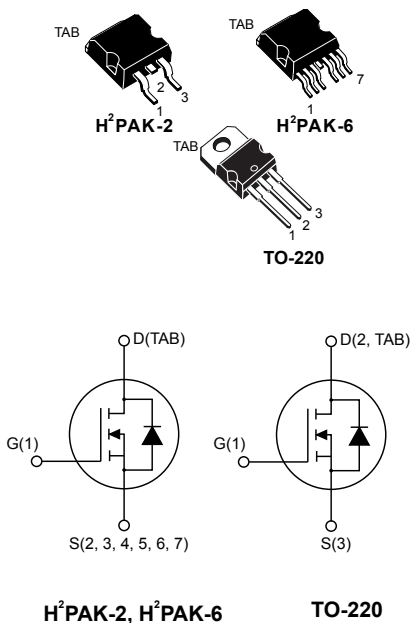


## N-channel 80 V, 0.0017 $\Omega$ typ., 180 A STripFET F7 Power MOSFETs in an H<sup>2</sup>PAK-2, H<sup>2</sup>PAK-6 and TO-220 packages



H2PAK\_2\_6\_N-CHG1DTABS234567\_TO-220\_N-CHG1D2TABS3



### Product status links

[STH270N8F7-2](#)

[STH270N8F7-6](#)

[STP270N8F7](#)

### Features

Order codes	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STH270N8F7-2	80 V	0.0021 $\Omega$	180 A
STH270N8F7-6			
STP270N8F7		0.0025 $\Omega$	

- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent FoM (figure of merit)
- Low C<sub>rss</sub>/C<sub>iss</sub> 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.

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	80	V
$V_{GS}$	Gate-source voltage	$\pm 20$	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 power dissipation at $T_C = 25\text{ }^\circ\text{C}$	315	W
$E_{AS}^{(4)}$	Single pulse avalanche energy	1.16	J
$T_j$	Operating junction temperature range	-55 to 175	$^\circ\text{C}$
$T_{stg}$	Storage temperature range		

1. Current limited by package.
2. Pulse width limited by safe operating area.
3. This value is rated according to  $R_{thJC}$
4. Starting  $T_j=25\text{ }^\circ\text{C}$ ,  $I_D=65\text{ A}$ ,  $V_{DD}=50\text{ V}$

**Table 2. Thermal data**

Symbol	Parameter	Value		Unit
		H <sup>2</sup> PAK-2, H <sup>2</sup> PAK-6	TO-220	
$R_{thJC}$	Thermal resistance, junction-to-case	0.48		$^\circ\text{C/W}$
$R_{thJB}^{(1)}$	Thermal resistance, junction-to-board	35		$^\circ\text{C/W}$
$R_{thJA}$	Thermal resistance, junction-to-ambient		62.5	$^\circ\text{C/W}$

1. When mounted on an 1 inch<sup>2</sup> FR-4, 2 Oz copper board.

## 2 Electrical characteristics

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

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$	80			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\ \text{V}$ , $V_{DS} = 80\ \text{V}$			10	$\mu\text{A}$
		$V_{GS} = 0\ \text{V}$ , $V_{DS} = 80\ \text{V}$ , $T_C = 125\text{ °C}$ <sup>(1)</sup>			100	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	For H <sup>2</sup> PAK-2, H <sup>2</sup> PAK-6: $V_{GS} = 10\ \text{V}$ , $I_D = 90\ \text{A}$		0.0017	0.0021	$\Omega$
		For TO-220: $V_{GS} = 10\ \text{V}$ , $I_D = 90\ \text{A}$		0.0021	0.0025	

1. Defined by design, not subject to production test.

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 50\ \text{V}$ , $f = 1\ \text{MHz}$ , $V_{GS} = 0\ \text{V}$	-	13600	-	pF
$C_{oss}$	Output capacitance		-	2050	-	pF
$C_{riss}$	Reverse transfer capacitance		-	236	-	pF
$Q_g$	Total gate charge	$V_{DD} = 40\ \text{V}$ , $I_D = 180\ \text{A}$ ,	-	193	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 0$ to $10\ \text{V}$	-	96	-	nC
$Q_{gd}$	Gate-drain charge	(see Figure 20. Test circuit for gate charge behavior)	-	46	-	nC

