

Automotive-grade N-channel 24 V, 0.95 mΩ typ., 180 A STripFET™ III Power MOSFET in a H²PAK-6 package

Datasheet — production data

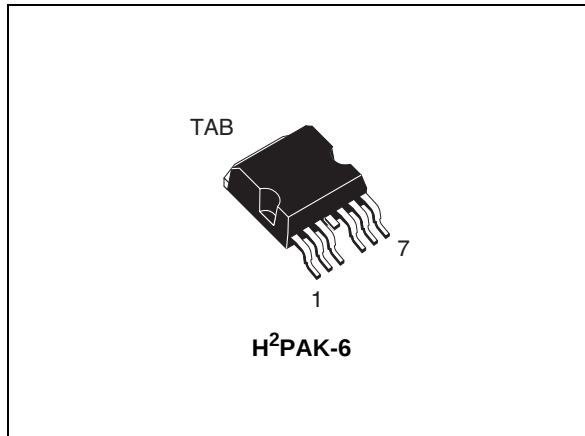
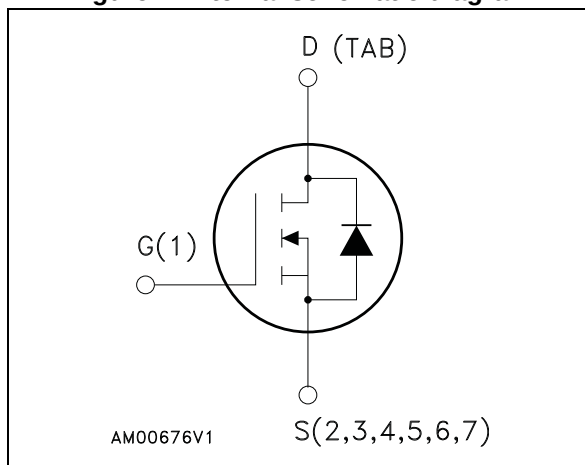


Figure 1. Internal schematic diagram



Features

Order code	V _{DSS}	R _{DS(on)} max.	I _D ⁽¹⁾
STH300NH02L-6	24 V	< 1.2 mΩ	180 A

1. Current limited by package.

- 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 enhancement mode Power MOSFET produced using STMicroelectronics' STripFET™ III technology, which is specifically designed to minimize on-resistance and gate charge to provide superior switching performance.

Table 1. Device summary

Order code	Marking	Package	Packaging
STH300NH02L-6	300NH02L	H ² PAK-6	Tape and reel

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	24	V
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
$P_{TOT}^{(3)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
	Derating factor	2	W/ $^\circ\text{C}$
$E_{AS}^{(4)}$	Single pulse avalanche energy	1.6	J
T_{stg}	Storage temperature	-55 to 175	$^\circ\text{C}$
T_j	Operating junction temperature		

1. Current limited by package
2. Pulse width limited by safe operating area
3. This value is rated according to R_{thj-c}
4. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 60\text{ A}$, $V_{DD} = 20\text{ V}$

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 1 inch² FR-4 2 oz 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 ($V_{GS} = 0$)	$I_D = 250 \mu A$	24			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 24 V$, $V_{DS} = 24 V$, $T_C = 125^\circ C$			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250 \mu A$	1			V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10 V$, $I_D = 80 A$ $V_{GS} = 5 V$, $I_D = 40 A$		0.95 1.15	1.2 1.5	m Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 15 V$, $f = 1 MHz$, $V_{GS} = 0$	-	7050	-	pF
C_{oss}	Output capacitance		-	3250	-	pF
C_{rss}	Reverse transfer capacitance		-	307	-	pF
Q_g	Total gate charge	$V_{DD} = 20 V$, $I_D = 120 A$, $V_{GS} = 10 V$ (see Figure 14)	-	109	-	nC
Q_{gs}	Gate-source charge		-	30	-	nC
Q_{gd}	Gate-drain charge		-	26	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20 V$, $I_D = 80 A$ $R_G = 4.7 \Omega$, $V_{GS} = 10 V$, (see Figure 13)	-	18	-	ns
t_r	Rise time		-	275	-	ns
$t_{d(off)}$	Turn-off delay time	$V_{DD} = 20 V$, $I_D = 80 A$ $R_G = 4.7 \Omega$, $V_{GS} = 10 V$, (see Figure 13)	-	138	-	ns
t_f	Fall time		-	94.4	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current	$I_{SD} = 180\text{ A}$, $V_{GS} = 0$	-		180	A
$I_{SD}^{(2)}$	Source-drain current (pulsed)				720	A
$V_{SD}^{(3)}$	Forward on voltage				1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 120\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 15)	-	65		ns
Q_{rr}	Reverse recovery charge		-	90		nC
I_{RRM}	Reverse recovery current		-	2.8		A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

