

## N-channel 60 V, 0.0028 Ω typ., 80 A STripFET™ F7 Power MOSFETs in H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6 packages

Datasheet - production data

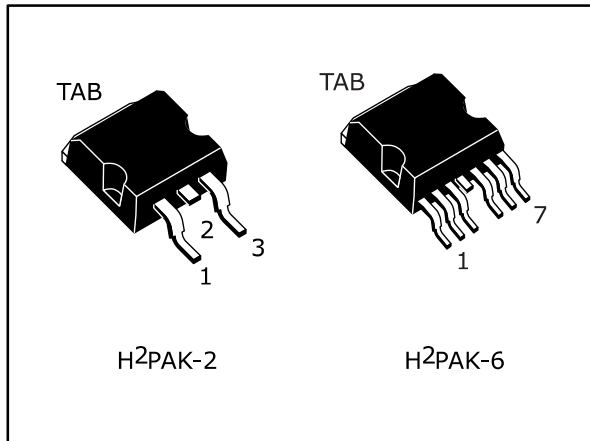
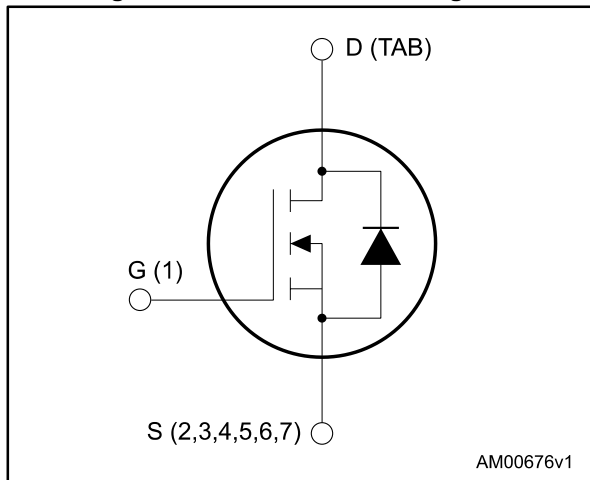


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STH140N6F7-2	60 V	0.0032 Ω	80 A	158 W
STH140N6F7-6				

- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent figure of merit (FoM)
- Low C<sub>rss</sub>/C<sub>iss</sub> ratio for EMI immunity
- High avalanche ruggedness

### Applications

- Switching applications

### Description

This N-channel Power MOSFET utilizes 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 code	Marking	Package	Packing
STH140N6F7-2	140N6F7	H <sup>2</sup> PAK-2	Tape and Reel
STH140N6F7-6	140N6F7	H <sup>2</sup> 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	60	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25\text{ }^\circ\text{C}$	80	A
	Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$	80	
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
$P_{TOT}$	Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$	158	W
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_j$	Maximum junction temperature	175	

**Notes:**

(1) Current is limited by package.

(2) Pulse width is limited by safe operating area.

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	$^\circ\text{C/W}$
$R_{thj-case}$	Thermal resistance junction-case	0.95	

**Notes:**

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

## 2 Electrical characteristics

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

**Table 4: Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 1\text{ mA}$	60			V
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 60\text{ V}$			1	$\mu\text{A}$
		$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 60\text{ V}$ , $T_{\text{case}} = 125\text{ °C}$			100	
$I_{\text{GSS}}$	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = +20\text{ V}$			100	nA
$V_{\text{GS}(\text{th})}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$	2		4	V
$R_{\text{DS}(\text{on})}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 40\text{ A}$		0.0028	0.0032	$\Omega$

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{\text{iSS}}$	Input capacitance	$V_{\text{DS}} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{\text{GS}} = 0\text{ V}$	-	3100	-	$\mu\text{F}$
$C_{\text{oSS}}$	Output capacitance		-	1520	-	
$C_{\text{rSS}}$	Reverse transfer capacitance		-	193	-	
$Q_{\text{g}}$	Total gate charge	$V_{\text{DD}} = 30\text{ V}$ , $I_{\text{D}} = 80\text{ A}$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 14: "Gate charge test circuit"</a> )	-	55	-	nC
$Q_{\text{gs}}$	Gate-source charge		-	19	-	
$Q_{\text{gd}}$	Gate-drain charge		-	18	-	

**Table 6: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d}(\text{on})}$	Turn-on delay time	$V_{\text{DD}} = 30\text{ V}$ , $I_{\text{D}} = 40\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 13: "Switching times test circuit for resistive load"</a> and <a href="#">Figure 18: "Switching time waveform"</a> )	-	24	-	ns
$t_{\text{r}}$	Rise time		-	68	-	
$t_{\text{d}(\text{off})}$	Turn-off delay time		-	39	-	
$t_{\text{f}}$	Fall time		-	20	-	

