STH270N8F7-2, STH270N8F7-6, STP270N8F7

N-channel 80 V, 0.0017 Ω typ., 180 A, STripFET™ F7 Power MOSFETs in H²PAK-2, H²PAK-6 and TO-220 packages

Datasheet – production data

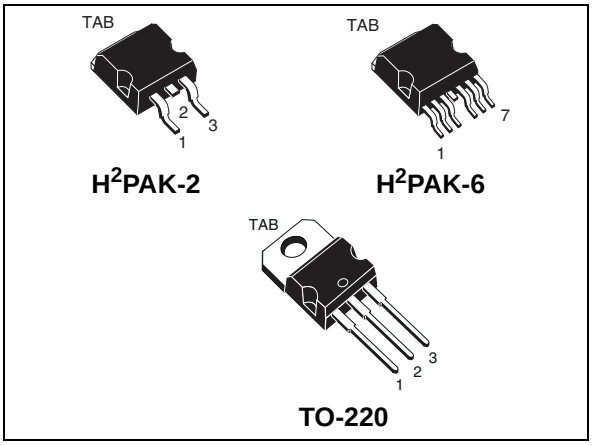
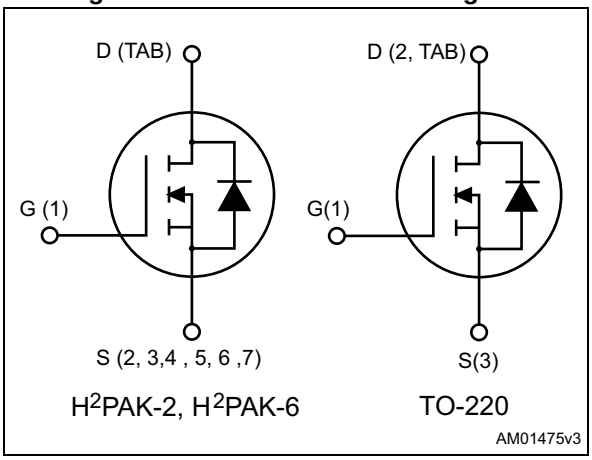


Figure 1. Internal schematic diagram



Features

Order codes	V_{DS}	$R_{DS(on)}$ max	I_D
STH270N8F7-2	80 V	0.0021 Ω	180 A
STH270N8F7-6			
STP270N8F7		0.0025 Ω	

- Among the lowest $R_{DS(on)}$ on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

These N-channel Power MOSFETs utilize STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STH270N8F7-2	270N8F7	H²PAK-2	Tape and reel
STH270N8F7-6		H²PAK-6	
STP270N8F7		TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	80	V
V_{GS}	Gate-source voltage	± 20	V
I_D (1)	Drain current (continuous)	180	A
I_D (1)	Drain current (continuous) at T_C = 100 °C	180	A
I_{DM} (2)	Drain current (pulsed)	720	A
P_{TOT} (3)	Total dissipation at T_C = 25 °C	315	W
E_{AS} (4)	Single pulse avalanche energy	1.16	J
T_J	Operating junction temperature	-55 to 175	°C
T_{stg}	Storage temperature		°C

1. Limited by package
2. Pulse width limited by safe operating area
3. This value is rated according to $R_{thj\text{-}c}$
4. Starting T_j = 25°C, I_d = 65 A, V_{dd} = 50 V

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		H^2PAK-2, H^2PAK-6	TO-220	
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.48		°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	35		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max		62.5	°C/W

1. When mounted on FR-4 board of 1 inch^2, 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 (V_{GS}= 0)	I_D = 250 µA	80			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 80 V V_{DS} = 80 V; T_C=125 °C			10 100	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	For H^2PAK-2, H^2PAK-6: V_{GS}= 10 V, I_D= 90 A		0.0017	0.0021	Ω
		For TO-220: V_{GS}= 10 V, I_D= 90 A		0.0021	0.0025	

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} =50 V, f=1 MHz, V_{GS}=0	-	13600	-	pF
C_{oss}	Output capacitance		-	2050	-	pF
C_{rss}	Reverse transfer capacitance		-	236	-	pF
Q_g	Total gate charge	V_{DD}=40 V, I_D = 180 A V_{GS} =10 V *Figure 19*	-	193	-	nC
Q_{gs}	Gate-source charge		-	96	-	nC
Q_{gd}	Gate-drain charge		-	46	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD}=40 V, I_D= 90 A, R_G=4.7 Ω, V_{GS}= 10 V *Figure 18*	-	56	-	ns
t_r	Rise time		-	180	-	ns
$t_{d(off)}$	Turn-off delay time		-	98	-	ns
t_f	Fall time		-	42	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		180	A
I_{SDM}(1)	Source-drain current (pulsed)		-		720	A
V_{SD}(2)	Forward on voltage	I_{SD} = 90 A, V_{GS}=0	-		1.2	V
t_{rr}	Reverse recovery time	I_{SD} = 180 A, di/dt = 100 A/µs, V_{DD}=64 V, T_j=150 °C	-	78		ns
Q_{rr}	Reverse recovery charge		-	182		nC
I_{RRM}	Reverse recovery current		-	4.7		A