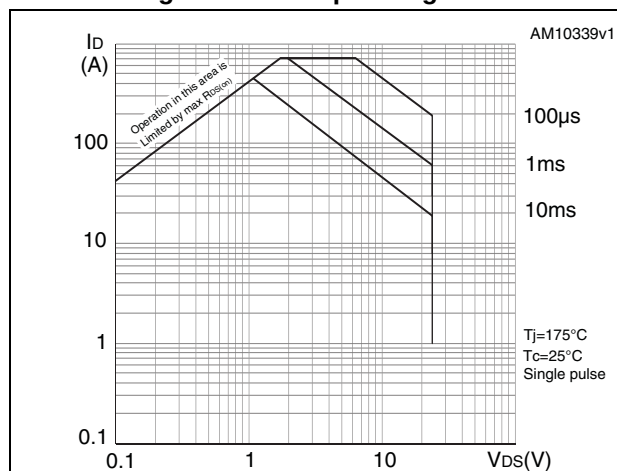


Figure 3. Thermal impedance

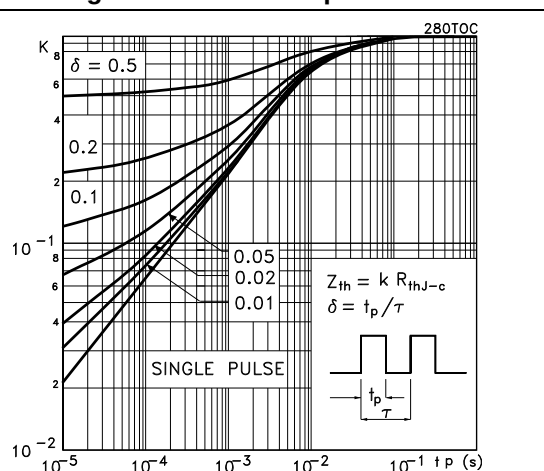


Figure 4. Output characteristics

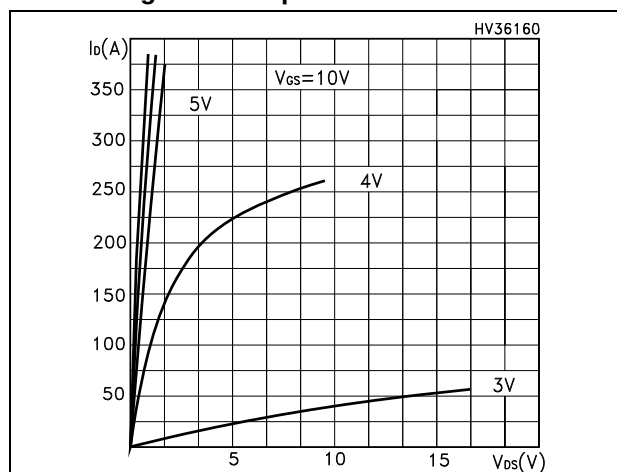


Figure 5. Transfer characteristics

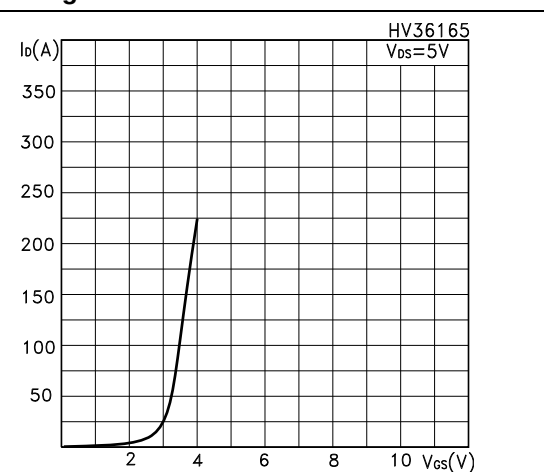
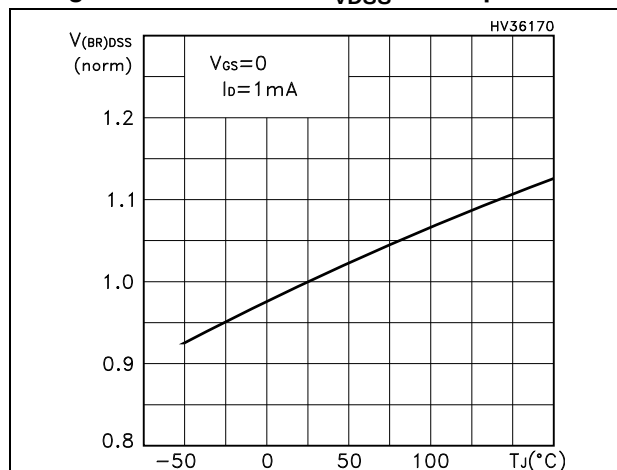
Figure 6. Normalized B_{VDS} vs temperature