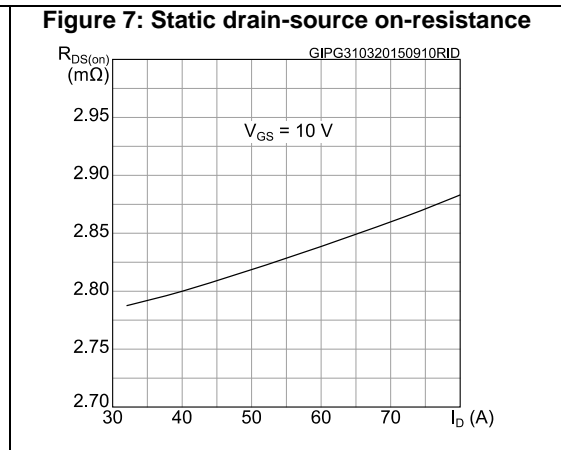
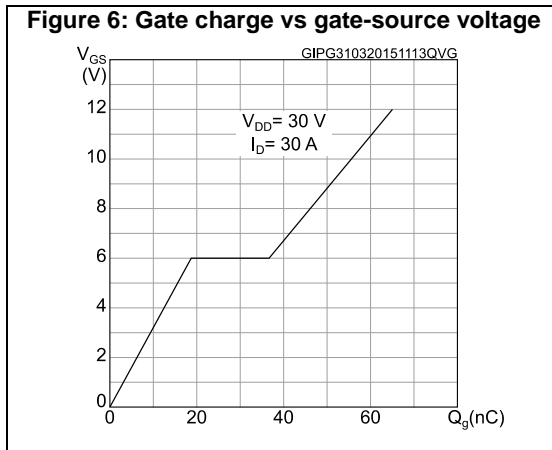
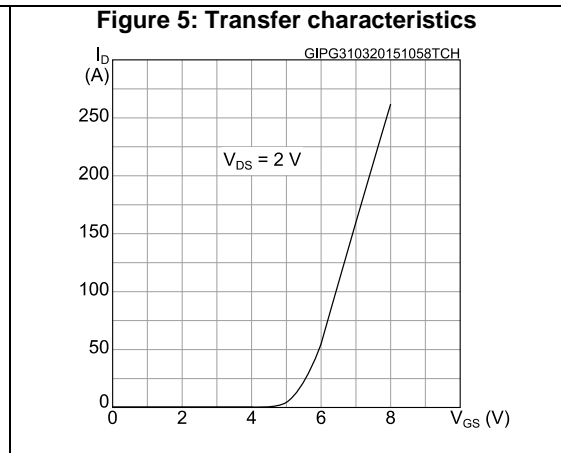
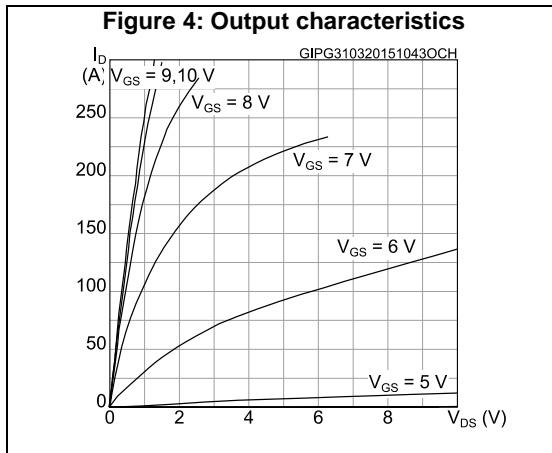
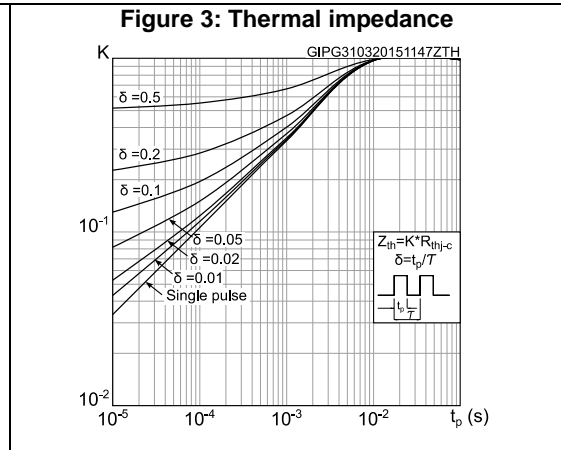
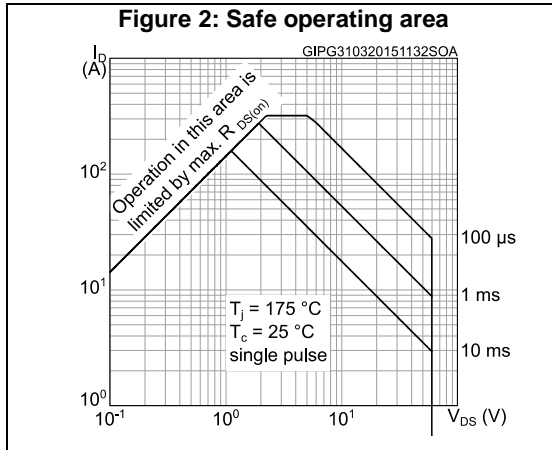
Table 7: Source-drain diode