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

3 Electrical characteristics (curves)

Figure 2. Safe operating area for H²PAK-2 and H²PAK-6

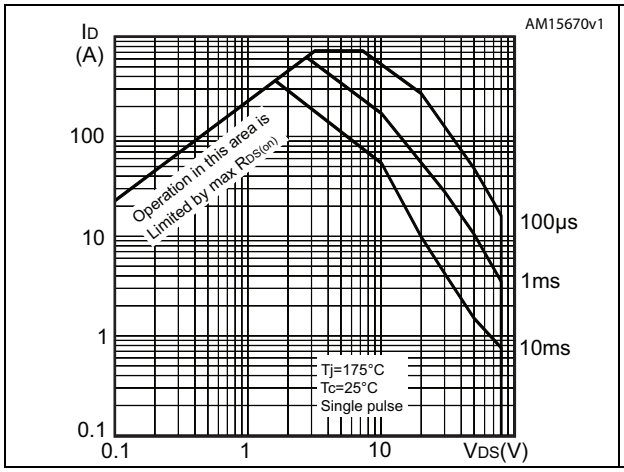


Figure 3. Safe operating area for TO-220

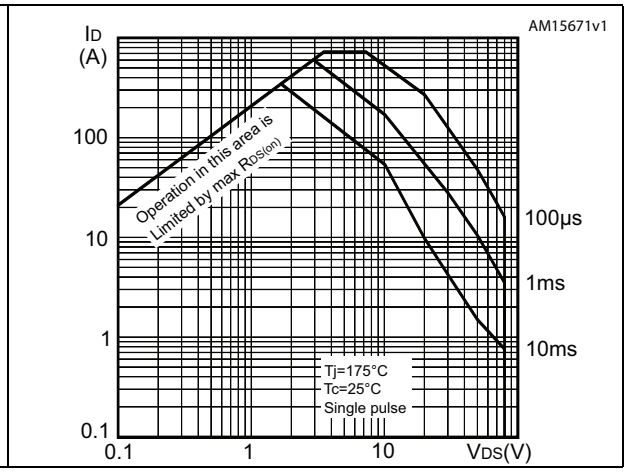


Figure 4. Thermal impedance

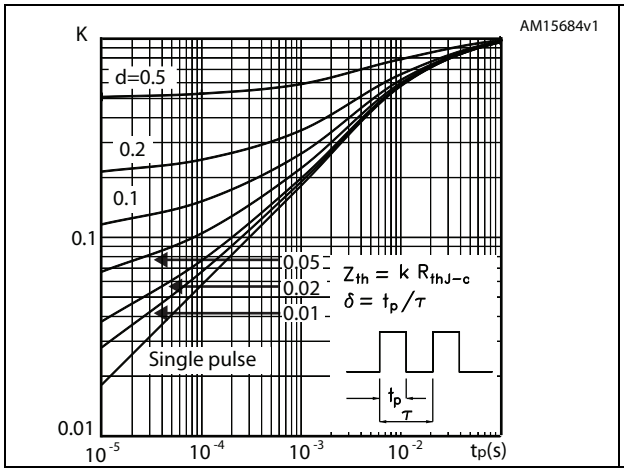


Figure 5. Gate charge vs gate-source voltage

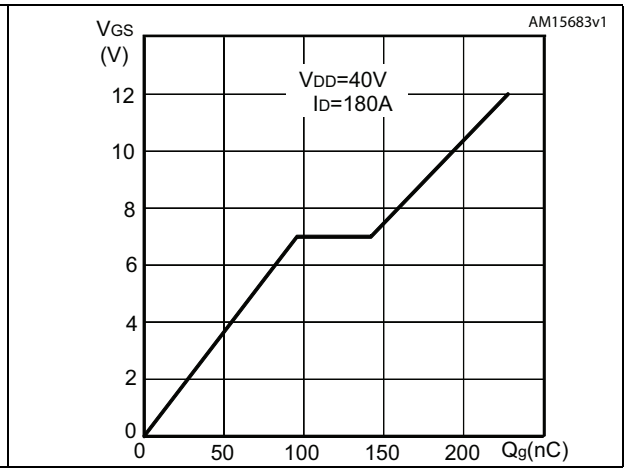


Figure 6. Output characteristics for TO-220

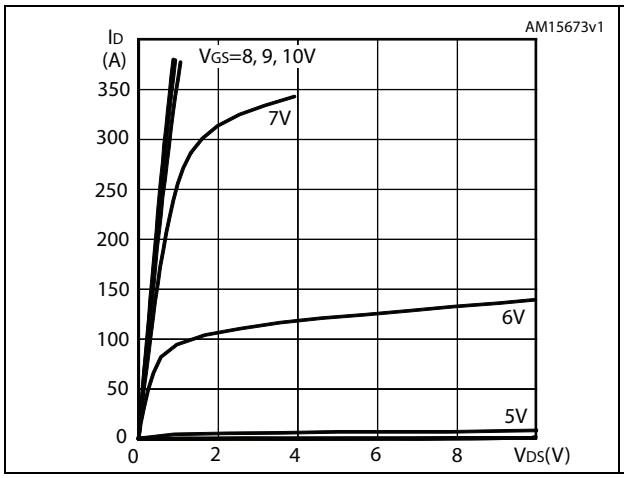


Figure 7. Transfer characteristics for TO-220

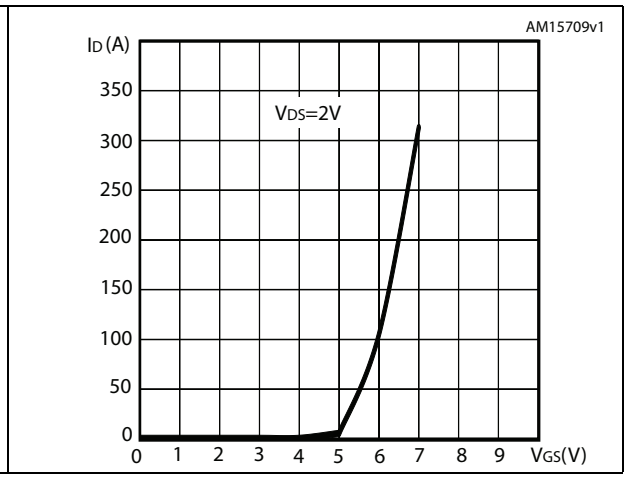


Figure 8. Output characteristics for H²PAK-2 and H²PAK-6

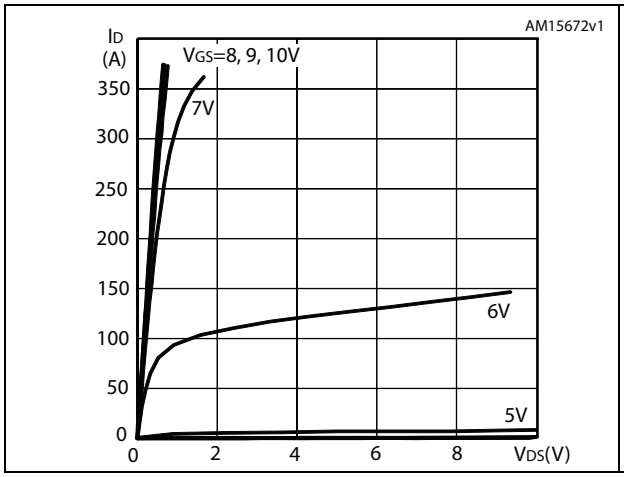