Figure 7. Static drain-source on-resistance

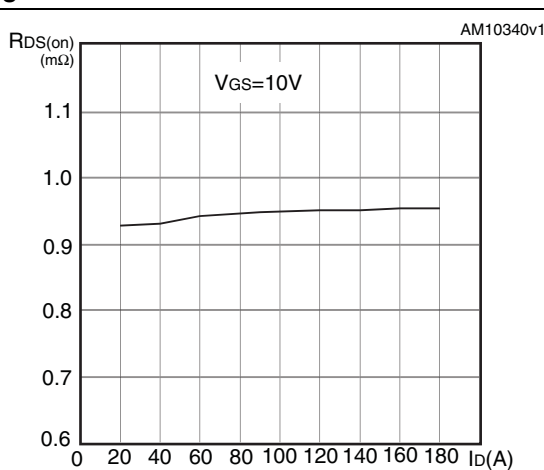


Figure 8. Gate charge vs gate-source voltage

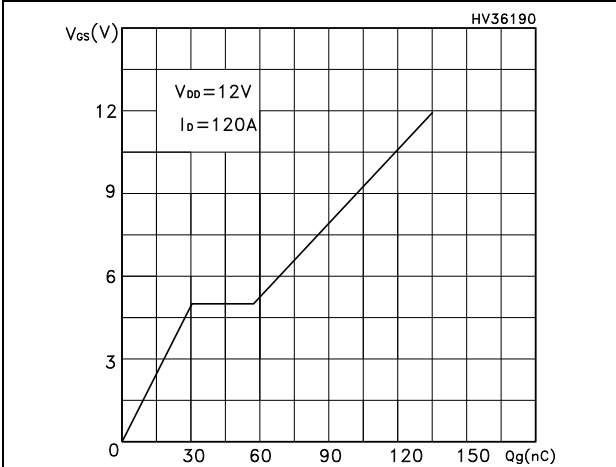


Figure 9. Capacitance variations

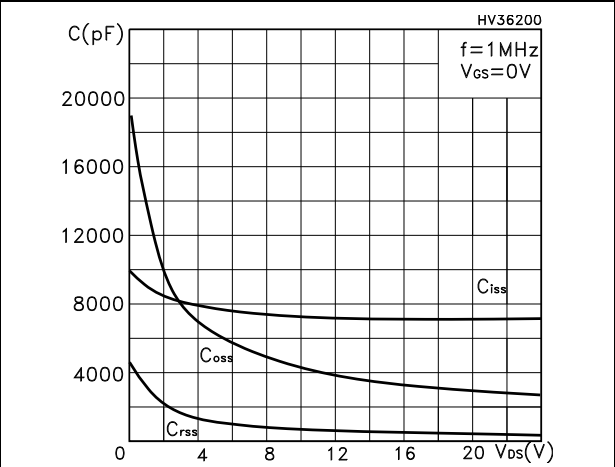


Figure 10. Normalized gate threshold voltage vs temperature

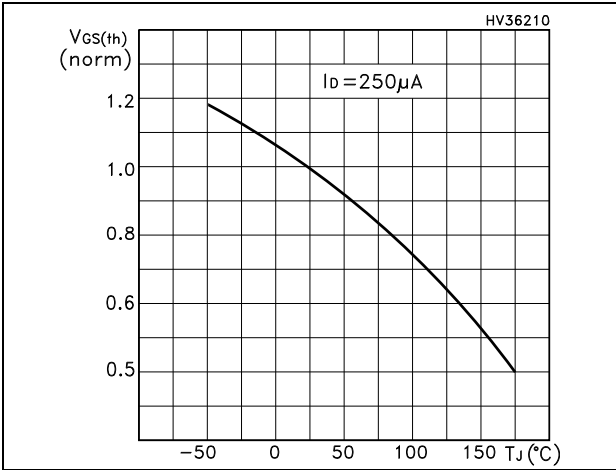


Figure 11. Normalized on resistance vs temperature

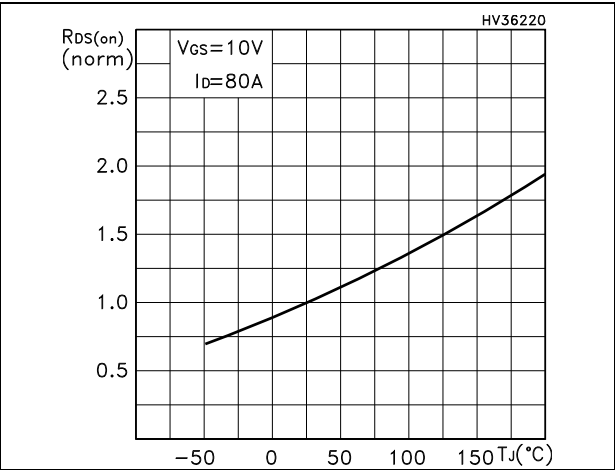
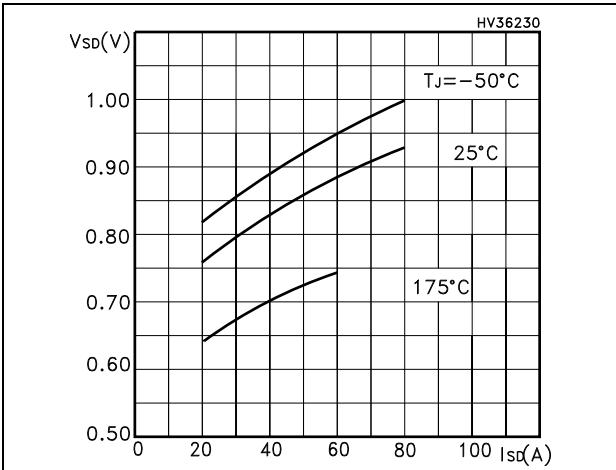