**Table 5. Switching times**

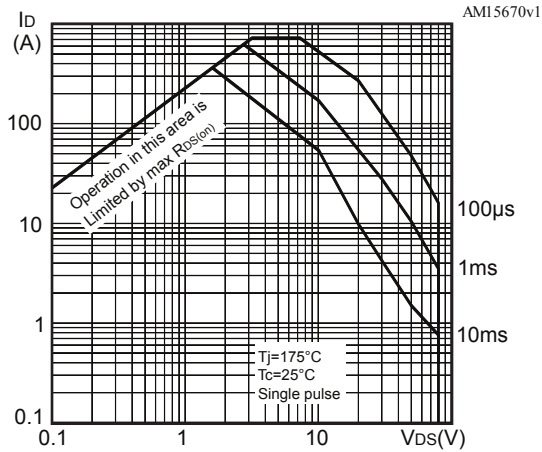
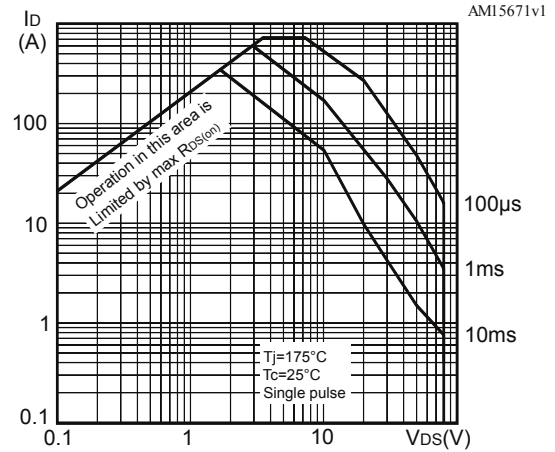
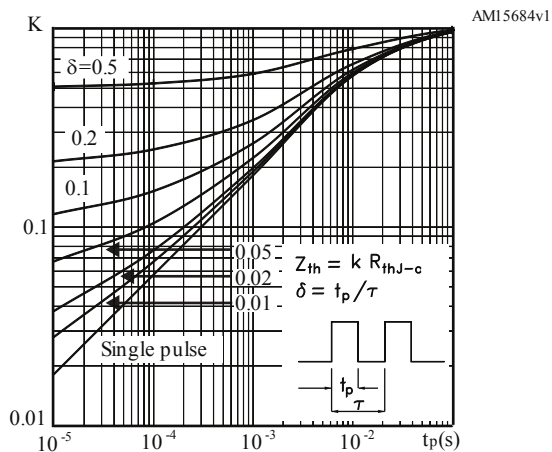
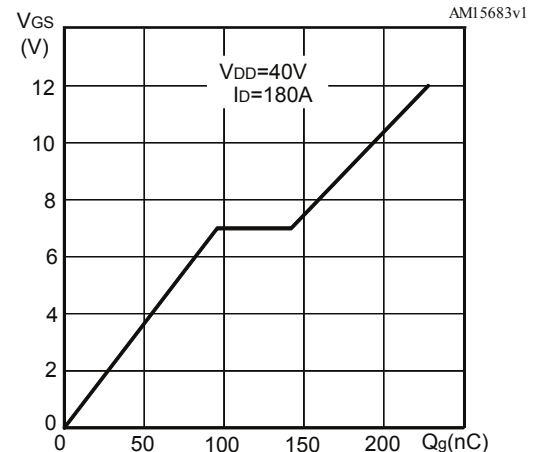
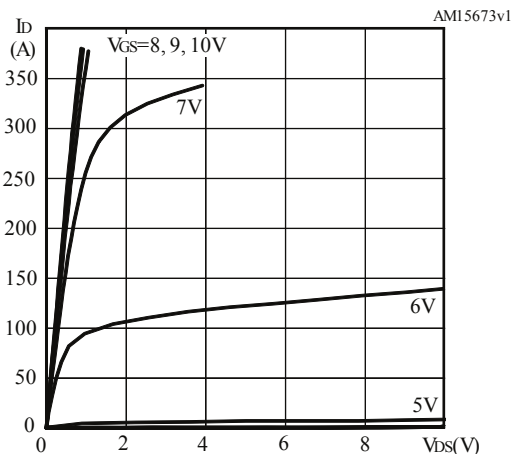
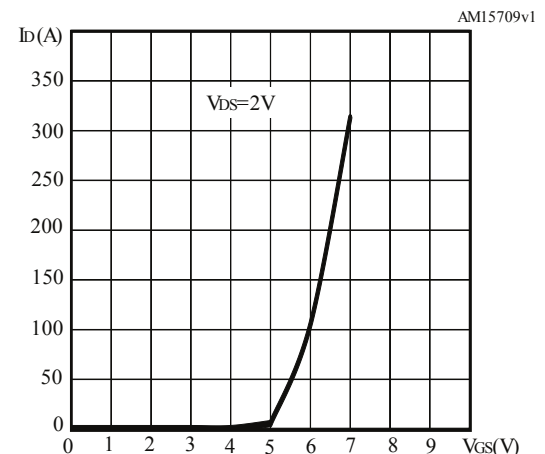
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 40\ \text{V}$ , $I_D = 90\ \text{A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\ \text{V}$ (see Figure 19. Test circuit for resistive load switching times and Figure 24. Switching time waveform)	-	56	-	ns
$t_r$	Rise time		-	180	-	ns
$t_{d(off)}$	Turn-off delay time		-	98	-	ns
$t_f$	Fall time		-	42	-	ns