Figure 9. Transfer characteristics for H²PAK-2 and H²PAK-6

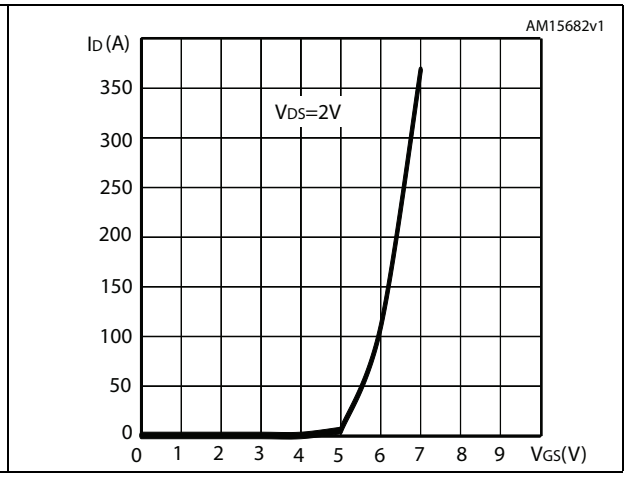


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

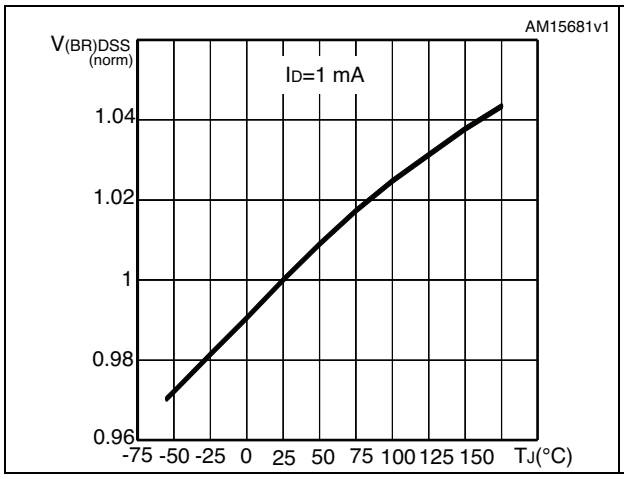


Figure 11. Static drain-source on-resistance for H²PAK-2 and H²PAK-6

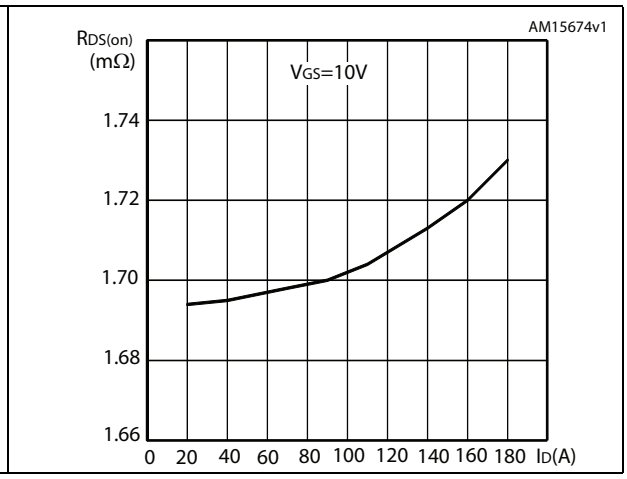


Figure 12. Static drain-source on-resistance for TO-220

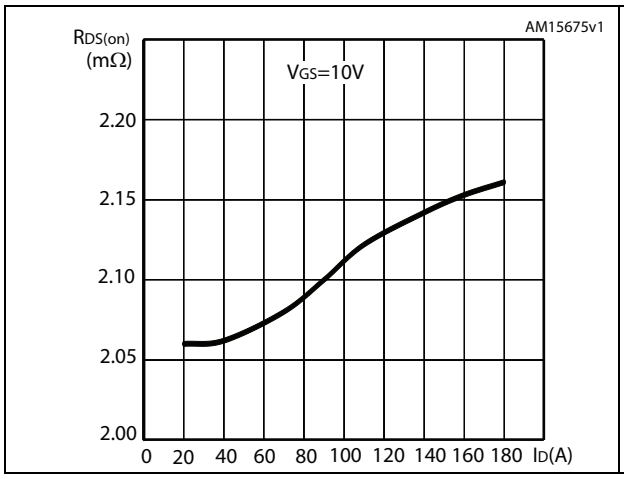


Figure 13. Capacitance variations

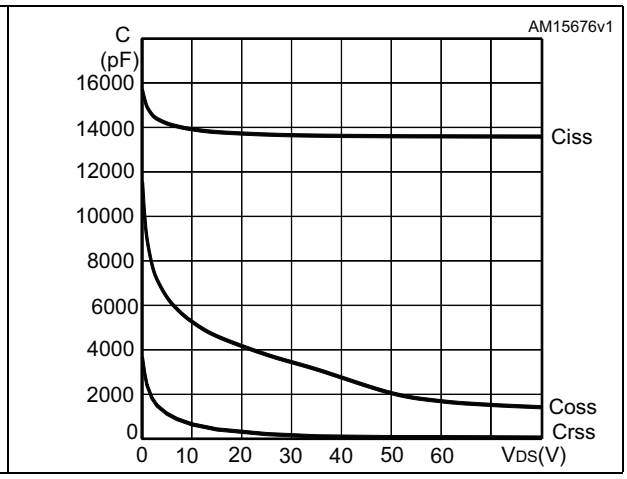


Figure 14. Source-drain diode forward characteristics

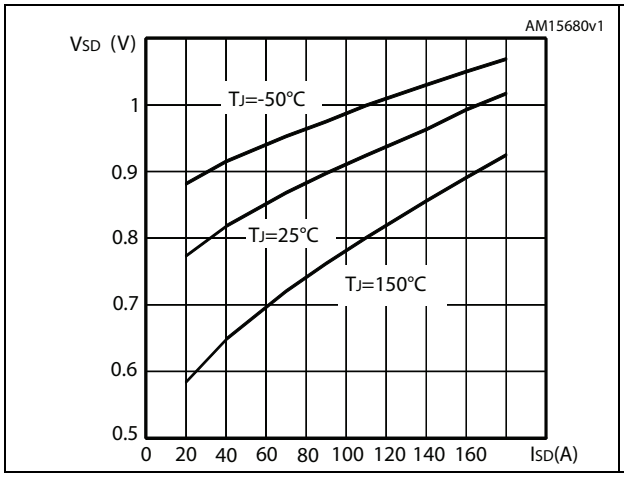


Figure 15. Normalized gate threshold voltage vs temperature

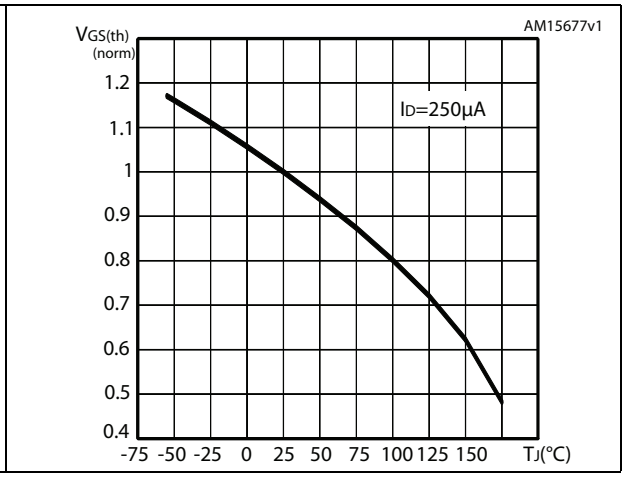


Figure 16. Normalized on-resistance vs temperature for H^2PAK-2 and H^2PAK-6