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

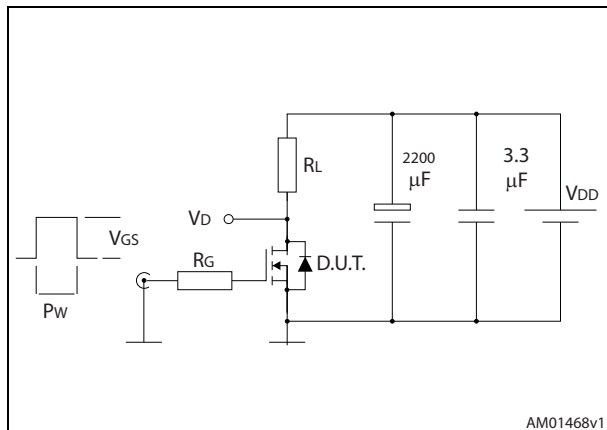


Figure 14. Gate charge test circuit

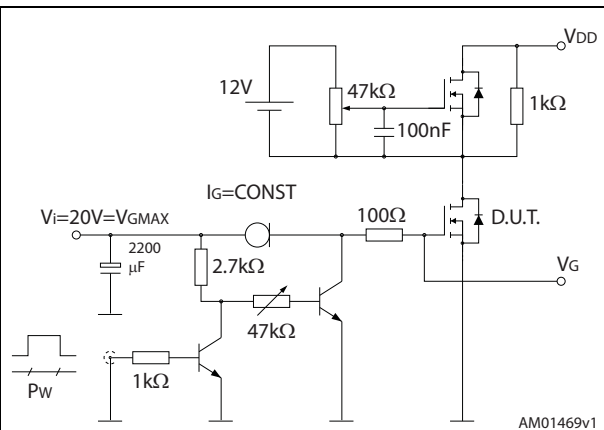


Figure 15. Test circuit for inductive load switching and diode recovery times

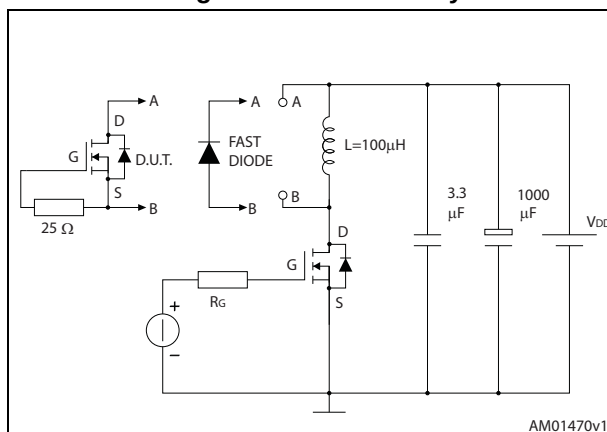


Figure 16. Unclamped inductive load test circuit

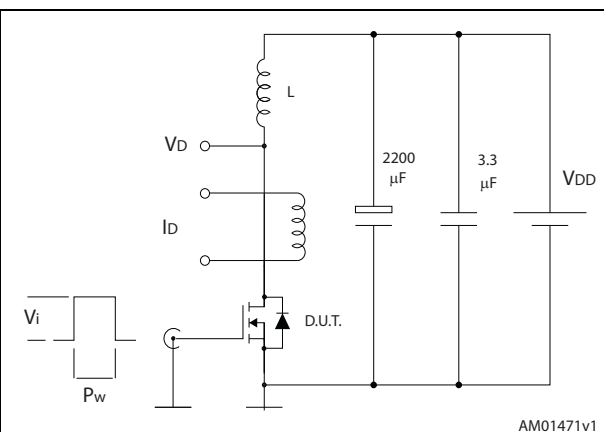


Figure 17. Unclamped inductive waveform

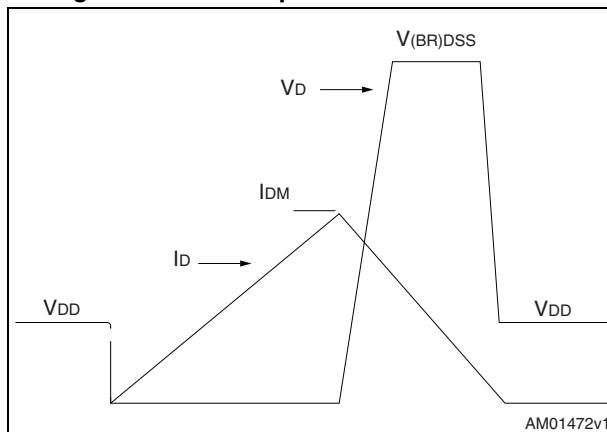
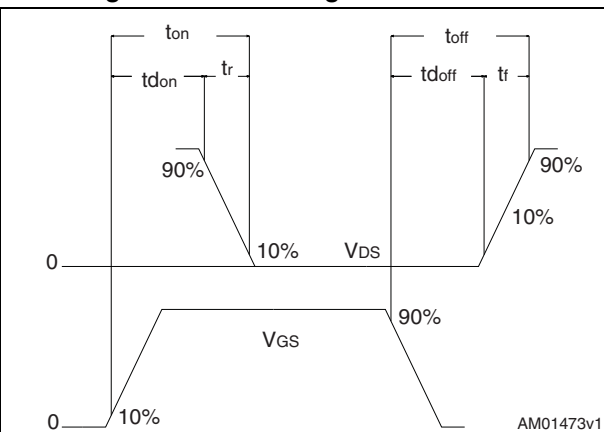


Figure 18. Switching time waveform



4 Package mechanical data

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Table 8. H²PAK-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	7.40		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 19. H²PAK-6 drawing