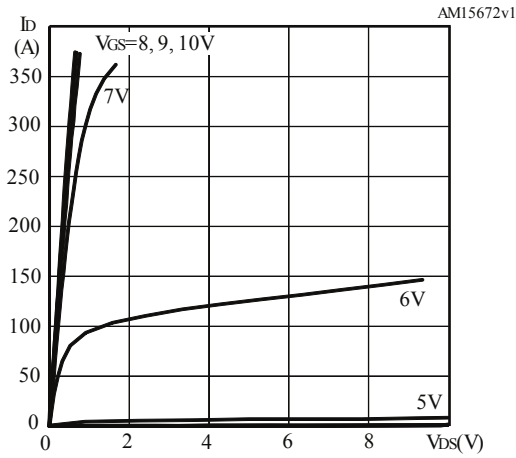
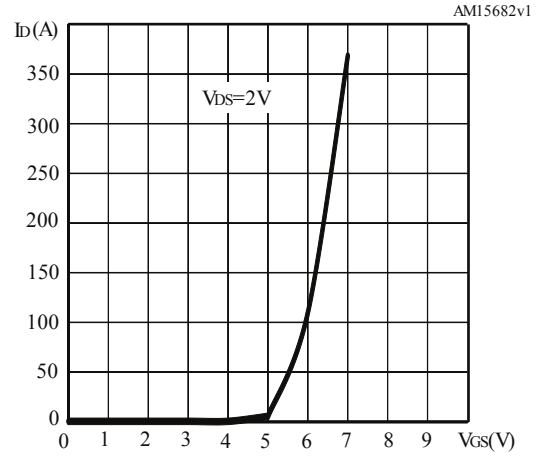
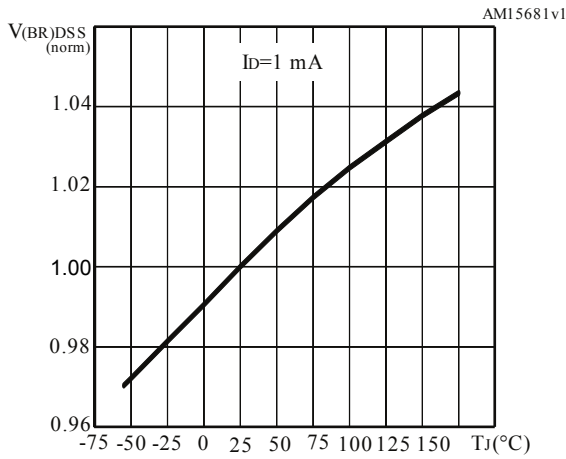
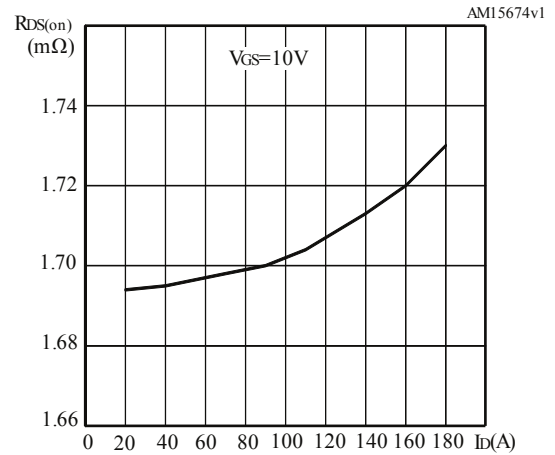
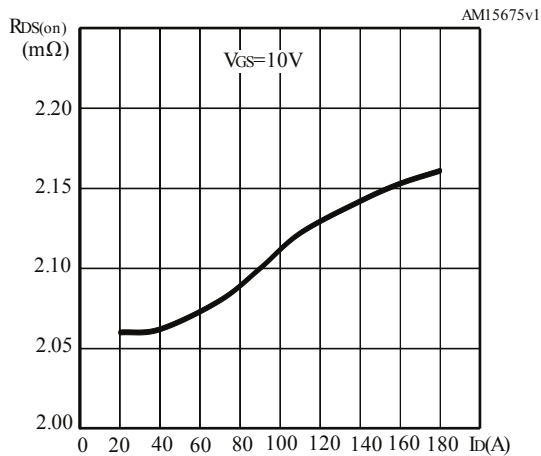
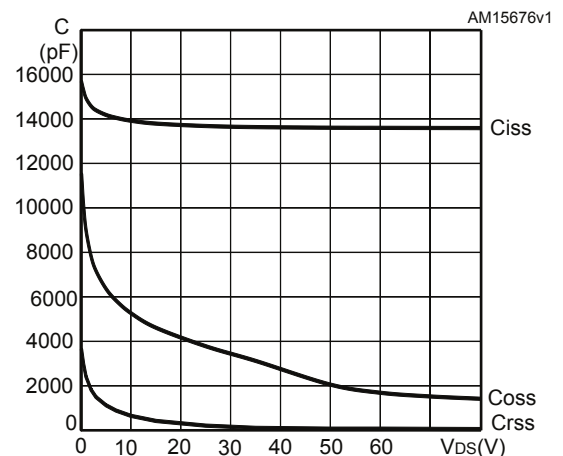
**Table 6. Source-drain diode**

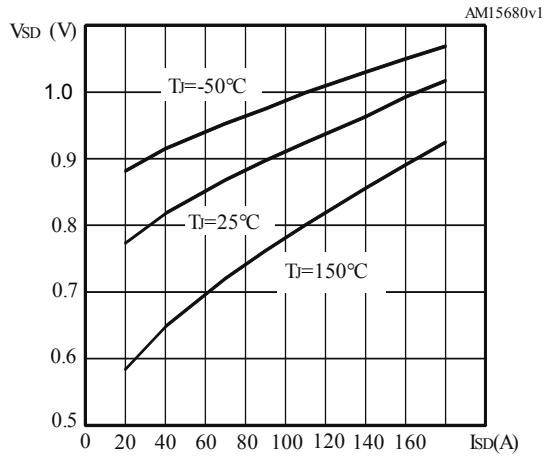
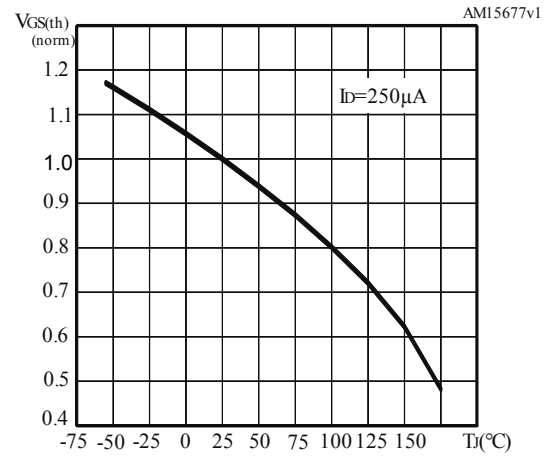
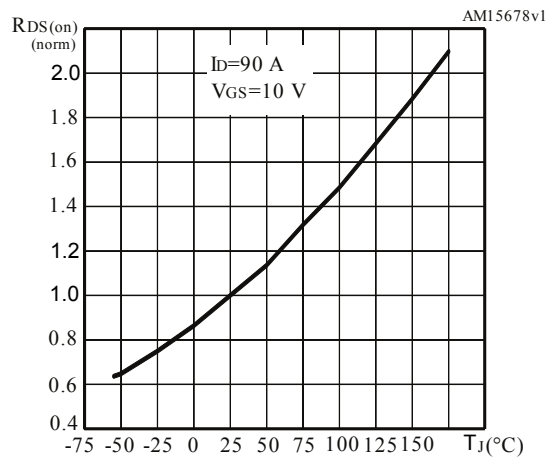
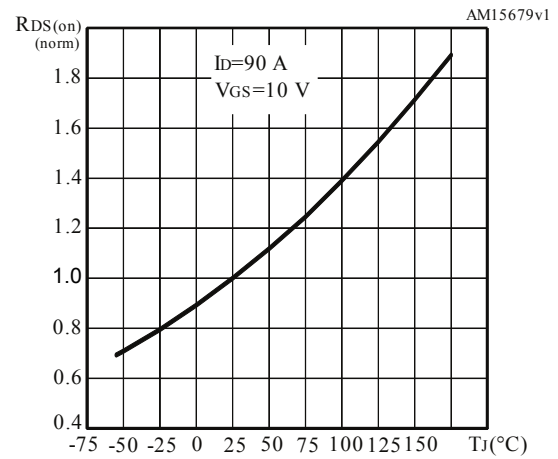
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		180	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		720	A
$V_{SD}^{(2)}$	Source-drain current	$I_{SD} = 90\text{ A}, V_{GS} = 0\text{ V}$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 180\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	-	78		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 64\text{ V}, T_J = 150\text{ }^\circ\text{C}$ (see Figure 21. Test circuit for inductive load switching and diode recovery times)	-	182		nC
$I_{RRM}$	Reverse recovery current		-	4.7		A