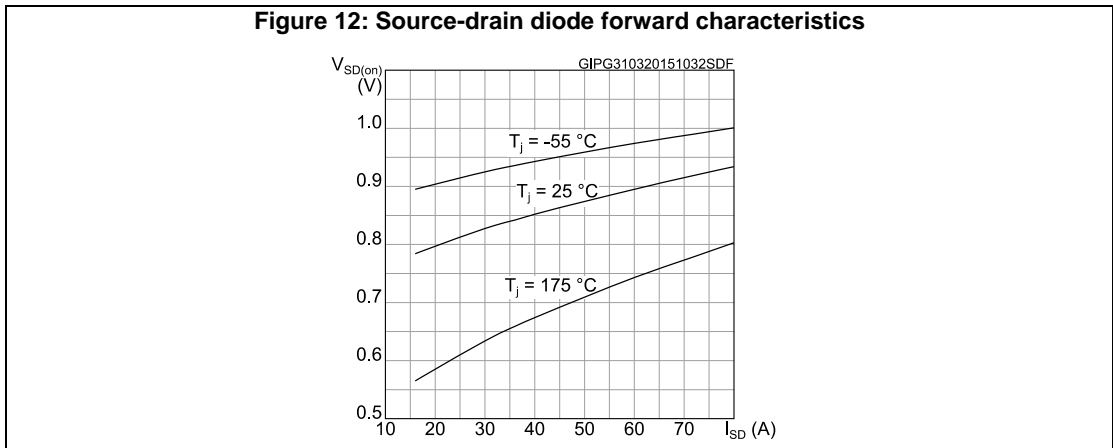
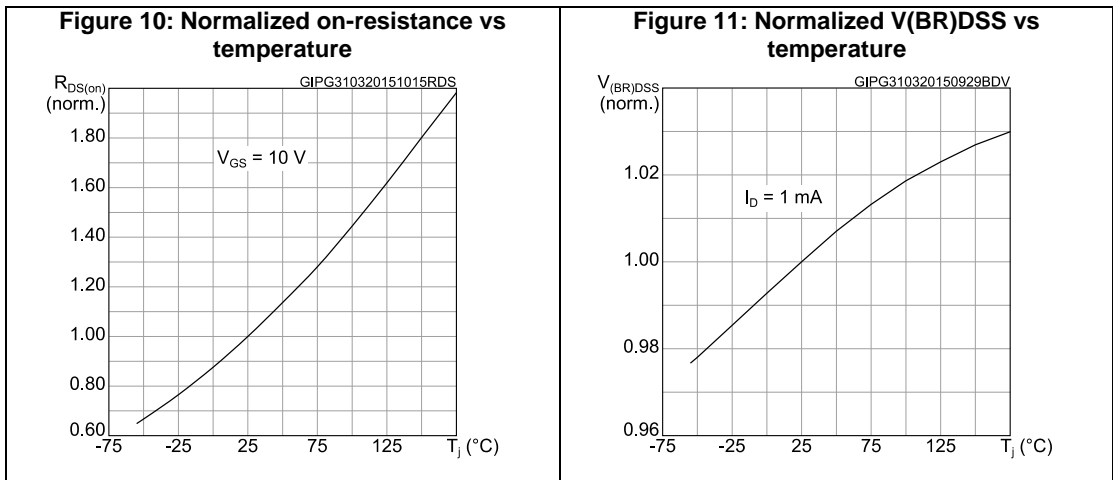
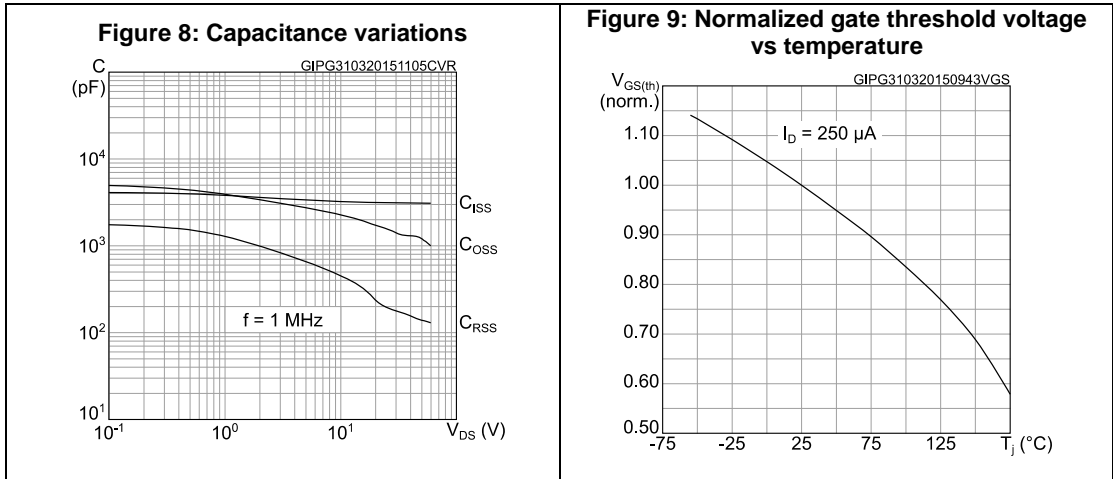
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 80 \text{ A}$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 80 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 48 \text{ V}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	42.4		ns
$Q_{rr}$	Reverse recovery charge		-	38.2		nC
$I_{RRM}$	Reverse recovery current		-	1.8		A