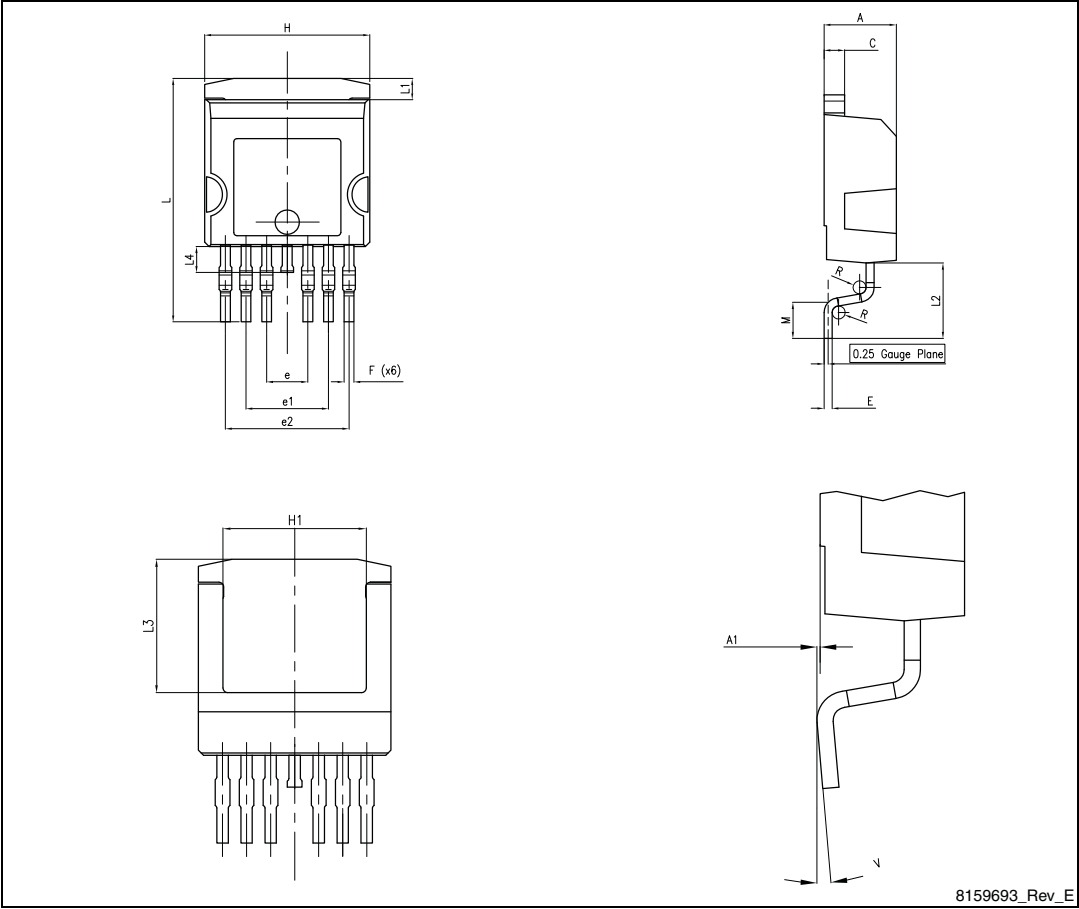