1. Pulse width limited by safe operating area.

2. Pulsed: pulse duration=300  $\mu\text{s}$ , duty cycle 1.5%.

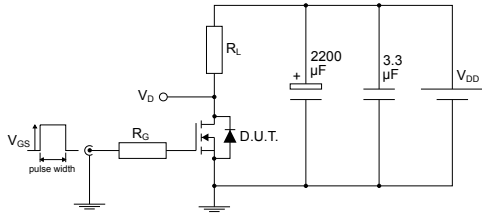
**2.1 Electrical characteristics (curves)**
**Figure 1. Safe operating area for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6**

**Figure 2. Safe operating area for TO-220**

**Figure 3. Normalized transient thermal impedance**

**Figure 4. Typical gate charge characteristics**

**Figure 5. Typical output characteristics for TO-220**

**Figure 6. Typical transfer characteristics for TO-220**


**Figure 7. Typical output characteristics for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6**

**Figure 8. Typical transfer characteristics for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6**

**Figure 9. Normalized breakdown voltage vs temperature**

**Figure 10. Typical drain-source on-resistance for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6**

**Figure 11. Typical drain-source on-resistance for TO-220**

**Figure 12. Typical capacitance characteristics**


**Figure 13. Typical reverse diode forward characteristics**

**Figure 14. Normalized gate threshold vs temperature**

**Figure 15. Normalized on-resistance vs temperature for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6**

**Figure 16. Normalized on-resistance vs temperature for TO-220**


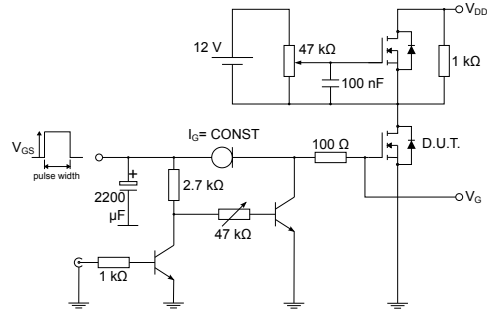