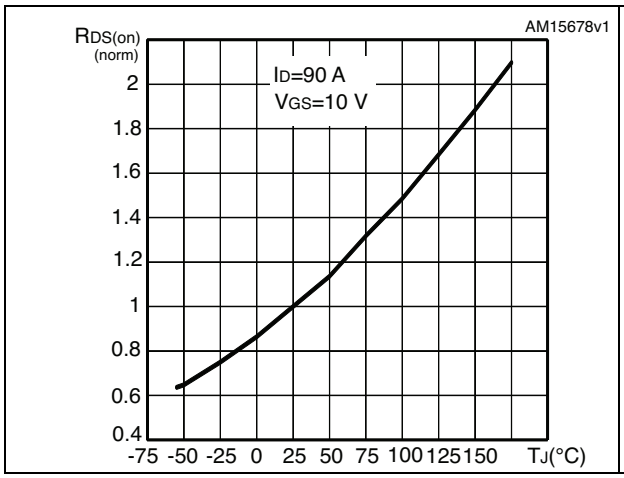
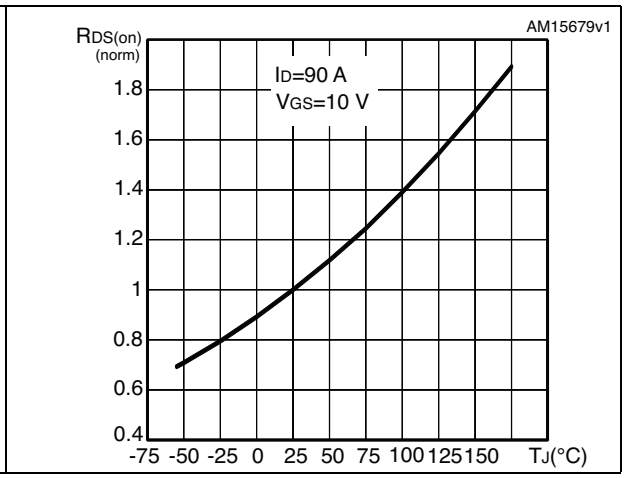


Figure 17. Normalized on-resistance vs temperature for TO-220



4 Test circuits

Figure 18. Switching times test circuit for resistive load

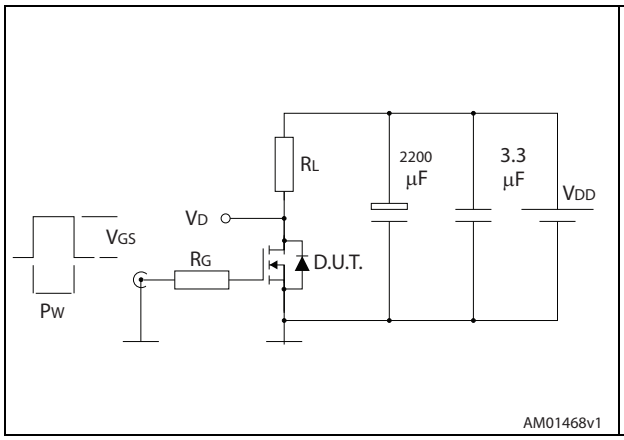


Figure 19. Gate charge test circuit

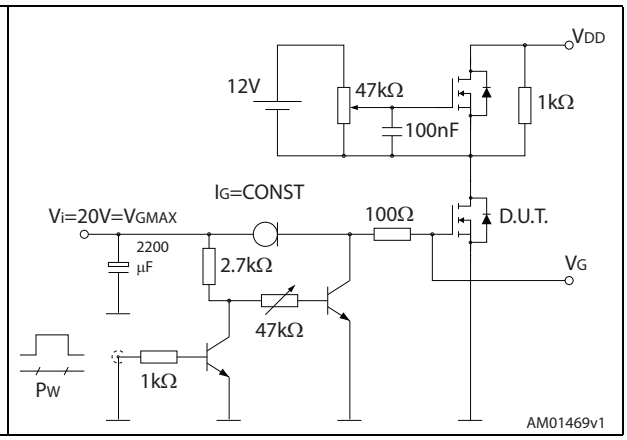


Figure 20. Test circuit for inductive load switching and diode recovery times

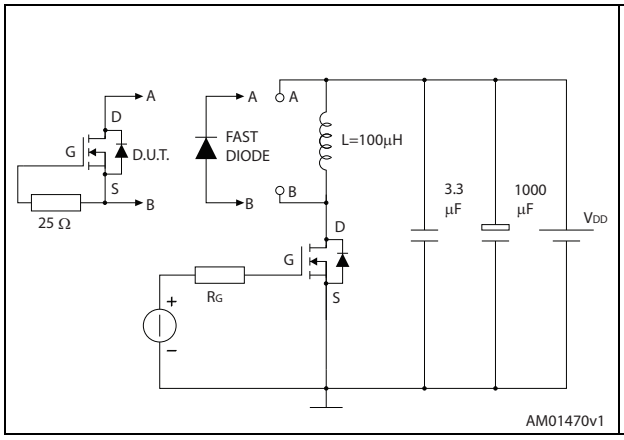


Figure 21. Unclamped inductive load test circuit

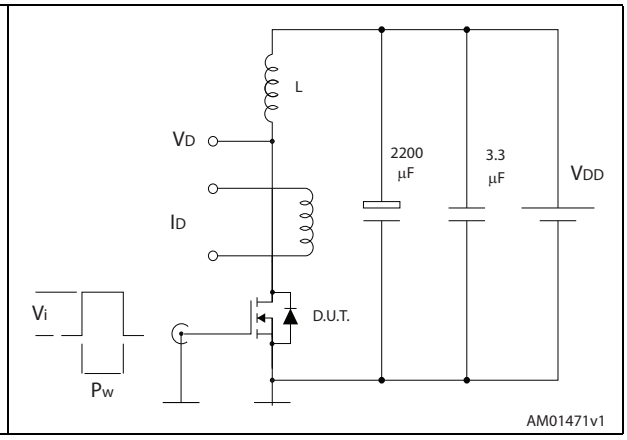


Figure 22. Unclamped inductive waveform

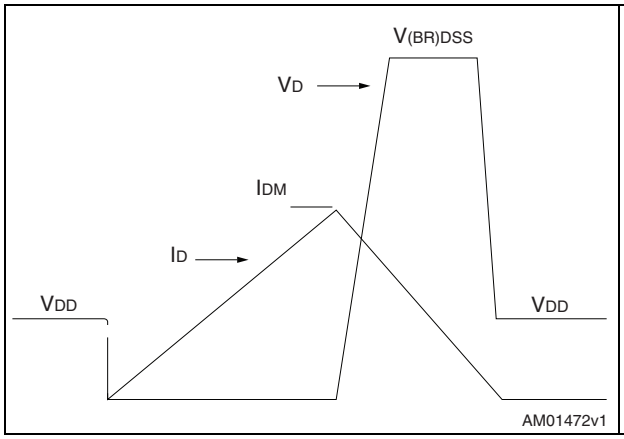
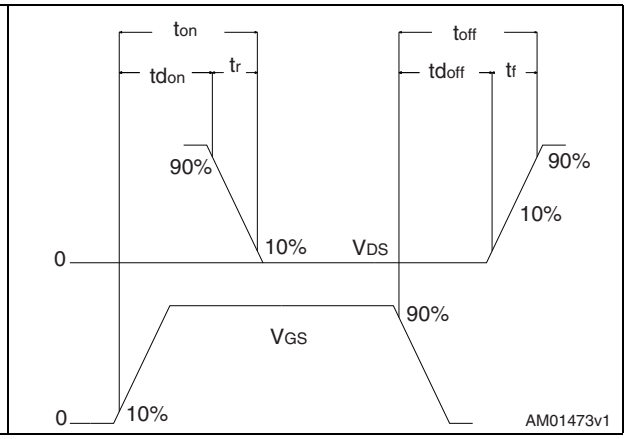