**Notes:**

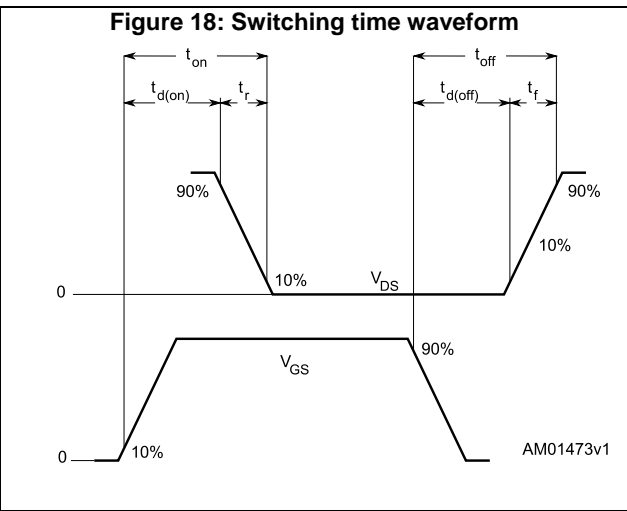
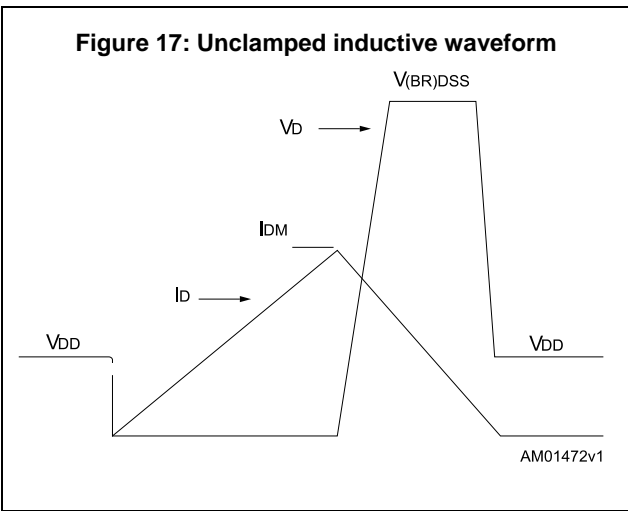
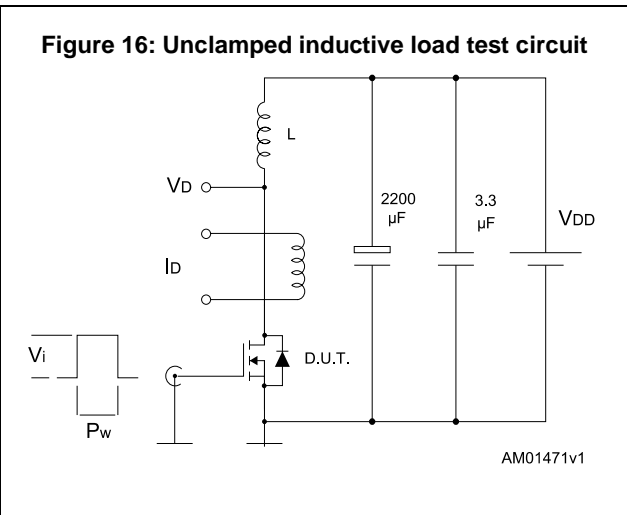
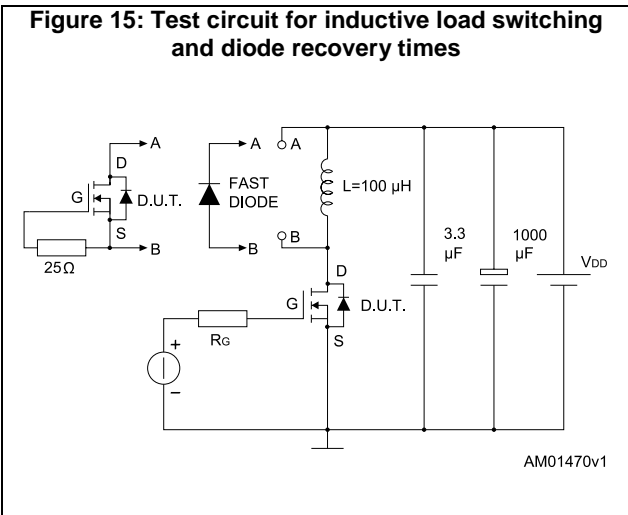
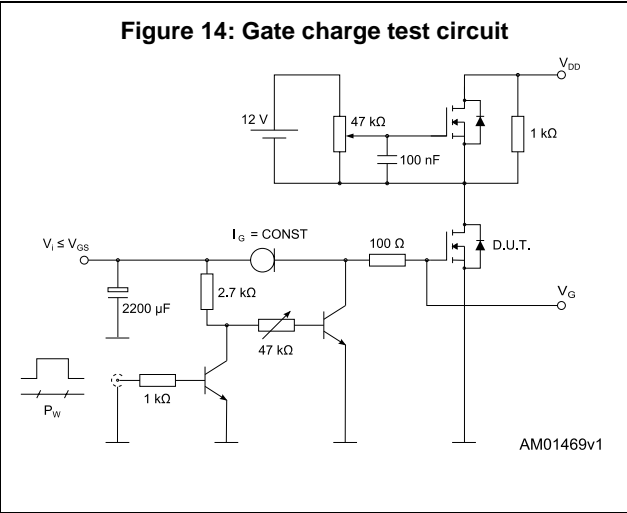
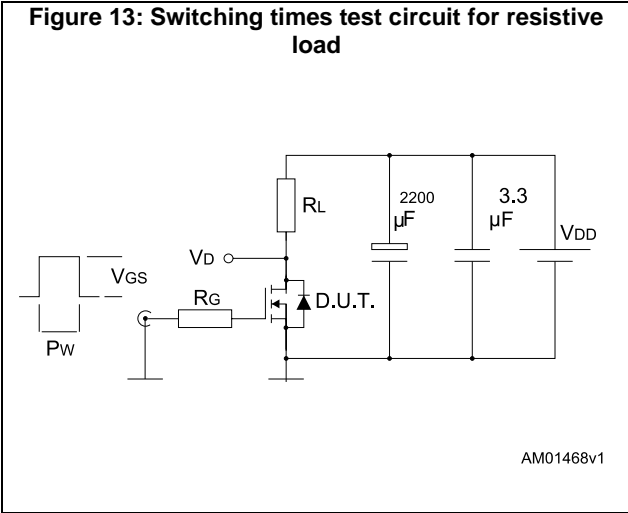
(1) Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)