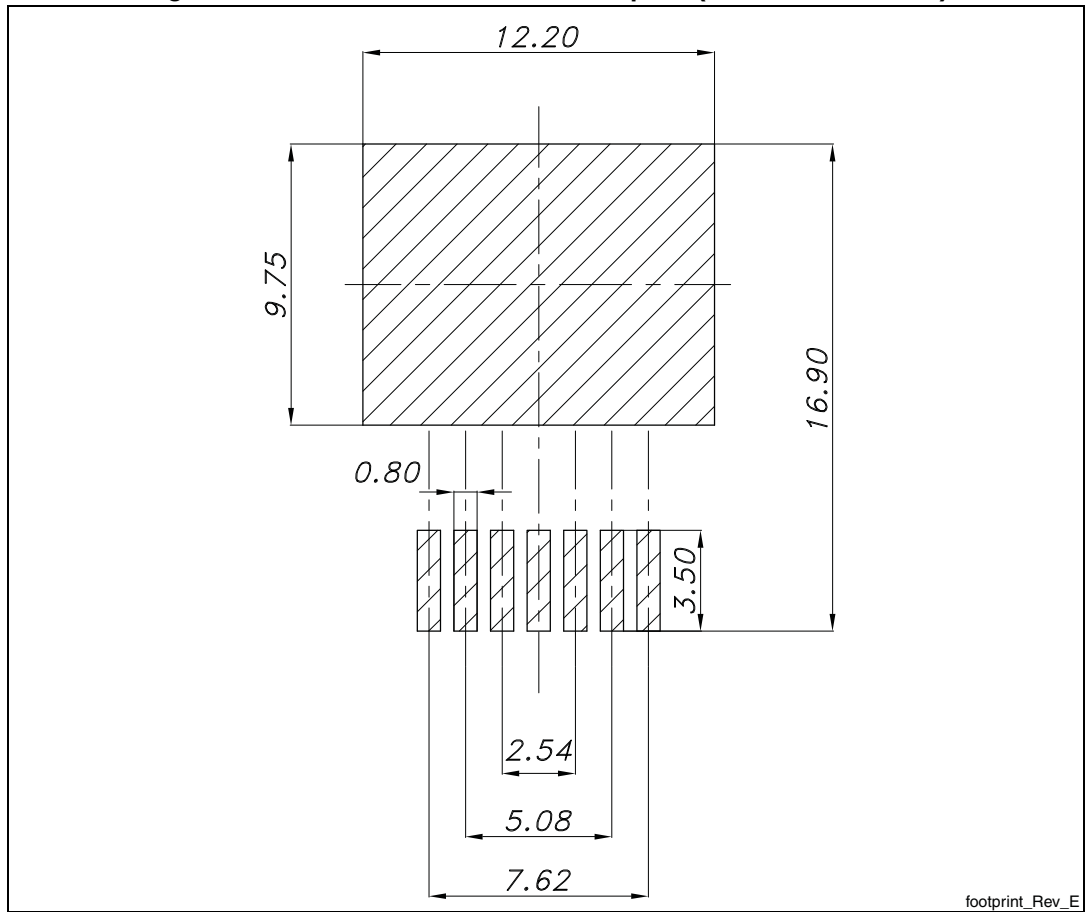