### 3 Test circuits

Figure 17. Test circuit for resistive load switching times



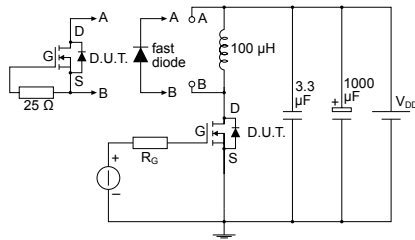
AM01468v1

Figure 18. Test circuit for gate charge behavior



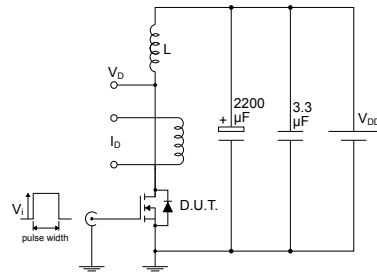
AM01469v1

Figure 19. Test circuit for inductive load switching and diode recovery times



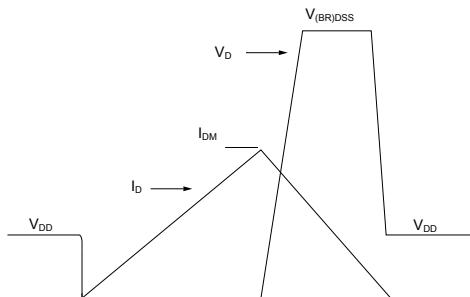
AM01470v1

Figure 20. Unclamped inductive load test circuit



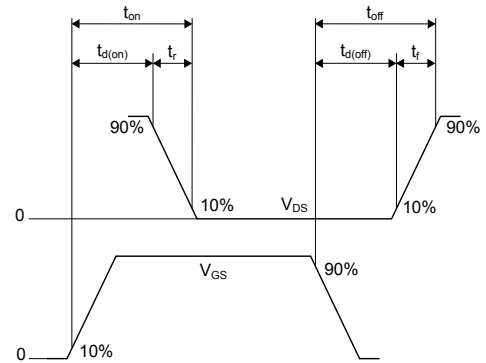
AM01471v1

Figure 21. Unclamped inductive waveform



AM01472v1

Figure 22. Switching time waveform



AM01473v1

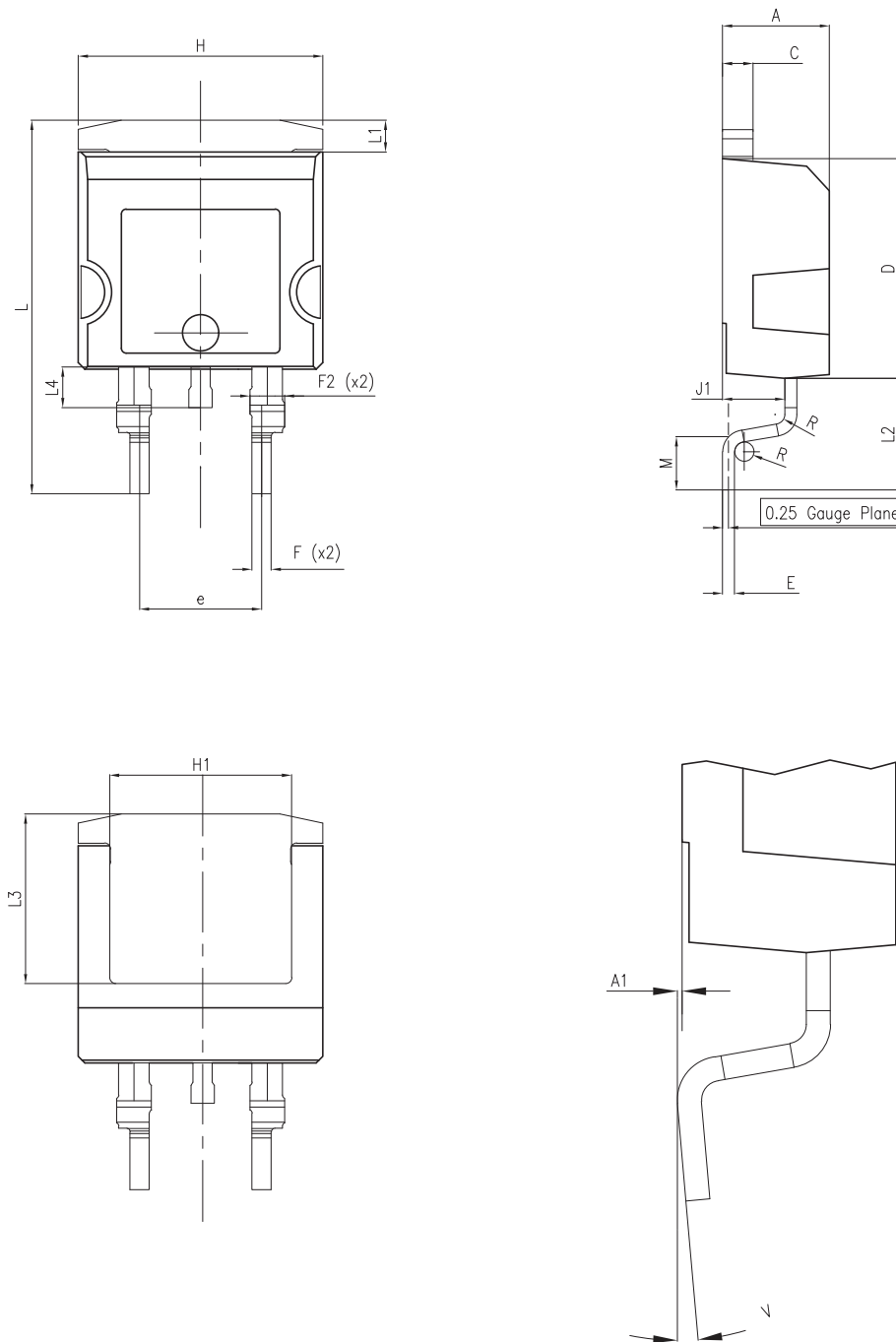


## 4 Package information

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

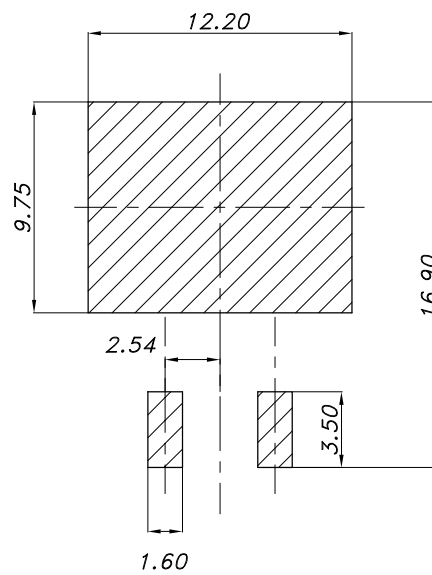
Figure 23. H<sup>2</sup>PAK-2 package outline



8159712\_9

**Table 7. H<sup>2</sup>PAK-2 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.70
A1	0.03		0.20
C	1.17		1.37
D	8.95		9.35
e	4.98		5.18
E	0.50		0.90
F	0.78		0.85
F2	1.14		1.70
H	10.00		10.40
H1	7.40	-	7.80
J1	2.49		2.69
L	15.30		15.80
L1	1.27		1.40
L2	4.93		5.23
L3	6.85		7.25
L4	1.50		1.70
M	2.60		2.90
R	0.20		0.60
V	0°		8°