Figure 23. Switching time waveform



5 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.

5.1 H²PAK-2 package information

Figure 24. H²PAK-2 package information

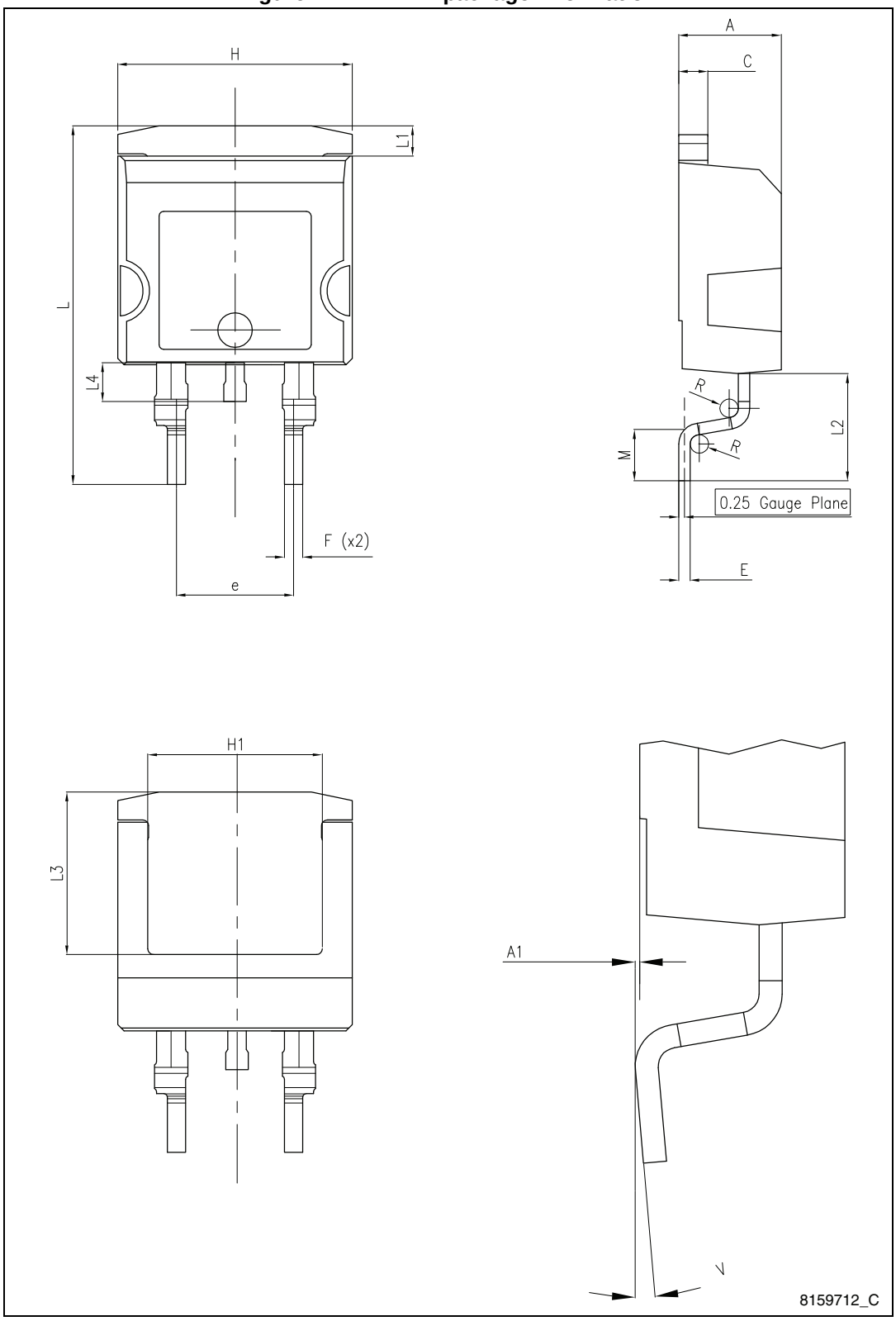
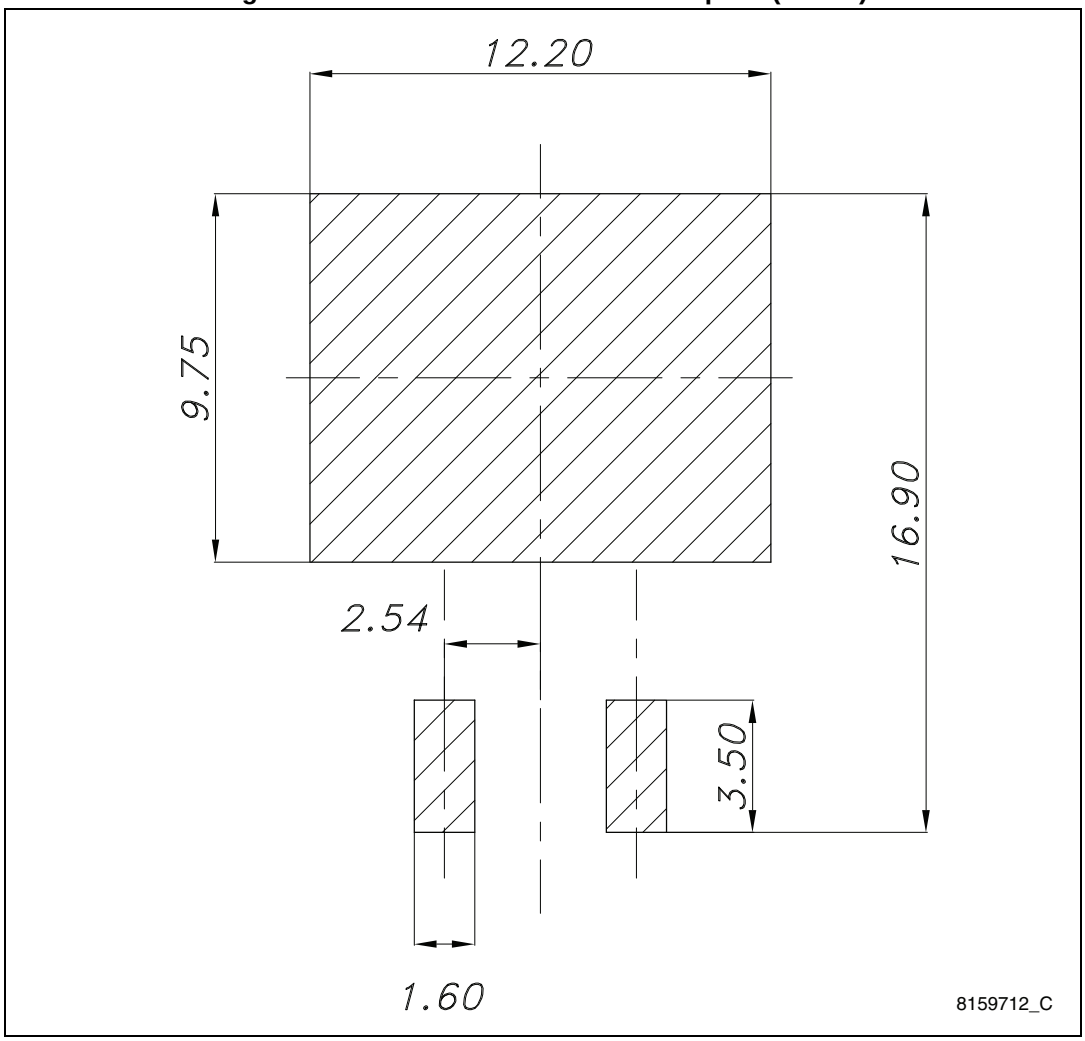