Figure 20. H²PAK-6 recommended footprint (dimensions in mm)



5 Packaging mechanical data

Table 9. 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			

Figure 21. Tape

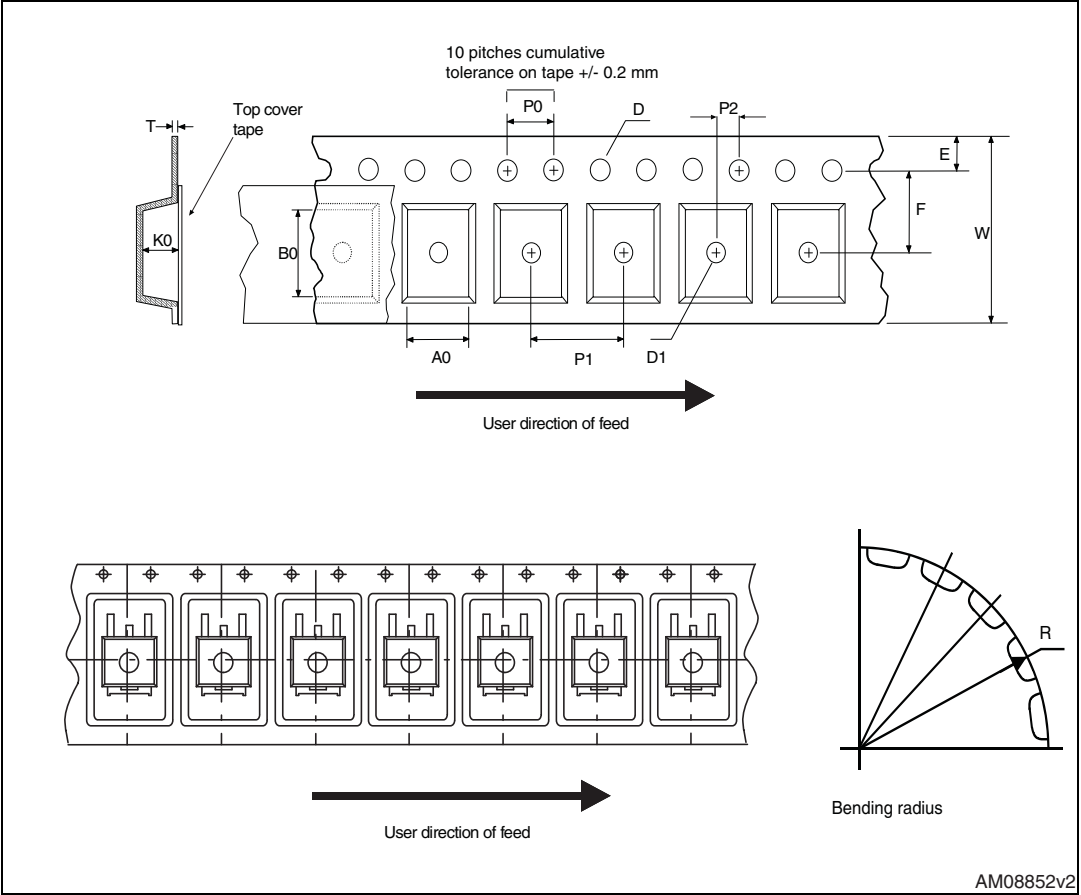
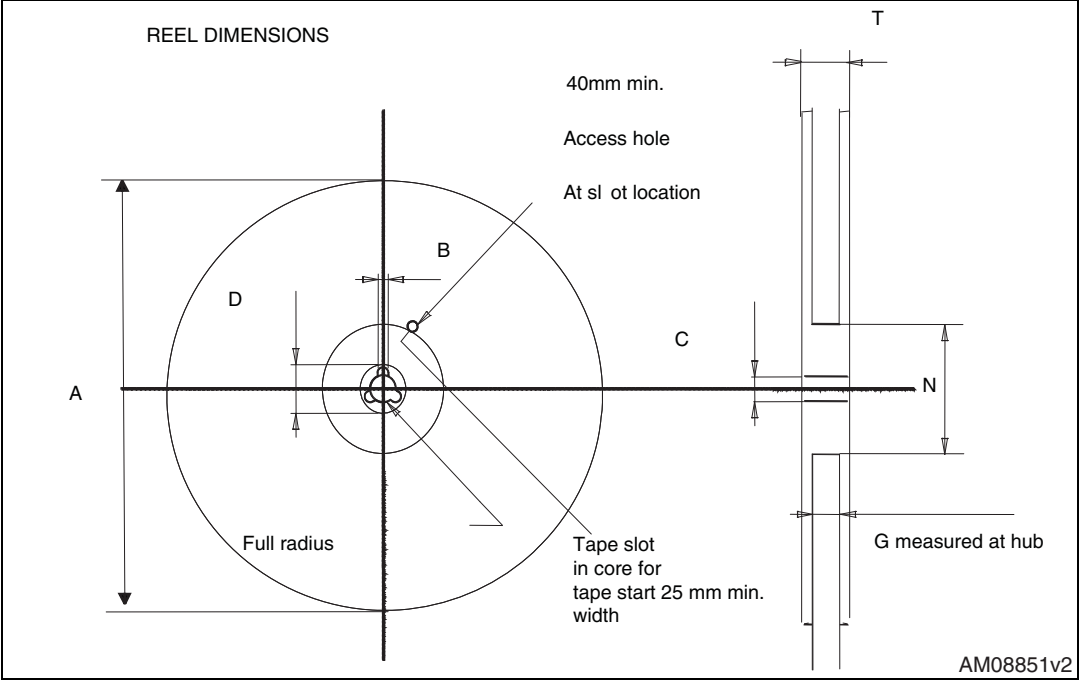


Figure 22. Reel



6 Revision history

Table 10. Document revision history

Date	Revision	Changes
12-Jul-2011	1	initial release
24-Oct-2011	2	Updated test conditions in Section Table 5.: Dynamic and Section Table 7.: Source drain diode .
15-May-2013	3	– Updated: title, Applications and Description in cover page – Minor text changes
22-Jul-2013	4	– Updated title in cover page.

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