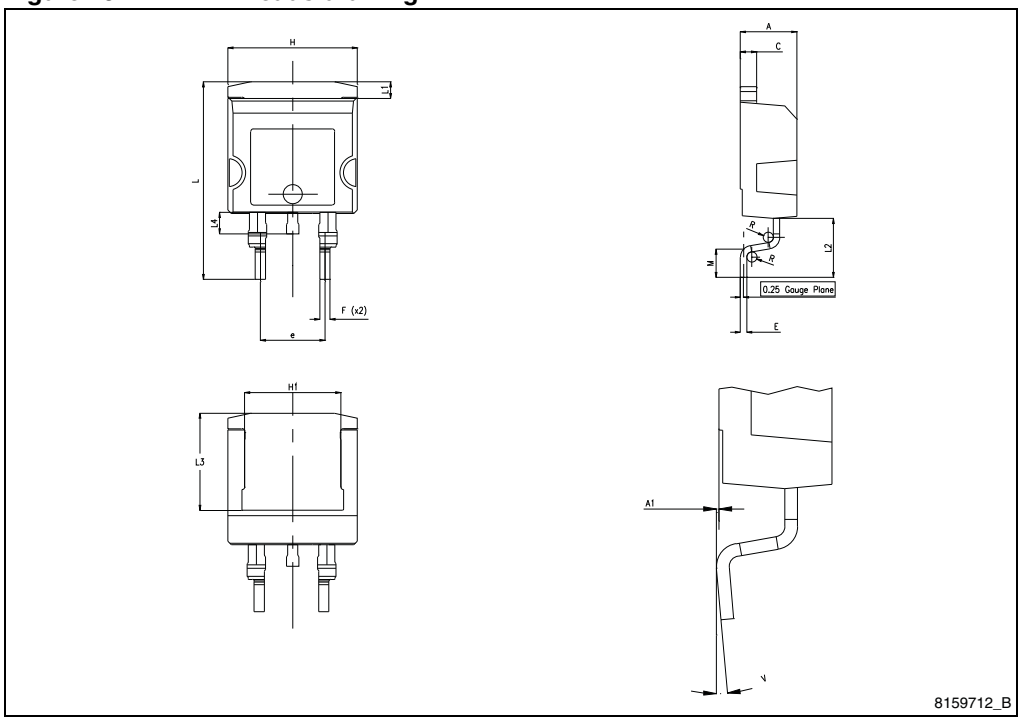
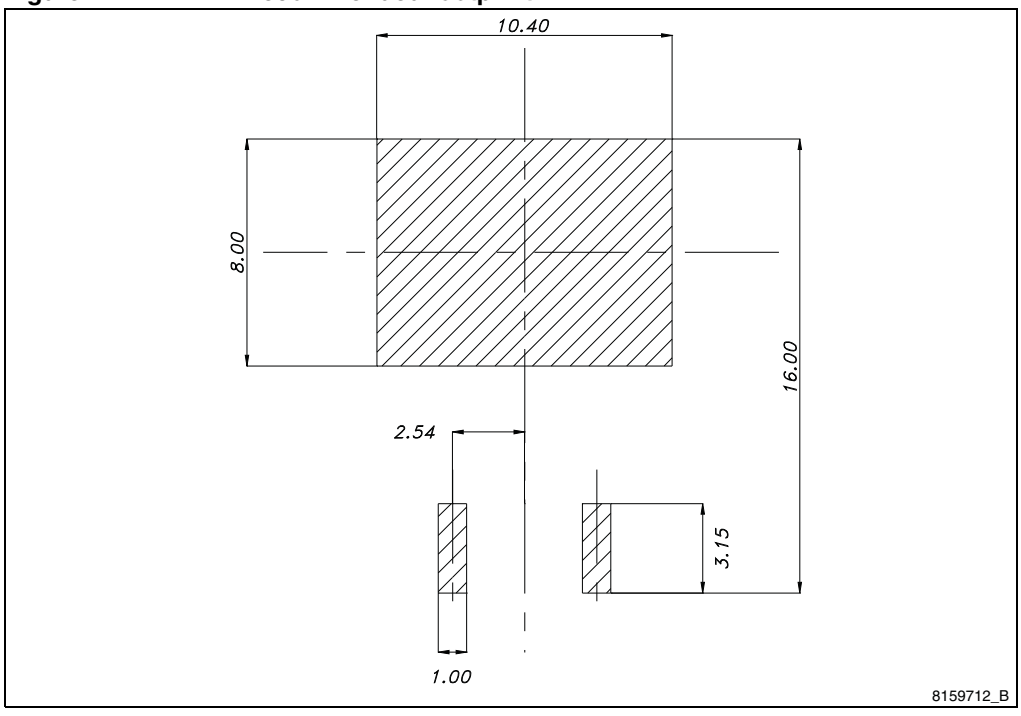


Figure 24. H²PAK 2 recommended footprint



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
01-Aug-2008	1	First version
03-Jun-2010	2	– Removed package, mechanical data: D²PAK – Added new package mechanical data: H²PAK
10-Mar-2011	3	Document status promoted from preliminary data to datasheet.

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