Table 8. H²PAK-2 package mechanical data

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 25. H²PAK-2 recommended footprint (in mm)



5.2 H²PAK-6 package information

Figure 26. H²PAK-6 package outline

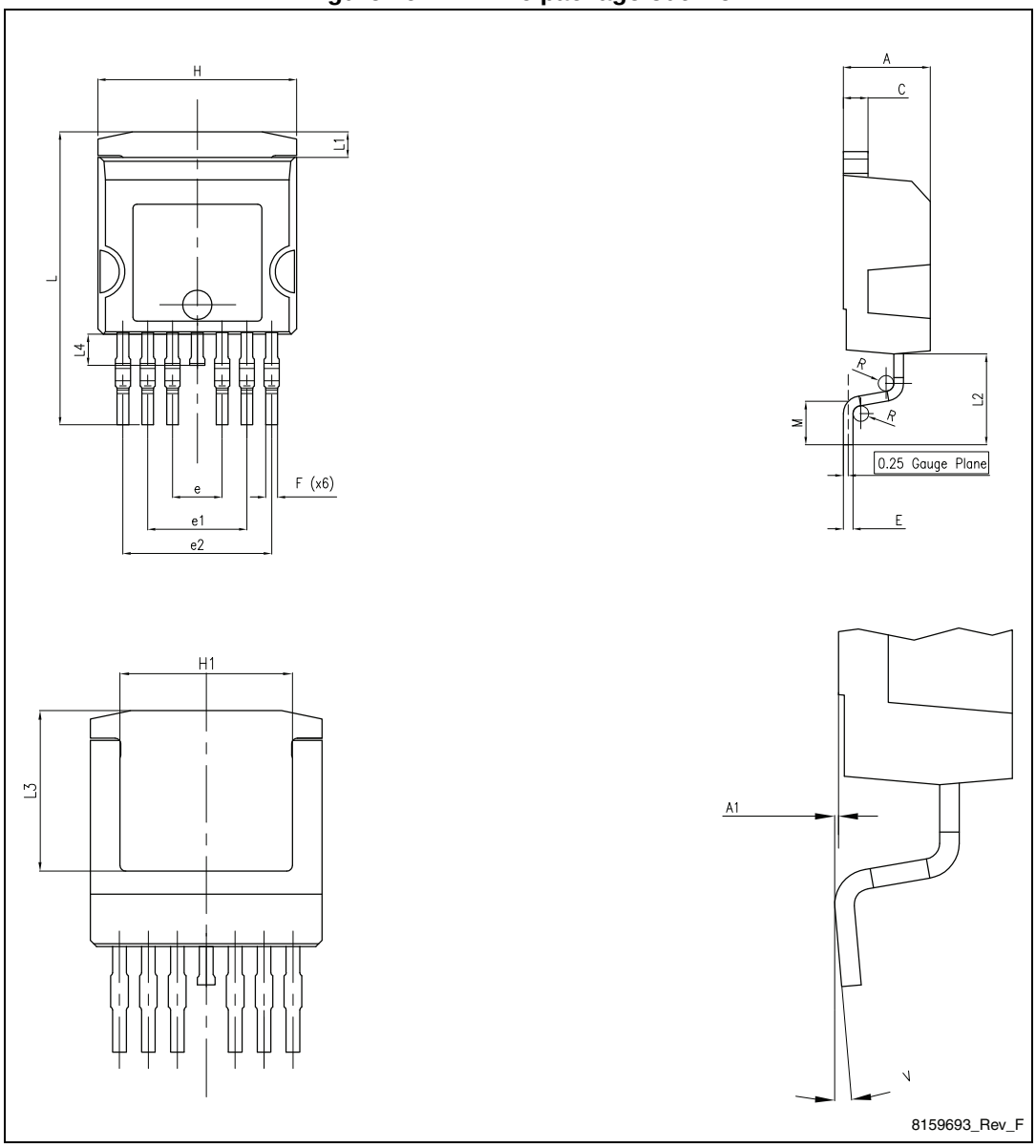
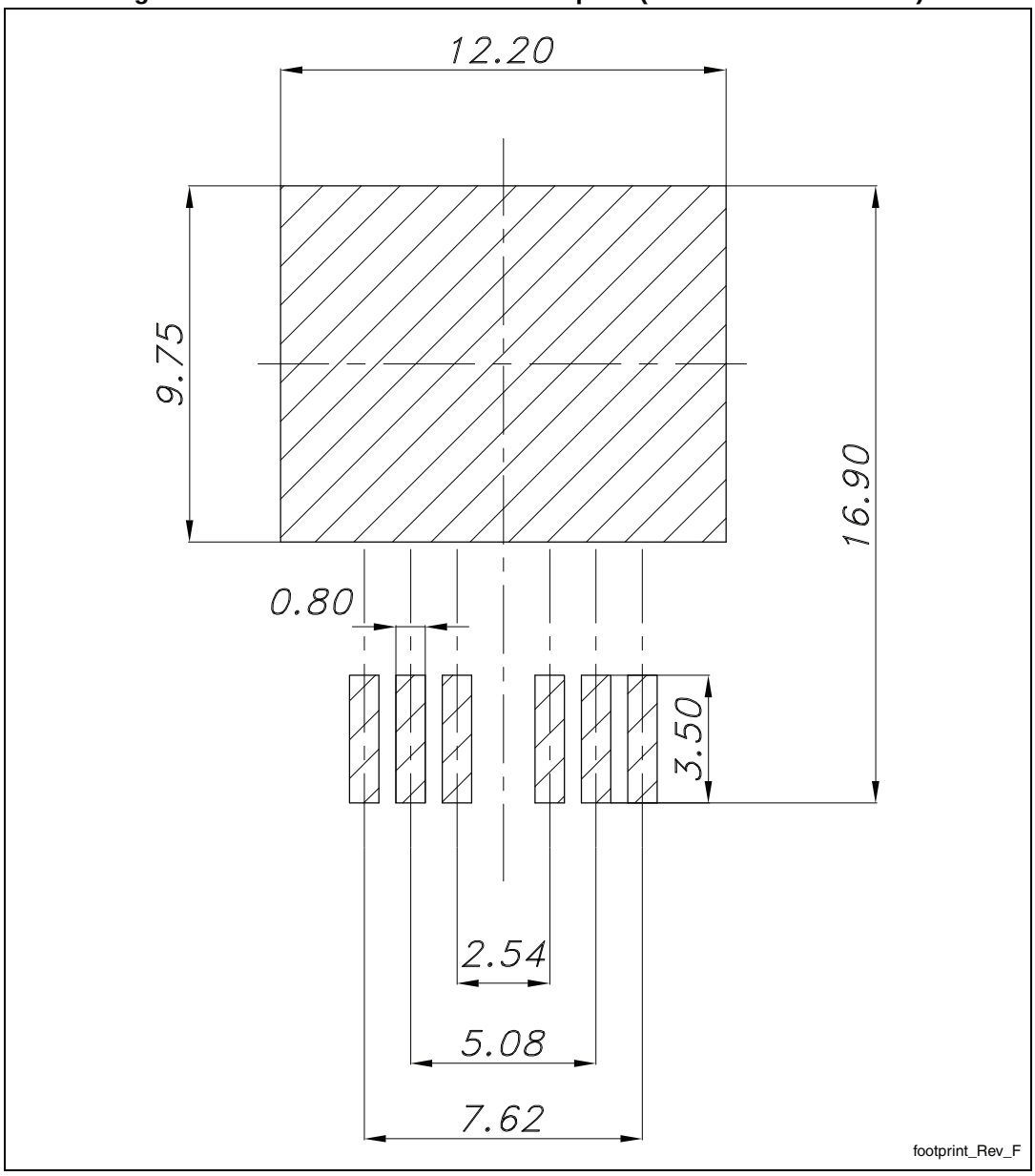