### 3 Test circuits





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

### 4.1 H<sup>2</sup>PAK-2 package information

Figure 19: H<sup>2</sup>PAK-2 package outline

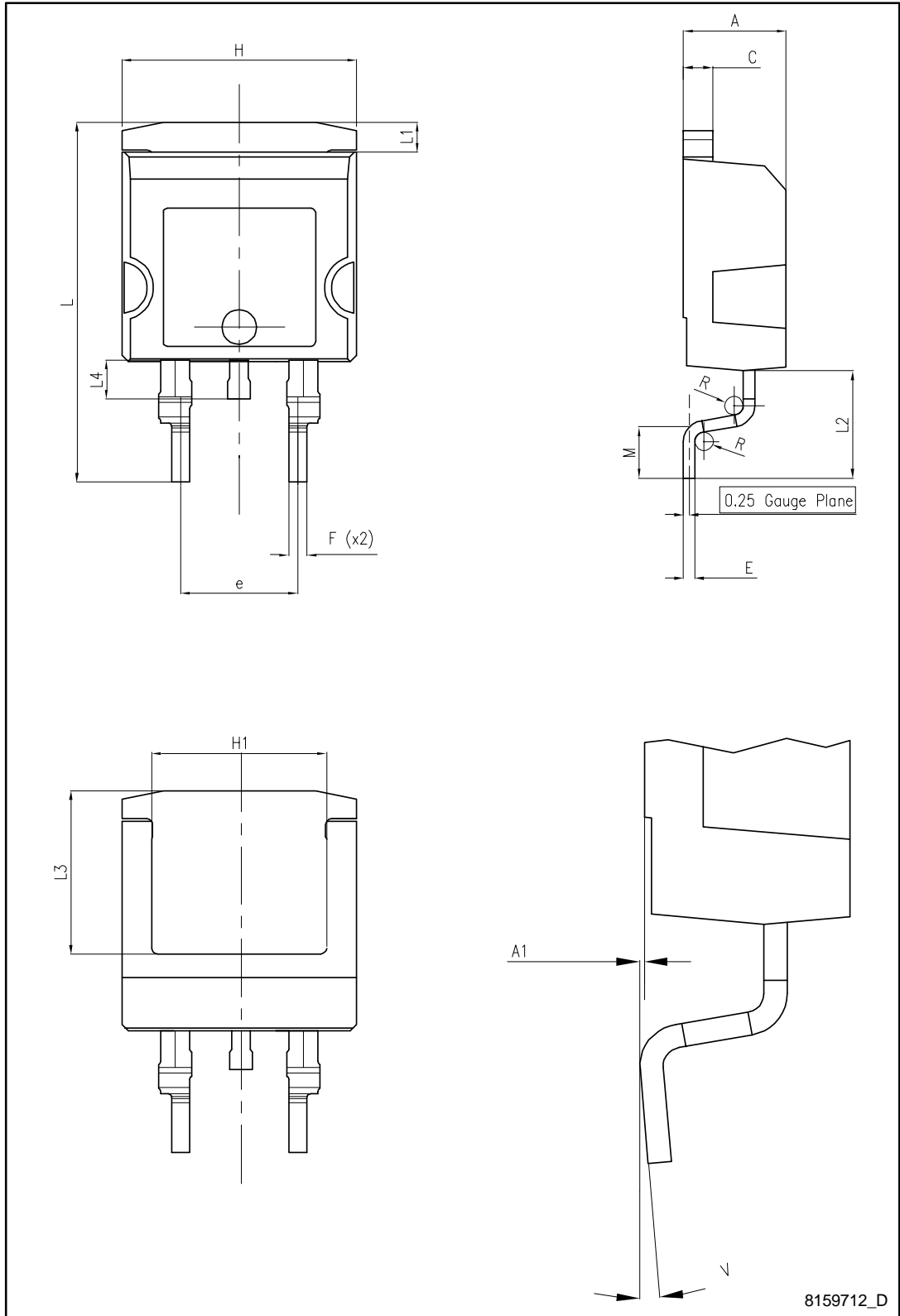
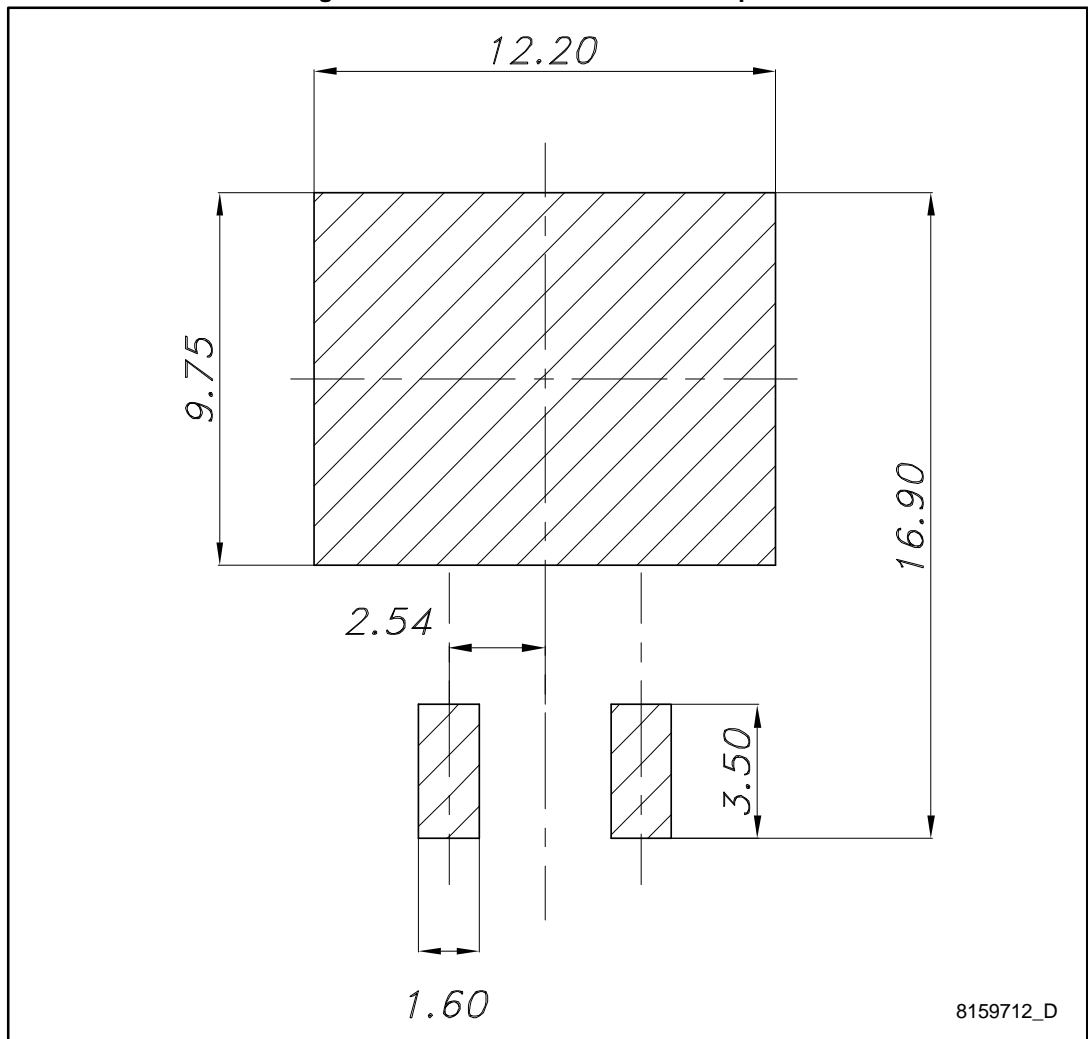