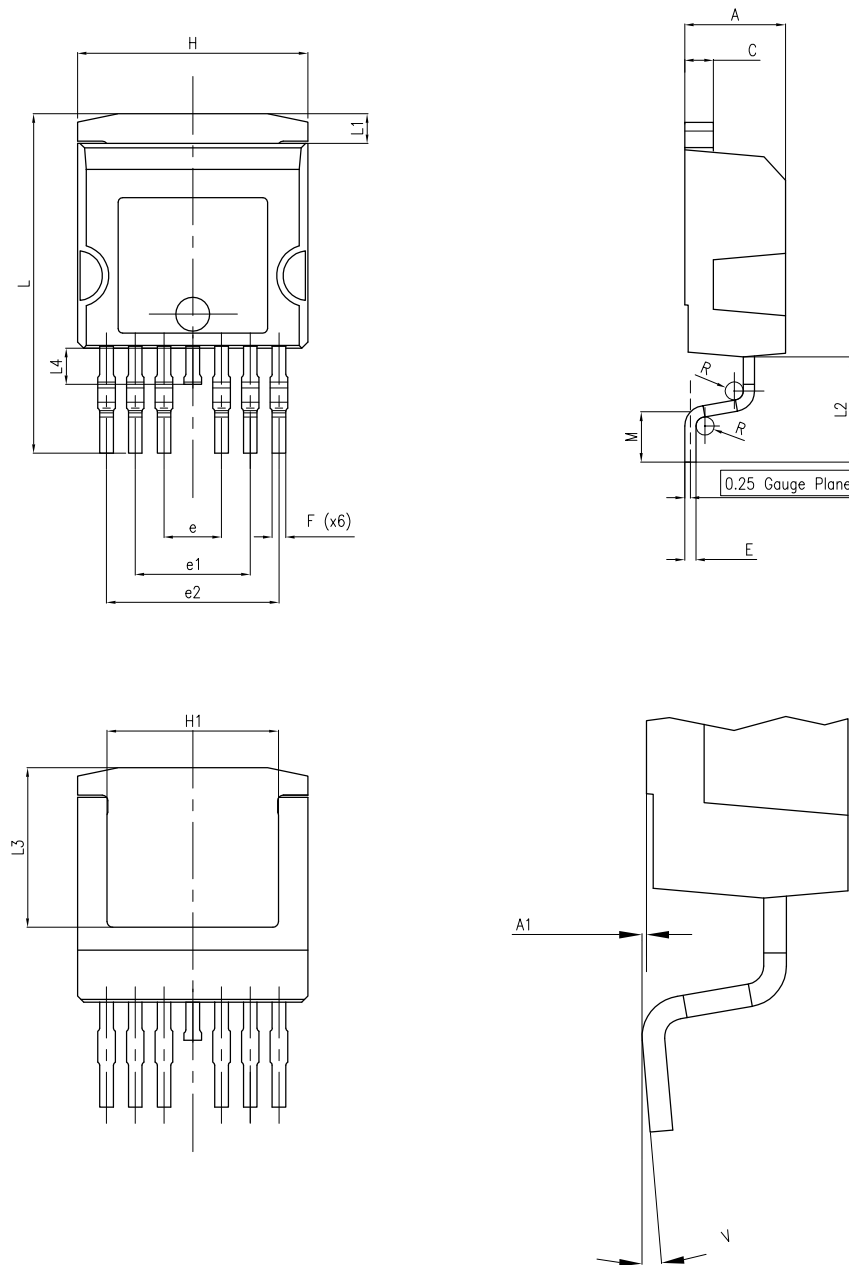
**Figure 24. H<sup>2</sup>PAK-2 recommended footprint**


8159712\_9

**Note:** Dimensions are in mm.

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

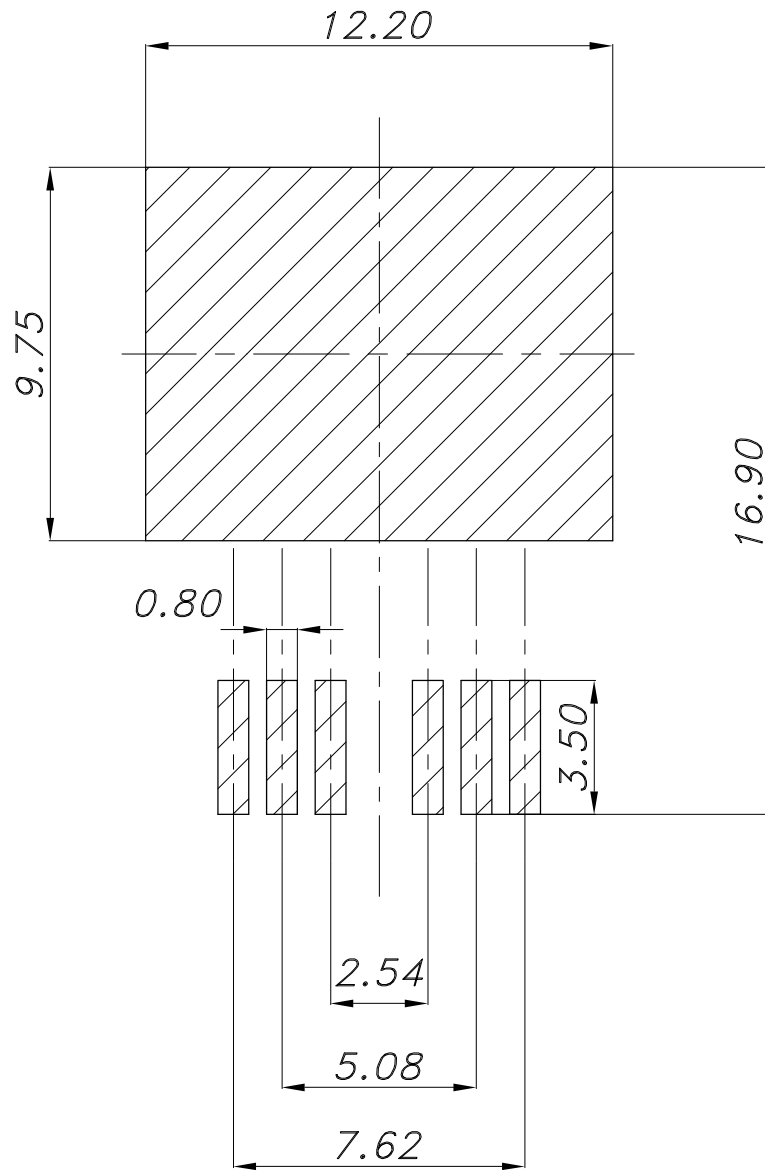
Figure 25. H<sup>2</sup>PAK-6 package outline



**Table 8. H<sup>2</sup>PAK-6 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.30		4.70
A1	0.03		0.20
C	1.17		1.37
e	2.34	2.54	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	1.50		1.75
M	1.90		2.50
R	0.20		0.60
V	0°		8°