Table 9. H²PAK-6 package mechanical data

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



5.3 TO-220 type A package information

Figure 28. TO-220 type A package outline

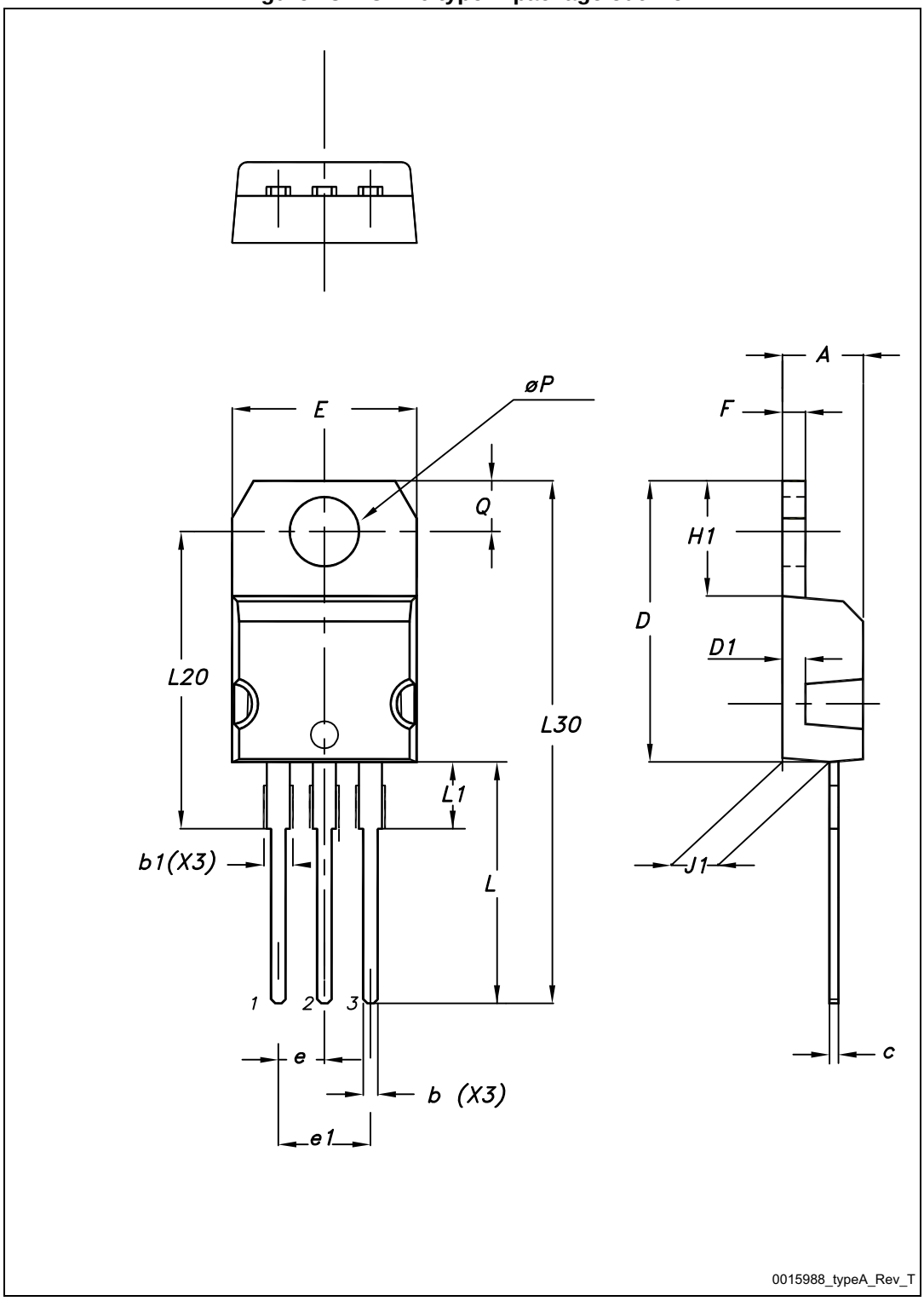


Table 10. TO-220 type A mechanical data

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

6 Packing information

Figure 29. Tape

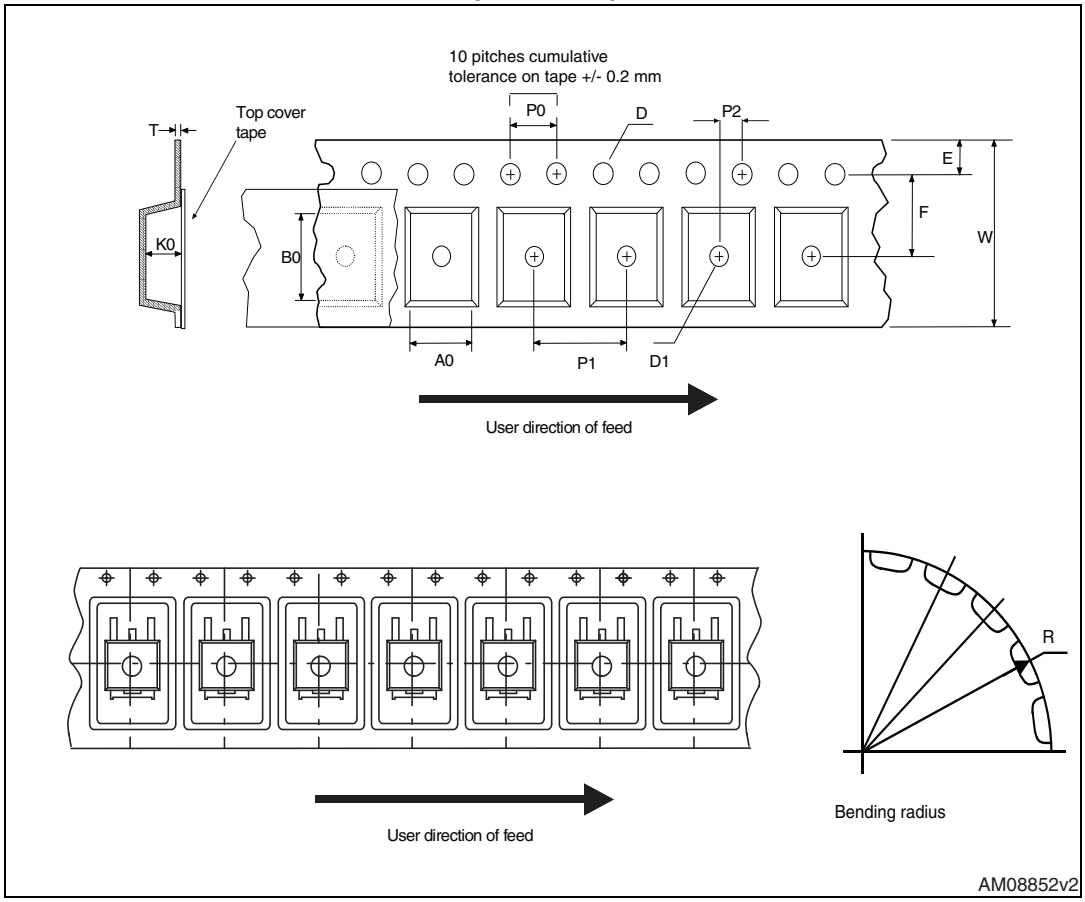


Figure 30. Reel

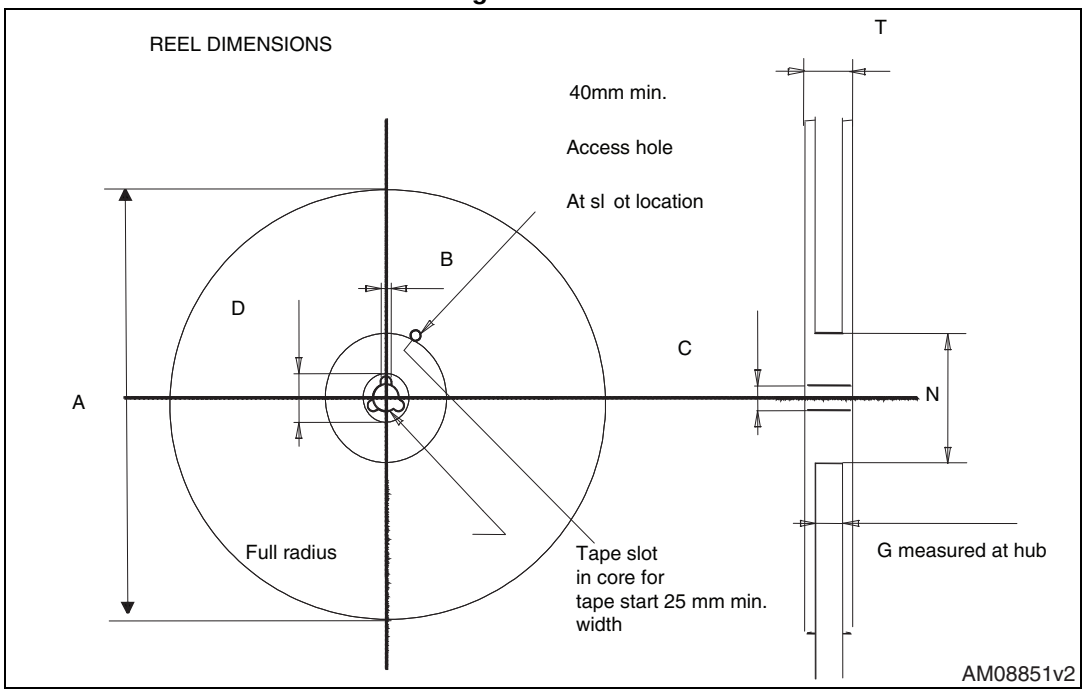


Table 11. H²PAK-2 and H²PAK-6 tape and reel mechanical data

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			

7 Revision history

Table 12. Document revision history

Date	Revision	Changes
03-Dec-2012	1	First release.
09-Apr-2013	2	– Modified: $R_{DS(on)\ max}$ values on *Features* table, I_{DSS}, I_{GSS} values on *Table 4*, $R_{DS(on)}$ value for H^2PAK-2, the entire typical values on *Table 5* and *6*, V_{SD} test conditions and max values, T_{RR}, Q_{RR}, I_{RRM} typical values on *Table 7* – Inserted:*Section 3: Electrical characteristics (curves)* – Document status promoted to preliminary data to production data – Added: H^2PAK-6 package – Minor text changes
11-Oct-2013	3	– Modified: C_{rss} typical value in *Table 5* – Updated: *Section 5: Package information* – Updated: *Figure 18*, *19*, *20* and *21* – Minor text changes
14-May-2015	4	– Updated title, features and description in cover page. – Minor text changes