Table 8: H<sup>2</sup>PAK-2 package mechanical data

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 20: H<sup>2</sup>PAK-2 recommended footprint



8159712\_D

### 4.2 H<sup>2</sup>PAK-6 package information

Figure 21: H<sup>2</sup>PAK-6 package outline

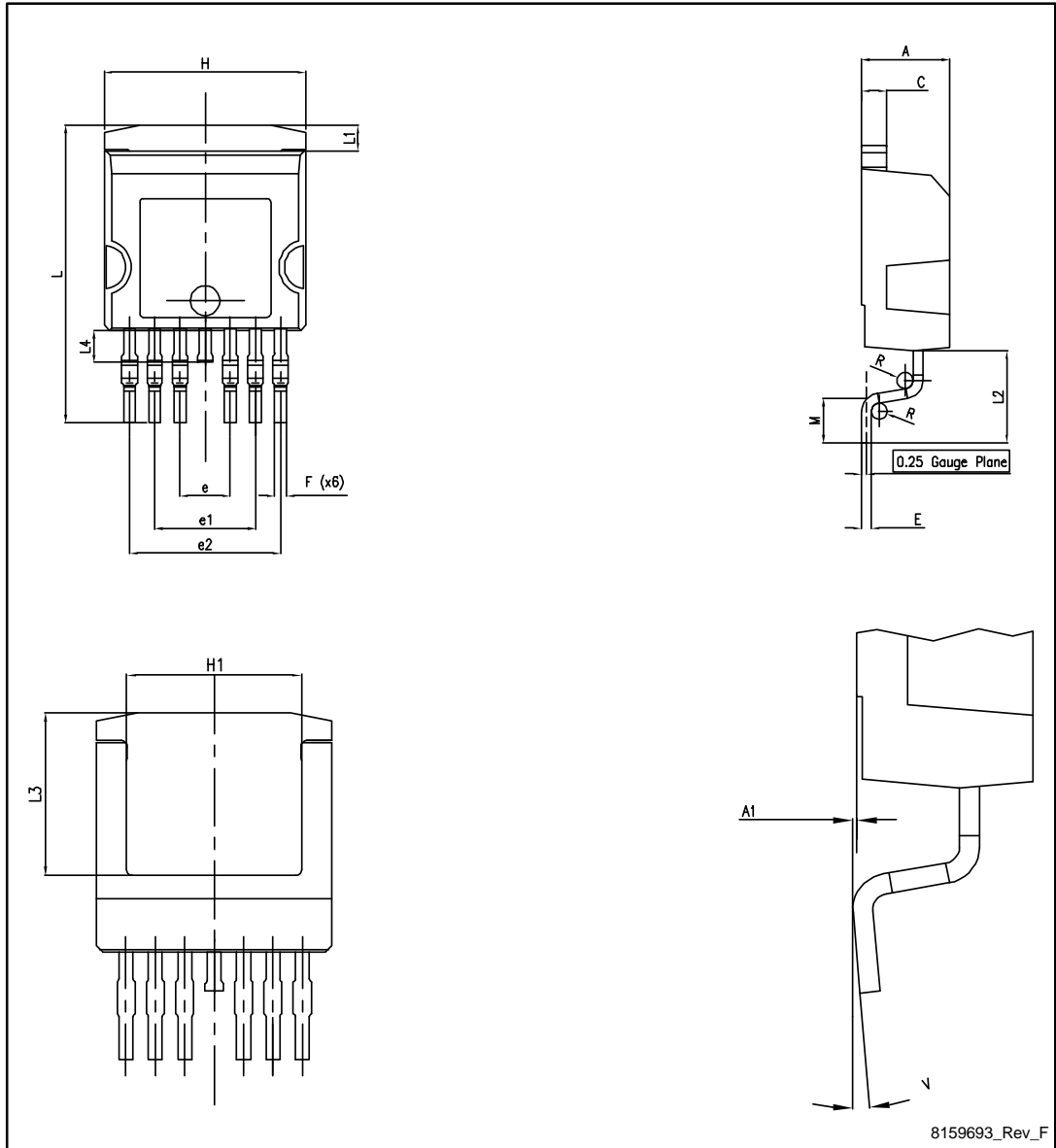
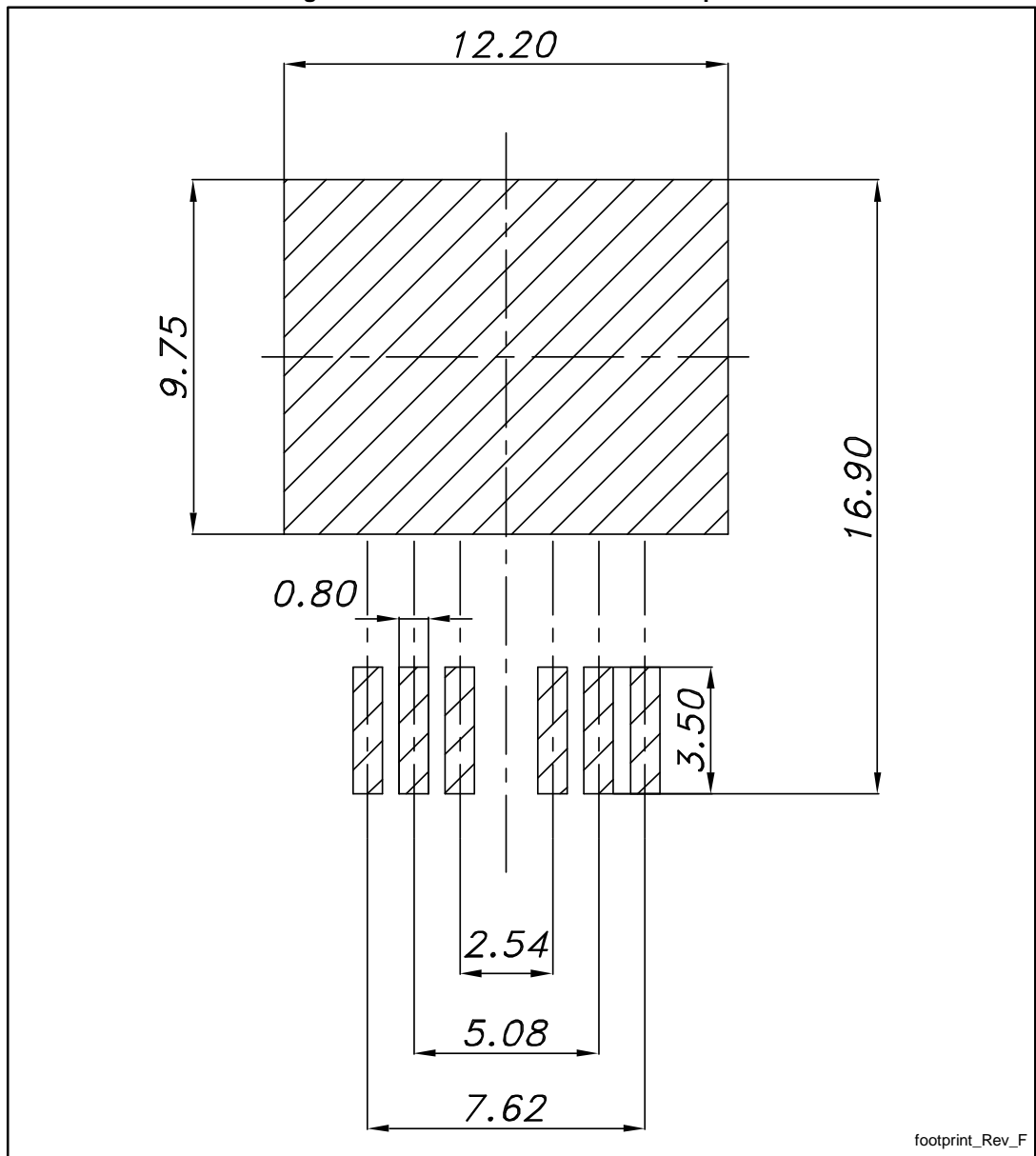


Table 9: H<sup>2</sup>PAK-6 package mechanical data

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 22: H<sup>2</sup>PAK-6 recommended footprint



footprint\_Rev\_F



Dimensions are in mm.