Figure 26. H<sup>2</sup>PAK-6 recommended footprint

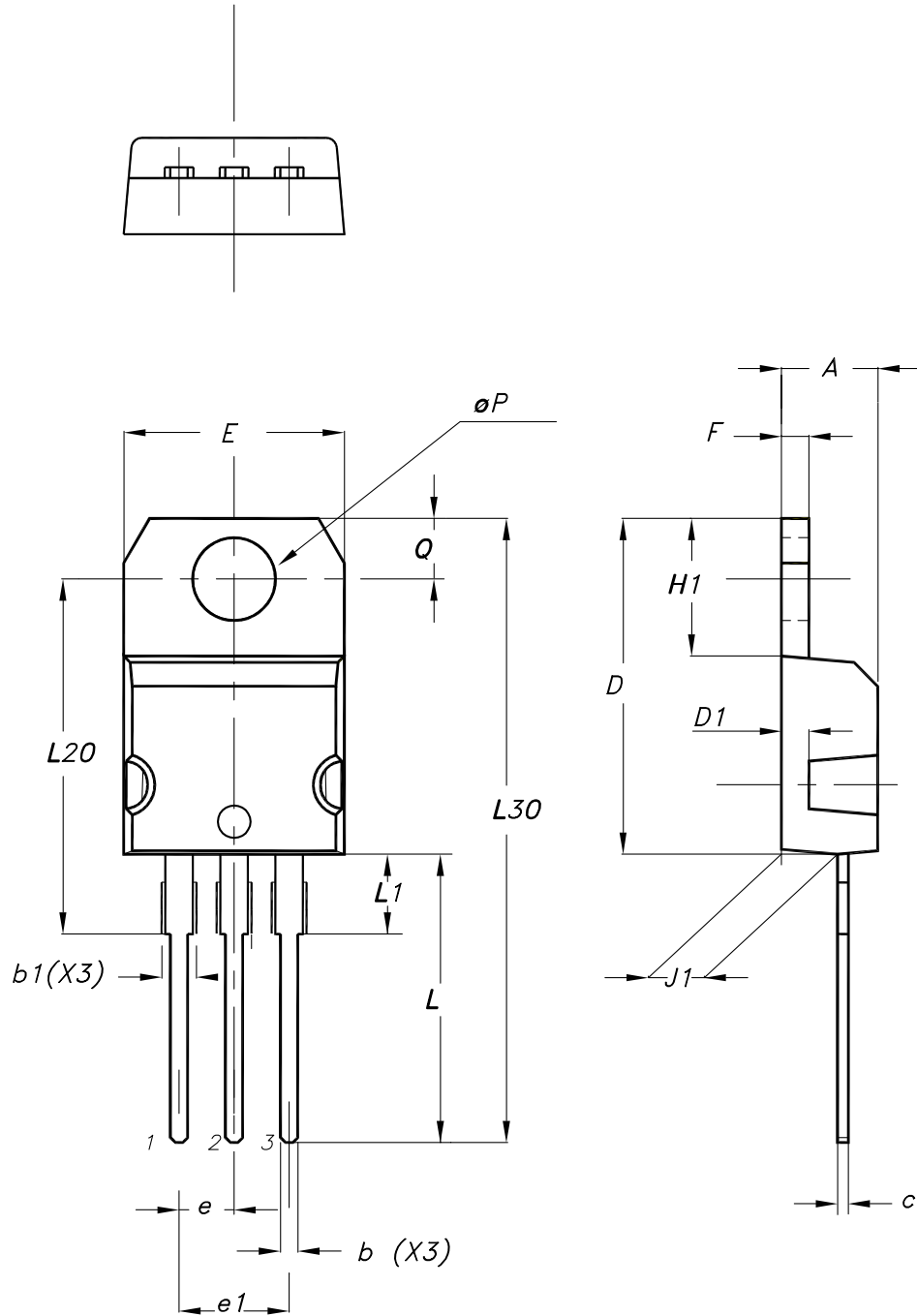


footprint\_Rev\_8

Note: Dimensions are in mm.