### 4.3 H<sup>2</sup>PAK packing information

Figure 23: Tape outline

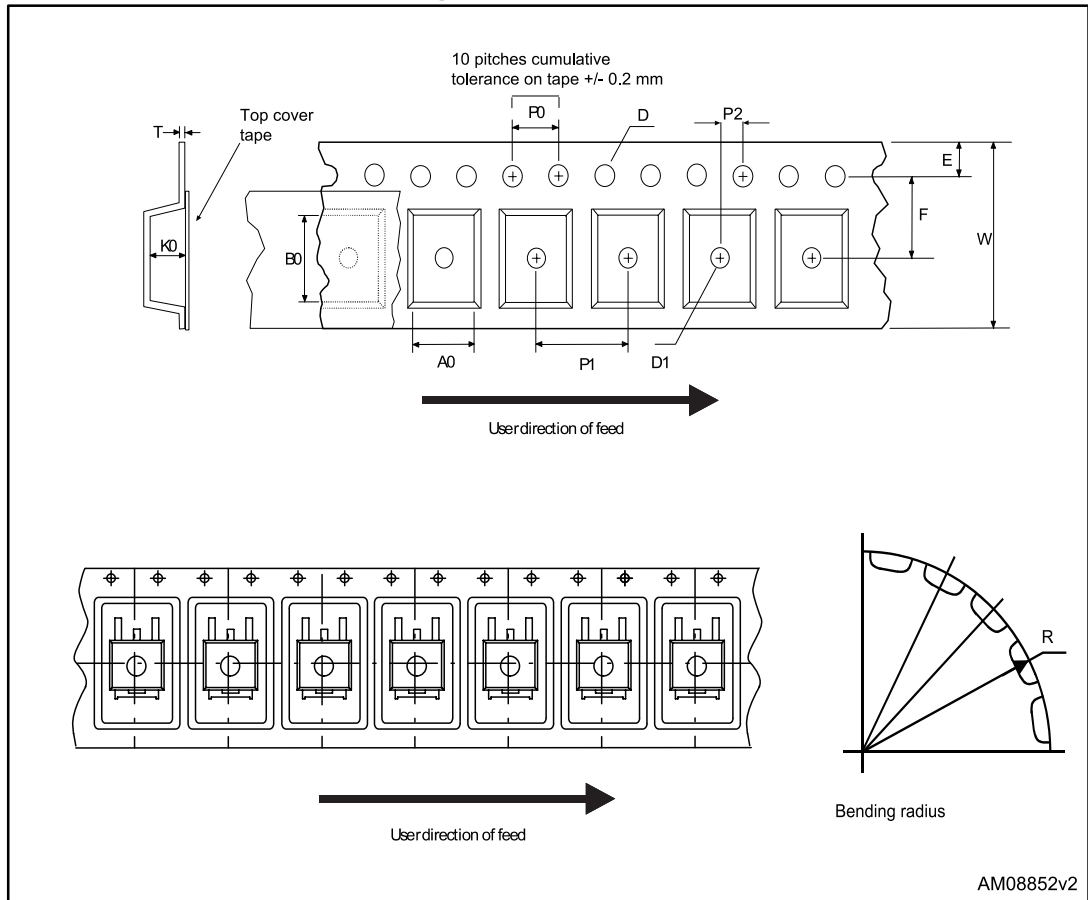


Figure 24: Reel outline

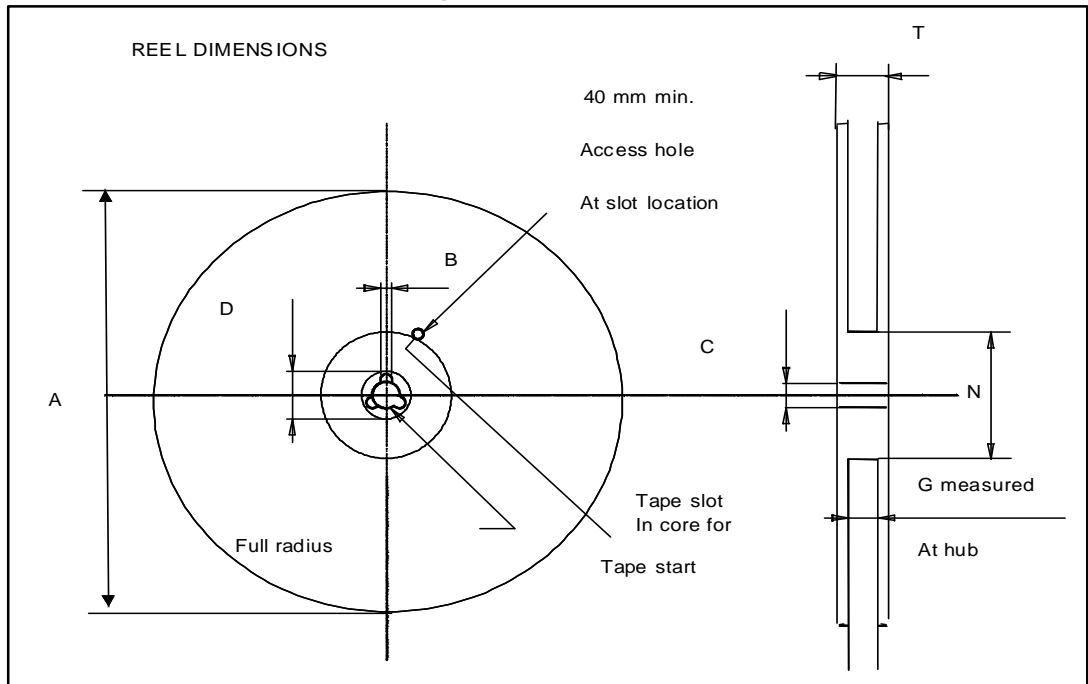




Table 10: Tape and reel mechanical data

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 quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

## 5 Revision history

**Table 11: Document revision history**

Date	Revision	Changes
02-Aug-2013	1	Initial release.
01-Apr-2015	2	Throughout document: <ul style="list-style-type: none"> <li>• minor text changes</li> <li>• added H<sup>2</sup>PAK-6 package information.</li> <li>• removed TO-220FP and TO-220 package information.</li> </ul> In Section 1 Electrical ratings: <ul style="list-style-type: none"> <li>• updated Table 2. Absolute maximum ratings</li> <li>• updated Table 3. Thermal data</li> </ul> In Section 2 Electrical characteristics: <ul style="list-style-type: none"> <li>• updated and renamed Table 4. Static (was "On /off states")</li> <li>• updated Table 5. Dynamic</li> <li>• updated Table 6. Switching times</li> <li>• updated Table 7. Source drain diode</li> <li>• added Section 2.1 Electrical characteristics (curves)</li> </ul>
16-Jul-2015	3	Document status promoted from preliminary to production data.

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