### 4.3 TO-220 type A package information

Figure 27. TO-220 type A package outline



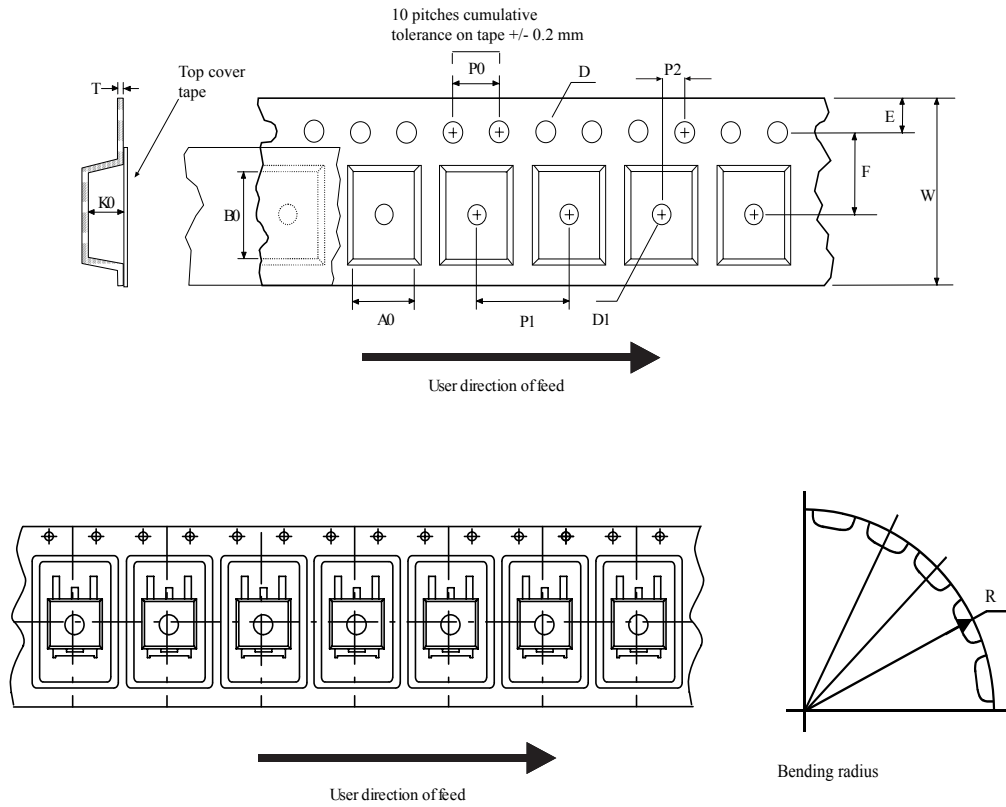
0015988\_typeA\_Rev\_23

**Table 9. TO-220 type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95
Slug flatness		0.03	0.10

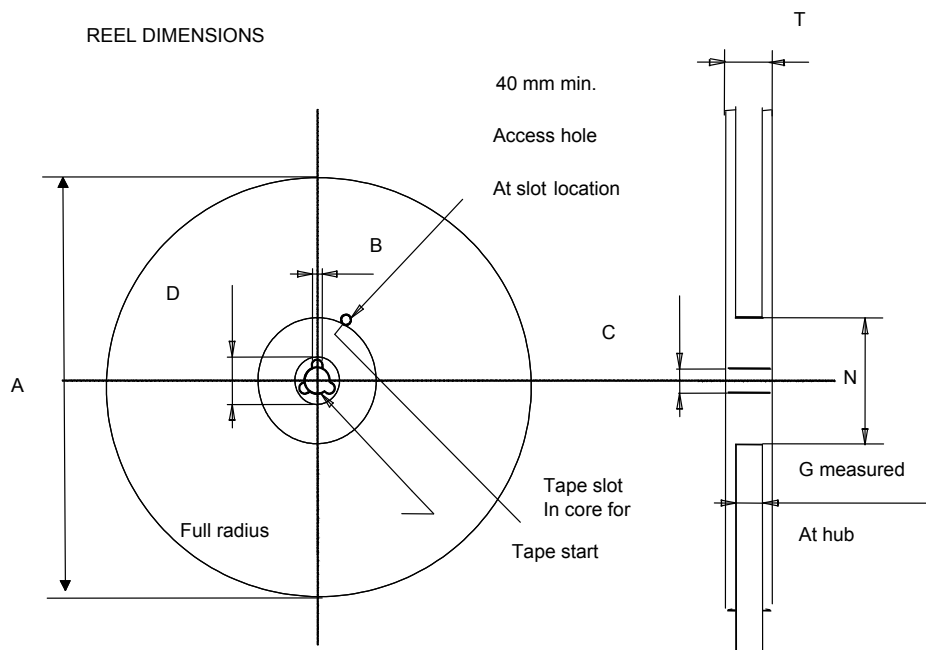
#### 4.4 Packing information

Figure 28. Tape outline



AM08852v2

Figure 29. 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 Ordering information

Table 11. Order codes

Order codes	Marking	Package	Packing
STH270N8F7-2	270N8F7	H <sup>2</sup> PAK-2	Tape and reel
STH270N8F7-6		H <sup>2</sup> PAK-6	
STP270N8F7		TO-220	Tube

## Revision history

**Table 12. Document revision history**

Date	Version	Changes
03-Dec-2012	1	First release.
09-Apr-2013	2	<ul style="list-style-type: none"> <li>– Modified: <math>R_{DS(on)}</math> max values on <i>Features</i> table, <math>I_{DSS}</math>, <math>I_{GSS}</math> values on <i>Table 4</i>, <math>R_{DS(on)}</math> value for H<sup>2</sup>PAK-2, the entire typical values on <i>Table 5</i> and <i>6</i>, <math>V_{SD}</math> test conditions and max values, <math>T_{RR}</math>, <math>Q_{RR}</math>, <math>I_{RRM}</math> typical values on <i>Table 7</i></li> <li>– Inserted: <i>Section 3: Electrical characteristics (curves)</i></li> <li>– Document status promoted to preliminary data to production data</li> <li>– Added: H<sup>2</sup>PAK-6 package</li> <li>– Minor text changes</li> </ul>
11-Oct-2013	3	<ul style="list-style-type: none"> <li>– Modified: <math>C_{rSS}</math> typical value in <i>Table 5</i></li> <li>– Updated: <i>Section 5: Package information</i></li> <li>– Updated: <i>Figure 18, 19, 20</i> and <i>21</i></li> <li>– Minor text changes</li> </ul>
14-May-2015	4	<ul style="list-style-type: none"> <li>– Updated title, features and description in cover page.</li> <li>– Minor text changes</li> </ul>
12-Mar-2021	5	<ul style="list-style-type: none"> <li>Modified <a href="#">Table 3. On/off states</a>.</li> <li>Minor text changes.</li> </ul>

## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>2</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>3</b>
<b>2.1</b>	Electrical characteristics (curves) .....	<b>5</b>
<b>3</b>	<b>Test circuits</b> .....	<b>8</b>
<b>4</b>	<b>Package information</b> .....	<b>9</b>
<b>4.1</b>	H <sup>2</sup> PAK-2 package information .....	<b>9</b>
<b>4.2</b>	H <sup>2</sup> PAK-6 package information .....	<b>11</b>
<b>4.3</b>	TO-220 type A package information .....	<b>14</b>
<b>4.4</b>	Packing information .....	<b>16</b>
<b>5</b>	<b>Ordering information</b> .....	<b>18</b>
	<b>Revision history</b> .....	<b>19</b>



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